MDN

PHD is a member of the
MAC Distributor Network

phd®

SOLUTIONS FOR INDUSTRIAL AUTOMATION

PHD, Inc. • P.O. Box 9070 • Fort Wayne, IN 46899 • (260) 747-6151 • FAX (260) 747-6754
www.phdinc.com • phdinfo@phdinc.com

50 YEARS
of dedication

The products, supported by our strong commitment to delivery, service, and quality, have made us a leader in the modular automation industry.

In 2007, PHD celebrated its 50th anniversary. Since 1957, our customers have trusted PHD to produce high quality, reliable products for their automation needs.

Our full line of components: cylinders, escapements, grippers, slides, rotary actuators, clamps, multi-motion actuators, and proximity switches and sensors provide the motion you require. With millions of component variations, we can help move, turn, slide, lift, grip, reach, rotate, and clamp almost anything to increase your productivity.

Our components are completely modular. Using either bolt direct units or transition plates, our actuators can be combined to create millions of application variations.

support
the phd advantage

distributor support

PHD, Inc. is a proud member of the MAC Distributor Network (MDN). MDN is a customer focused network of global manufacturers and distributors providing worldwide sales and exceptional service. MDN is dedicated to working closely together with common goals and philosophies to support customers' needs. With partners located worldwide, we are equipped to provide you a wide variety of value added support and ongoing assistance.

Contact your local MDN distributor today for the full story on our automation solutions.

superior delivery

Nowhere in our industry is product delivery taken as seriously as it is at PHD. Even with the wide range of options offered on PHD products, shipping time in most cases is one to four working days. In today's fast-paced competitive markets, we understand the need for quick turnaround. With a track record of 98% on-time shipments, you can be assured of prompt delivery. And if you find yourself in an emergency situation, expedited service is also available.

engineering software

PHD's engineering software provides powerful design and selection tools at your fingertips. The software eliminates risk and simplifies your design process and component selection, while offering significant time savings.

CAD configurator

This dynamic online CAD configurator assists users to select accurate ordering data and generation of a CAD model in most Native CAD formats. See page 9.

product sizing software

Based on user's input, this software selects the proper size and model of the unit, ensuring the actuator will perform to your specific application requirements. See page 11.

PHD Unlimited™

Unique application designs require unique components. With over 50 years of experience, our team welcomes special requests for unique products, regardless of quantity or frequency of order. Find our unique solutions at the back of each actuator section, call 1-800-624-8511, or go online to request a quote.

contents

superior delivery

PHD is known in the industry for exceptional delivery. Some units can be shipped in as little as one working day. Use this delivery schedule as a general guide for standard PHD units. Certain options and unit variations can increase delivery time. Ask your local distributor or PHD Customer Service technician to confirm delivery on critical requirements.

1-800-624-8511

IMPORTANT:

This schedule represents the number of working days under normal situations to process, assemble, and ship standard units from the day PHD receives an order from your local distributor. Consult PHD for deliveries on non-stock units, specials, non-standard platings, large quantities, or on specific critical items.

NOTE: Orders containing multiple product types are shipped at one time and are scheduled based on the longest lead time item. Partial shipments of shorter lead time items are made when requested on original order. Most PHD products are built to order. With our extremely quick deliveries, the order may be in production within 1 to 2 days of receiving your order. Please bear this in mind when changing, revising, or canceling an order.

DELIVERY MAY VARY BASED ON CURRENT WORKING CONDITIONS.

cylinders

standard units	days	quantity
CV, CRS/CTS, A, AV, HV, TD	2	12
N, NPG, NHG	5	5

slides

standard units	days	quantity
SM, STP, SHP, SIP	2	5
SD/SE	3	10
SFM, SFP, SCV,	4	5
SG, SK/SL	4	10
SxL/SxH	1	5

escapements

standard units	days	quantity
LC, 160	1	10

grippers

standard units	days	quantity
GRD, 190/191, 8400	1	10
GRB, GRC, GRW	2	10
GRF, GRL, GRS, GRT, 5300, 8600	2	5
GRR	2	5

rotary actuators

standard units	days	quantity
RF, RI	2	5
RL, RA, RCC	1	5-8
1000-8000	2-4	8-12

multi-motion actuators

standard units	days	quantity
1000-4000	4-5	5
5000-8000	8	5

clamps

standard units	days	quantity
All Series	1	25

plastic packaging & components

standard units	days	quantity
BCS, BST, BCZ	5	10

switches

standard units	days	quantity
All Series	1	100

best delivery in the industry

adaptors, transition plates, and stanchions

connect PHD products together easily

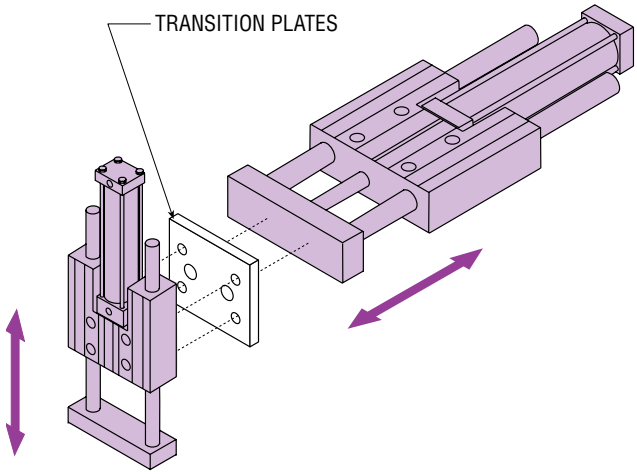
- reduce engineering time
- simplify design
- save money
- eliminate fabrication

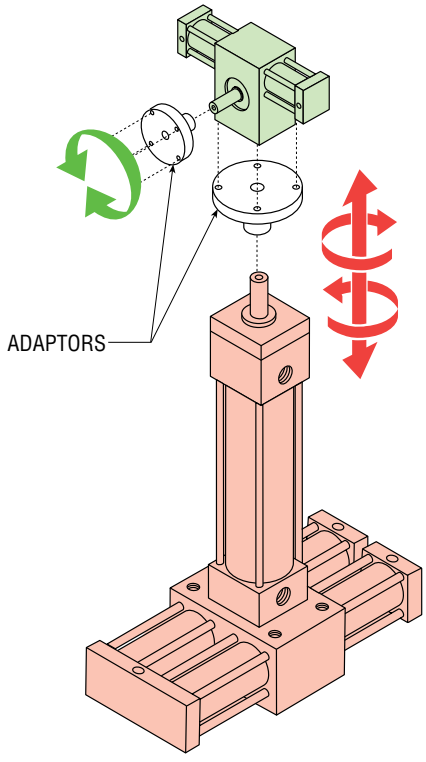
A complete listing of PHD adaptors and transition plates is available online. Go to www.phdinc.com and click on Product Catalogs on the navigation panel.

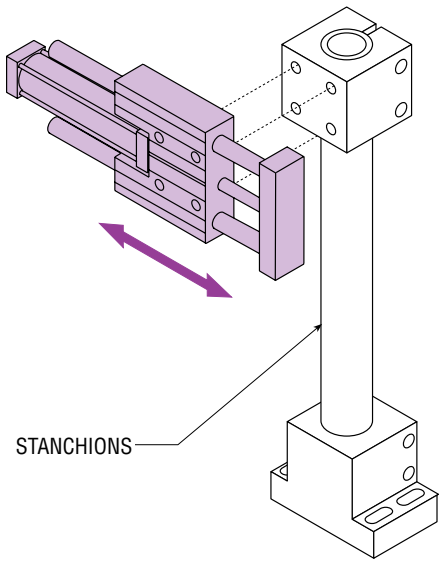
Simplify the design of your automation solutions using PHD's wide range of adaptors, transition plates, and stanchions. The use of standard hardware makes it easy to combine axes of motion. The hardware provides an efficient means of assembling individual actuators into a complete automation device. An unlimited number of combinations can be achieved to satisfy your specific motion requirements.

A complete line of stanchions is also offered. Stanchions provide a rigid support for mounting the assembled device above the work surface. Additionally, PHD stanchions are easily adjustable for achieving specific height requirements.

Integrating devices using standard PHD actuators and hardware will add greatly to the cost effectiveness of your design.







distribution
a worldwide network

...over 45 countries around the world...

- Germany
- France
- Italy
- United Kingdom
- Mexico
- Spain
- Switzerland
- Japan
- Israel
- India
- Singapore
- Egypt

PHD is represented in over 45 countries around the world, so you'll be sure to receive the service, delivery, and local support your business deserves. Contact PHD for the location of your nearest distributor. Or check our website's distributor location guide. Finding your distributor is as easy as keying in a zip code.

corporate offices

To meet the needs of the global market, corporate offices are located in the U.S.A. and Germany. PHD also offers some product catalogs in Spanish, German, French, and Italian.

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website
engineering resources

DESIGN PROCESS

PHD Advantage- shorten your design process

Initial Design & Specification
- Use phdinc.com to quickly and easily research ideas and products
- View animated graphics on the Automation Resource CD as provided by your MDN distributor

Engineering Requirements
- Use phdinc.com to review products that might fit your application
- Define requirements and locate products that fit
- Use sizing software to narrow choices and determine best product

Concept Design
- Use sizing software to locate proper size and model required
- Configure accurate part numbers, options, and accessories
- Generate CAD models to create preliminary design

Quote
- Use PHD's configurator to generate accurate ordering data
- Contact MDN distributor to determine price for actuator and accessories quickly
- Distributor support tools enable your MDN distributor to give you quick response to your request. PHD's online distributor support tools allow access to price and delivery from anywhere including their mobile phone.

Detail Design
- Refine design and verify if product is sized correctly with PHD's sizing software
- Configure accurate part numbers with additional features
- Generate updated CAD model with options including switches and accessories
- Documentation of specific product catalog pages and replacement parts

Purchase
- Send purchase order to your MDN distributor
- Distributor electronically submits error free order to PHD via automated electronic entry
- PHD automatically schedules your order and delivers directly to the shop floor for the quickest response

Build/Deliver
- PHD has the fastest delivery in the industry and quickly delivers the product to you so you can meet your project deadlines.

www.phdinc.com/tools/designprocess

ONLINE TOOLS

save time with online engineering resources

PHD's website has complete engineering resources that will save you time. PHD's website includes product information, catalogs, application examples, sizing, CAD in numerous native formats, and a variety of digital literature in pdf format.

- request native and neutral CAD drawings from the most popular formats available
- request information
- size online
- search the knowledgebase
- request a Unique Solutions™ quote
- download software updates
- learn about products and new developments from PHD
- view product literature, graphics, and animations online
- communicate with PHD
- view continually updated information
- view application examples
- find local distributor by zip code search
- request application assistance

You can access information from our website 24 hours a day, seven days a week. By joining our mailing list, you will receive the latest information as it becomes available.

www.phdinc.com

website
engineering resources

WEB NAVIGATION

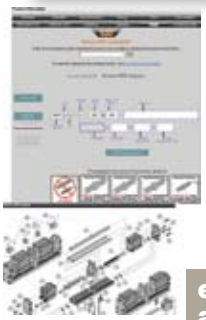
...the most current information at your fingertips...

Complete product information online!

sizing

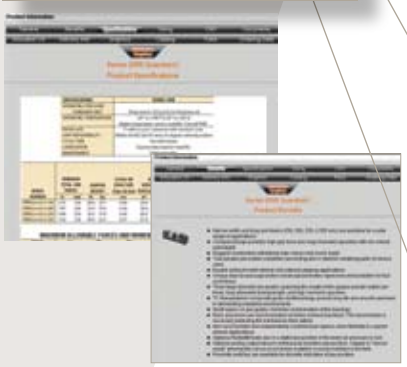
CAD

replacement parts



catalog

benefits/specifications



delivery

education center/ animations

ordering data

bulletins/support documents

interactive graphics

most popular formats

AutoCad®, Inventor®, Unigraphics®,
Solidworks®, Solidedge®, Catia®, Pro-E®,
IDEAS®, and More!

CAD

CAD models online

This popular design tool enables the designer to configure an actuator and request CAD models via PHD's website. PHD's CAD Configurator lets the designer configure only accurate part numbers. Features and options such as stroke, shocks, switches and mountings are represented in the geometry. PHD's CAD models are available in most popular CAD formats. It's PHD's commitment to be able to speak your native language, whether it's AutoCad®, Inventor®, Unigraphics®, Solidworks®, Solidedge®, Catia®, Pro-E®, and IDEAS® as well as many others.

3 easy steps

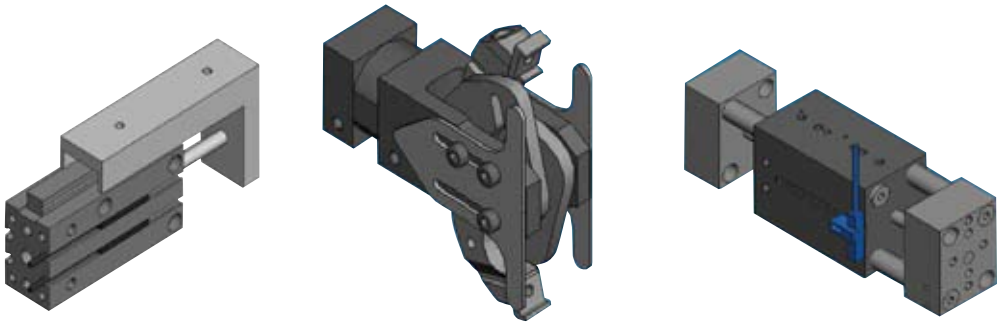
1 Select product type and product series.

2 Configure accurate ordering data.

3 Get CAD now.

Web application that enables users to quickly configure accurate ordering data on over 450 million combinations and request a detailed CAD model in a variety of CAD formats.

- Select from all the Native and Neutral most popular CAD Formats
- Download CAD models directly from your browser or have them emailed
- Graphical Configurator ensures that a proper PHD part number is generated and handles compatibility in real-time
- Briefcase and history option allows you to select multiple CAD models of PHD products at one time
- Geometry includes options and accessories like switches, shocks and other mountings
- Edit capabilities from briefcase and history



www.phdinc.com/cad

website
engineering resources

QUOTES

PHD Unlimited™ product quotes online

Our site allows you to enter information about your quote before submitting it to PHD. It also allows the addition of more quotes without filling out general contact information.

You will be asked a series of questions about your application requirements and after submitting them, an MDN representative will contact you with a quote.

Quoting request available 24 hours a day, seven days a week.

Select PHD Unlimited™ quotation and just log in.

Simply answer a few questions.

Just save and your quote will automatically be sent to PHD.

PHD UNLIMITED™ UNIQUE SOLUTIONS

submit quotes online at:
www.phdinc.com/unlimited/quote/default1.asp

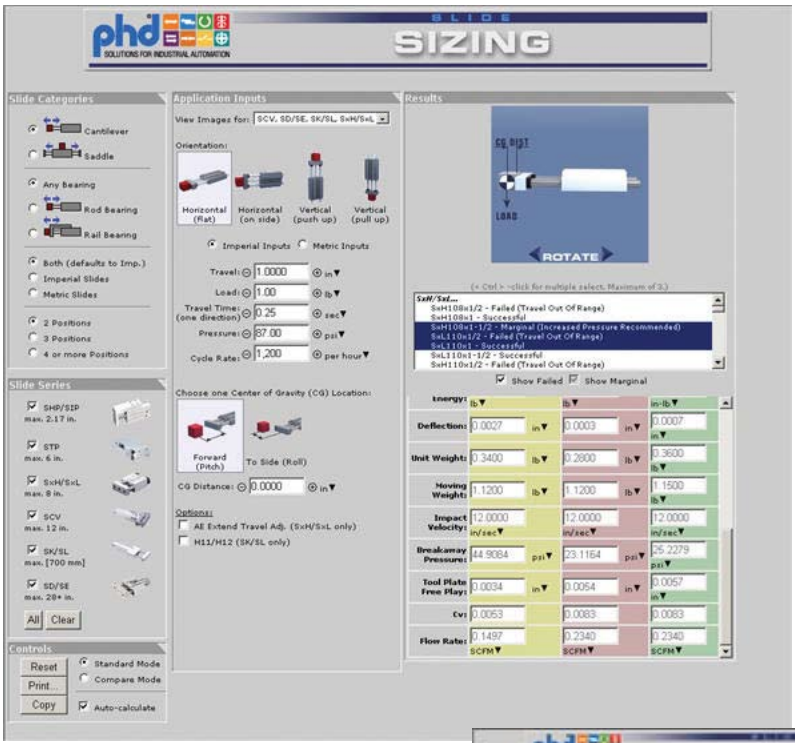
SIZING

sizing software online

This software provides accurate sizing of most PHD products. Users can input the application data and the software will aid in finding a product that will meet their requirements. Save time by calculating properly sized units.

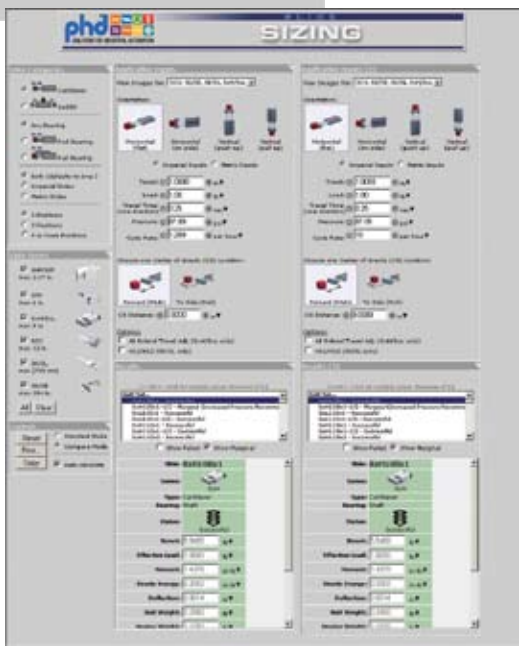
make your automation job easier ...

Access online or download for offline use.



Designed with great features to make sizing a product easier than ever.

- Automatic unit conversion
- On the fly calculations
- Run from web or local version available
- Easy filter method based on application preferences
- Combined product series to find best fit
- Cv and SCFM calculations included
- Side by side comparison
- Dynamic graphics to assist in entry
- Compare mode feature allows for different inputs to compare application possibilities
- Copy information to clipboard to use with user documentation



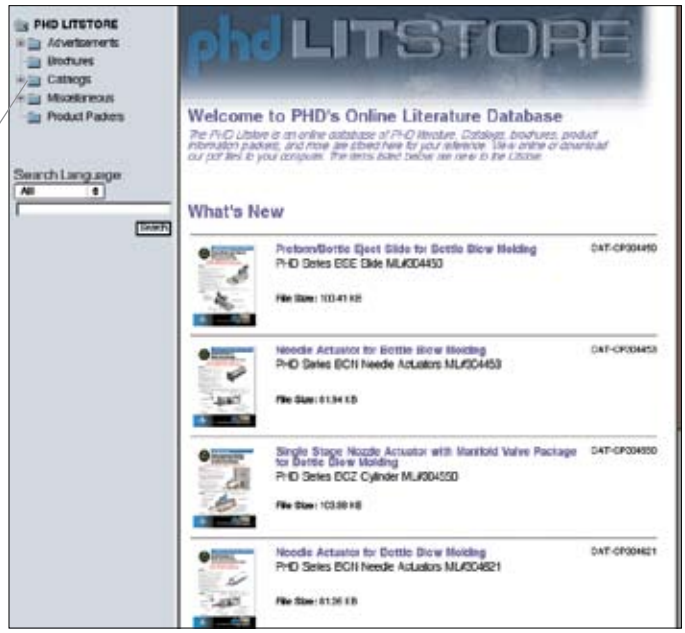
website
engineering resources

LITERATURE

PHD literature online

Select “PHD Literature” in the left menu bar and you will find PHD’s complete product catalogs and other documents in multiple languages for reference. With Acrobat PDF documents, users can download and print pages to their printer.

Use the bookmarks on the left to browse the LitStore.

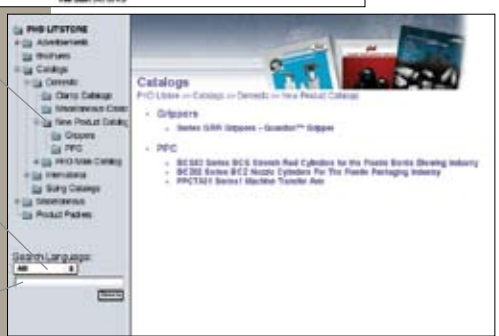


Titles, descriptions, catalog codes and file sizes are displayed on the right side of the page.

Information on PHD new products can be downloaded.

Search by language

Literature titles and descriptions can be searched for quick access.



globally linked network

the phd & mdn partnership

THINK GLOBAL • ACT LOCAL

THE PHD & MDN PARTNERSHIP

Focused on your industry

Increase your productivity

Service • Support • Products

Superior Products Supported by a Globally Linked Network

PHD, Inc. is a proud member of the MAC Distributor Network (MDN). MDN is a customer focused network of global manufacturers and distributors providing worldwide sales and exceptional service. MDN is dedicated to working closely together with common goals and philosophies to support customers' needs. With partners located worldwide, MDN is equipped to provide you a wide variety of value added support and ongoing assistance.

All distribution partners are factory trained, application oriented, and carry a wide range of supporting products. Backed by PHD's superior customer service and engineering expertise, you can be assured of a cost-effective and field proven solution. The solution offered will be the best blend of expertise available from PHD and our MDN partners.

Contact your local MDN distributor today for the full story on PHD's automation solutions.

globally linked network

the phd & mdn partnership

THINK GLOBAL • ACT LOCAL

PHD AUTOMATION SOLUTIONS

- MDN DISTRIBUTOR SUPPORT
- SUPERIOR 1 TO 4 DAY DELIVERY
- ENGINEERING SOFTWARE
- UNIQUE SOLUTIONS

ABOUT PHD

PHD manufactures a full line of pneumatic and hydraulic actuators: cylinders, escapements, grippers, slides, rotary actuators, clamps, multi-motion actuators, and proximity switches and sensors. With millions of actuator variations, PHD can help move, turn, slide, lift, grip, reach, rotate, and clamp most any part or material to increase your productivity.

If an application requires a modified actuator, our PHD Unlimited - Unique Solutions™ team is ready to help. PHD welcomes special requests for unique products, regardless of quantity or frequency of order. Ask for the new PHD Unlimited™ brochure for more information.

The products, supported by a strong commitment to delivery and service, have made PHD a leader in the modular automation industry.

HOW DOES PHD BENEFIT ME?

- Widest range of quality, robust actuators in the industry
- Engineering software and internet tools make designing simple
- 1 to 4 day delivery on most units. Best in the industry!
- With MDN partners, provide you or your customers the highest quality customer service, local response, and delivery worldwide…wherever your machines are located.

CAPACITY, DECADES OF EXPERTISE, AND DEDICATED PRODUCT CELLS

Ensures high quality, precision performance, and fast deliveries

MACHINING

Newest technology and proprietary fixtures produce true and parallel bearing bores. Ensures smooth and accurate slide performance.

CNC MACHINING

Dedicated equipment ensures flexibility and speed in producing custom product components.

DEDICATED WORKCELLS

Dedicated product specific workcells contain inventory, assembly, and test to support on-time deliveries.








INVENTORY

PHD's product line offers millions of combinations and options to provide you the exact actuator for your application. Built per order, PHD's extensive inventory supports our 1-4 day delivery on most products.

LIFE TESTED UNITS

All of PHD products are life tested up to 10 million trouble-free cycles.

PALLETECH EQUIPMENT

State of the art machining centers provide incredible flexibility and speed in producing clamp components to support 24-hour delivery on most clamp products.

TC BEARING MACHINES

In-house machining of TC composite bearings provides total control of precision tolerances. Ensures minimal shaft play and deflection on slides.

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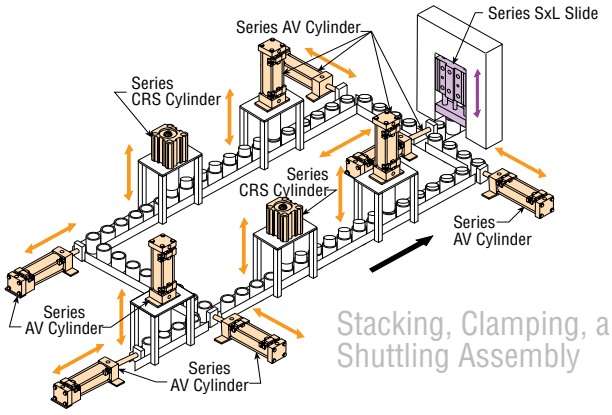
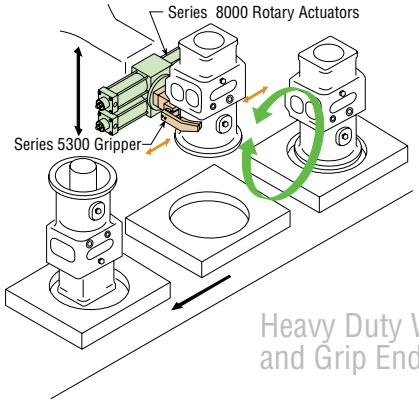
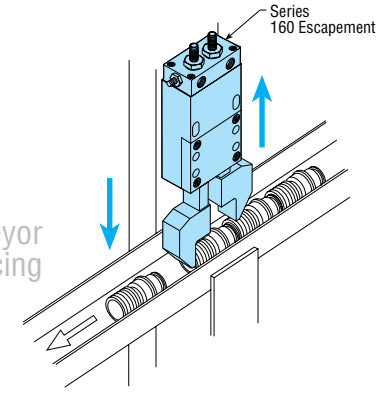


Stacking, Clamping, and Shuttling Assembly



Heavy Duty Wrist and Grip End Effectors



Conveyor Part Sequencing

SLIDES

- Compact rail bearing precision slides
- Pneumatic or hydraulic powered extend and retract motion
- PHD Slides can handle loads up to 300 lbs

CLAMPS

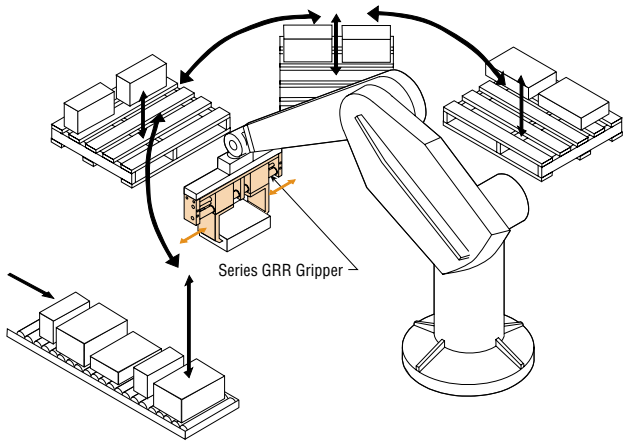
- Sheet metal industry solution
- Field repairable in just minutes

CYLINDERS

- Supply high-force linear motion for both hydraulic and pneumatic service
- Small bore cylinders 3/4" to 3"
- ISO/VDMA cylinders 20 mm to 100 mm bore

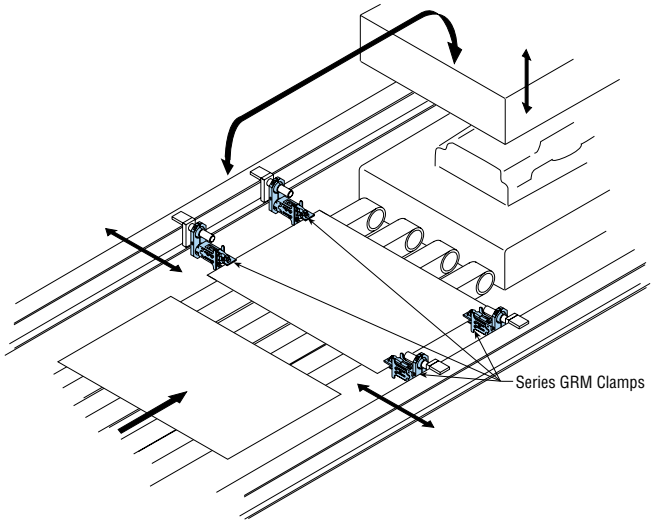
ROTARY ACTUATORS

- Available in a wide variety of configurations
- Rotations from as little as 45° to 450°



Heavy Payload Robotic End Effectors

Sheet Metal Stamping Transfer



GRIPPERS

- Angular or parallel motion grippers range in size from miniature to heavy duty
- For internal or external gripping applications
- Most provide four or more adjustable sensing positions

MULTI-MOTION ACTUATORS

- Provide rotary and linear motion from one output shaft
- Ideal for part turnaround, pick-and-place, transfer, and orientation options

SWITCHES & SENSORS

- Designed for easy interface between PHD actuators and today's various industrial controllers and logic systems

ESCAPEMENTS

- Pneumatically powered
- Internally-sequenced strokes make them ideal for applications where parts must be released individually from vibratory tracks, feeders, hoppers, or magazines

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EXAMPLES OF INDUSTRIES SERVED

WELDING

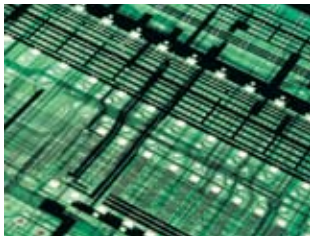
PLASTIC BOTTLES

AUTOMOTIVE

ROBOTICS

TIRE

SEMICONDUCTOR



CONVEYORS

STAMPING

ASSEMBLY MACHINERY

FOOD

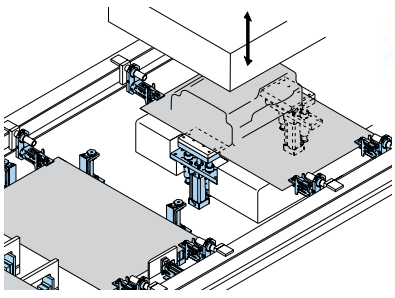
SPECIALTY MACHINERY

MEDICAL DEVICES

SPECIFIC PRODUCTS FOR SPECIFIC GROWTH INDUSTRIES

In unison with MDN partners, PHD is adept at understanding your manufacturing challenges and designing specific solutions for your unique requirements. Using the resources of the MDN network and close consultation with customers, products are developed to match your specific requirements.

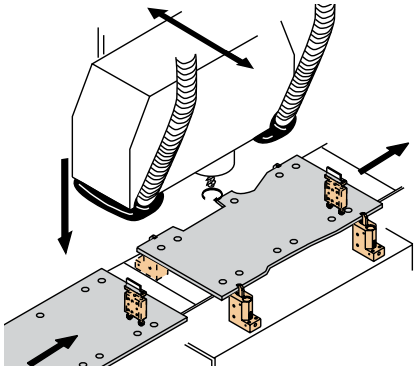
SHEET METAL STAMPING



SERIES GRM CLAMPS
- 2 sizes, 13 jaw styles, variety of accessories
- Up to 500 lbs of grip force
- Modular designed tips
- Panel present and double sheet detection options

SERIES PNC NUMBER CRUNCHER® CLAMPS
- Quietly crunches 9 characters in less than 200 milliseconds
- Low cost flexible marking system
- Easy tooling changes reduce press downtime
- Immediate return on investment
- Available with side, bayonet or rear mounting

SEMICONDUCTOR



SMALL PRECISE GRIPPER-ML#302988
- Precision jaw movement
- Lightweight, narrow profile/long jaw travel
- Optional Hall Sensor for up to four jaw position sensing
- Multiple routing surfaces, three sides with dowel pin holes
- Keyed jaws for precision tooling

SINGLE JAW PCB GRIPPER-ML#302993
- Compact and narrow, simple design
- Long life, high holding force
- Cutout design for larger components

PIN (SNUGGER) CYLINDER
- Compact, single acting
- Long life
- Custom pin height to fit your specific requirement
- Electroless nickel body, corrosion resistant

PLASTIC PACKAGING COMPONENTS

STRETCH ROD CYLINDERS-SERIES BCS
- Direct interface with your equipment
- Longer life
- Extended cushions
- Quiet operation
- Valve manifold assembled to cylinder available as standard

NOZZLE CYLINDERS-SERIES BCZ
- Direct replacement, CSD, Heat Set, Dual Cavity
- Longer life
- Easy and fast repairs
- Internal shock pads eliminate metal-to-metal contact
- Valve manifold assembled to cylinder available as standard

TRANSFER ARMS-SERIES BST
- Design is significantly more rigid (with reduced jaw vibration) than other available arms
- Jaw springs are manufactured especially for PHD and provide greater life
- Lighter in overall weight than other available arms
- Gripper heads are lower in profile

globally linked network

the phd & mdn partnership

THINK GLOBAL • ACT LOCAL

YOUR MDN PARTNER

- LOCAL SUPPORT
- PROBLEM SOLVING
- COST EFFECTIVE SOLUTIONS
- INDUSTRY SPECIFIC KNOWLEDGE

Mutual Responsibility and Accountability

Factory-Trained Application Specialists

An Independent - Interdependent Network

WHAT IS MDN?

The MAC Distributor Network is a global organization of independent distributors and manufacturers with the common focus of customer service and support anywhere in the world. MDN is dedicated to working closely together with common goals, philosophies, and mutual responsibility to support customers' needs. With partners located worldwide, we are equipped to help keep you or your customers' equipment running, profitable, and competitive.

HOW DOES MDN BENEFIT ME?

- A globally linked network of partners in over 45 countries ensures local response to multi-national customers. This network ensures seamless service and support at all locations.
- Entrenched commitment and mutual accountability within MDN to solve problems, reduce costs, and increase your machinery's efficiency.
- Factory-trained application and industry specialists ensure you a cost-effective and field-proven solution.
- Provides you or your customers the highest quality customer service, local response, and delivery worldwide…wherever your machines are located. MDN "as one," takes care of the customer.

www.mdnworldwide.com

SERVICE

- 24 hours
- 7 days/week
- Factory-trained technicians

SUPPORT

- Engineering sizing software
- CAD Configurator
- Engineering support

TRAINING

- Local training
- Customer specific training
- Video and data conferencing

TOTAL AUTOMATION SOLUTIONS

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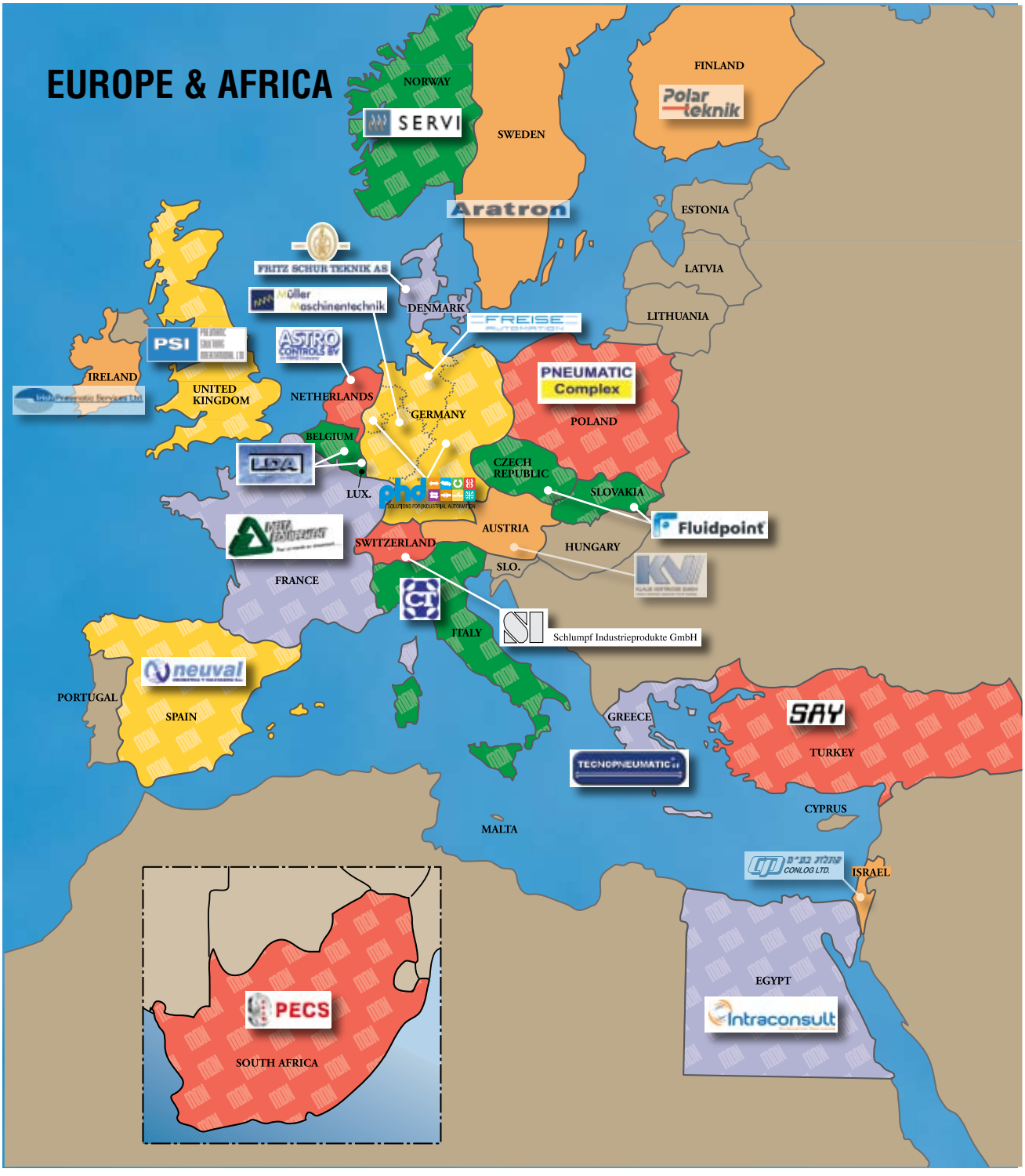


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SERIES		SIZE	MAX STROKE * in	[mm]	MAX FORCE † lb	[N]	MAJOR BENEFIT	INDUSTRY USE
CRS (Compact) page 1-5		12	3-1/4	[80]	26	[113]	• Compact • Optional shock pads extend cylinder life and minimize piston noise • Low profile	• Material handling • Conveyors • Packaging • Assembly machines • General industrial automation
		16	3-1/4	[80]	47	[201]		
		20	4	[100]	73	[314]		
		25	4	[100]	114	[491]		
		32	4-1/2	[115]	187	[804]		
		40	4-1/2	[115]	292	[1257]		
		50	5	[125]	456	[1964]		
		63	7	[175]	725	[3117]		
CTS page 1-19		12	2-1/2	[60]	26	[113]	• Compact • Hard chrome plated guide shafts for anti-rotation & increased side load capacity • Multiple mounting options	• Material handling • Conveyors • Assembly machines • General industrial automation • Automotive
		16	2-3/4	[70]	47	[201]		
		20	3-3/8	[85]	73	[314]		
		25	3-3/8	[85]	114	[491]		
		32	3-5/8	[90]	187	[804]		
		40	3-7/8	[95]	292	[1257]		
		50	3-3/4	[95]	456	[1964]		
		63	6	[150]	725	[3117]		
CV (ISO/VDMA) page 1-29		CVC20	[500]		73	[314]	• ISO/VDMA interchange for easy mounting • PTFE wear ring & built-in shock pads for long cylinder life • Rodlok® option for easy & dependable locking of piston	• Automotive • Material handling • Assembly machines • General industrial automation
		CVC25	[500]		114	[491]		
		CVB20	[750]		73	[314]		
		CVB25	[750]		114	[491]		
		32	[1000]		187	[804]		
		40	[1000]		292	[1257]		
		50	[1000]		457	[1964]		
		63	[1000]		725	[3117]		
		80	[1000]		1169	[5027]		
		100	[1000]		1826	[7854]		
AV, HV, A (NFPA) 3/4", 1", & 1-1/8" page 1-53 tom thumb®		3/4" A, AV	12		66	[295]	• Long life design for low maintenance • Repairable construction for extended life and long term savings	• Packaging • Assembly machines • Machine loading/ unloading • General industrial automation
		1" A, AV	18		118	[524]		
		1-1/8" A, AV	18		149	[663]		
		3/4" HV	12		663	[2948]		
		1" HV	18		1178	[5240]		
		1-1/8" HV	18		1491	[6632]		
AV, HV (NFPA) 1-3/8" page 1-67 tom thumb®		1-3/8" AV	24		223	[991]	• Long life design for low maintenance • Wide range of options for easy application and reduced design time	• Packaging • Assembly machines • Machine loading/ unloading • General industrial automation
		1-3/8" HV	24		2227	[9907]		

NOTES:
1) * Consult PHD for longer strokes.
2) † Maximum force is calculated at 150 psi [10.35 bar].

cylinders

SERIES		SIZE	MAX STROKE * in [mm]	MAX FORCE † lb [N]	MAJOR BENEFIT	INDUSTRY USE
TD (Air/Oil) page 1-79 tom thumb®		3/4" TD 1" TD 1-1/8" TD 1-3/8" TD 3/4" TD -X or -C 1" TD -X or -C 1-1/8" TD -X or -C 1-3/8" TD -X or -C	6 9 9 12 6 9 9 12	125 [557] 224 [997] 282 [1253] 416 [1850] 66 [295] 118 [524] 149 [663] 223 [991]	• Precise speed control and smooth operation at low velocities • Repairable construction for extended life and long term savings	• Packaging • Assembly machines • Machine loading/ unloading • General industrial automation
AV2, HV2, A2 (Back-to-Back) page 1-87 tom thumb®		3/4" A2, AV2 1" A2, AV2 1-1/8" A2, AV2 1-3/8" AV2 3/4" HV2 1" HV2 1-1/8" HV2 1-3/8" HV2	6 9 9 12 6 9 9 12	66 [295] 118 [524] 149 [663] 223 [991] 663 [2948] 1178 [5240] 1491 [6632] 2227 [9907]	• Long life design for low maintenance • Repairable construction for extended life and long term savings	• Packaging • Assembly machines • Machine loading/ unloading • General industrial automation
A3V, H3V, A3 (Three Position) page 1-95 tom thumb®		3/4" A3, A3V 1" A3, A3V 1-1/8" A3, A3V 1-3/8" A3V 3/4" H3V 1" H3V 1-1/8" H3V 1-3/8" H3V	6 9 9 12 6 9 9 12	66 [295] 118 [524] 149 [663] 223 [991] 663 [2948] 1178 [5240] 1491 [6632] 2227 [9907]	• Long life design for low maintenance • Repairable construction for extended life and long term savings	• Packaging • Assembly machines • Machine loading/ unloading • General industrial automation
NPG, NHG (Non-Rotating) page 1-105 tom thumb®		1-1/8" NPG 1-3/8" NPG 1-1/8" NHG 1-3/8" NHG	18 24 18 24	149 [663] 223 [991] 1491 [6632] 2227 [9907]	• Long life design for low maintenance • Non-rotating rod, adjustable positions • Repairable construction for extended life and long term savings	• Packaging • Assembly machines • Machine loading/ unloading • General industrial automation
AV, A, -O (Cleanroom) page 1-113 tom thumb®		3/4" A, AV -O 1" A, AV -O 1-1/8" A, AV -O	12 18 18	66 [295] 118 [524] 149 [663]	• Can be used in Class 100 Cleanroom applications • Vacuum port and special bushings offer rod protection	• Class 100 cleanroom • Food processing • Medical • Assembly machines • Machine loading/ unloading • Semi-conductor
SFP Slide (Rodless Cylinder) page 2-83		27 40	70.8 [1800] 133.8 [3400]	MAX FORCE @ 110 psi [7.6 bar] 98 [435] 215 [955]	• Space saving design • Smooth, precise movement • High load capacity with very low deflection	• General automation • Packaging • Assembly machine builders • Medical • Semiconductor • Optical • Plastics • Automotive

NOTES:
1) * Maximum stroke (per cylinder 1 or 2) consult PHD for longer strokes.
2) † Maximum force calculated at 150 psi [10.35 bar].

SEE THE PHD CLASSICS CATALOG FOR THE FOLLOWING PHD CYLINDERS:

Series AS, AVS, & HVS Spherical Mount Cylinders
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page 1-115

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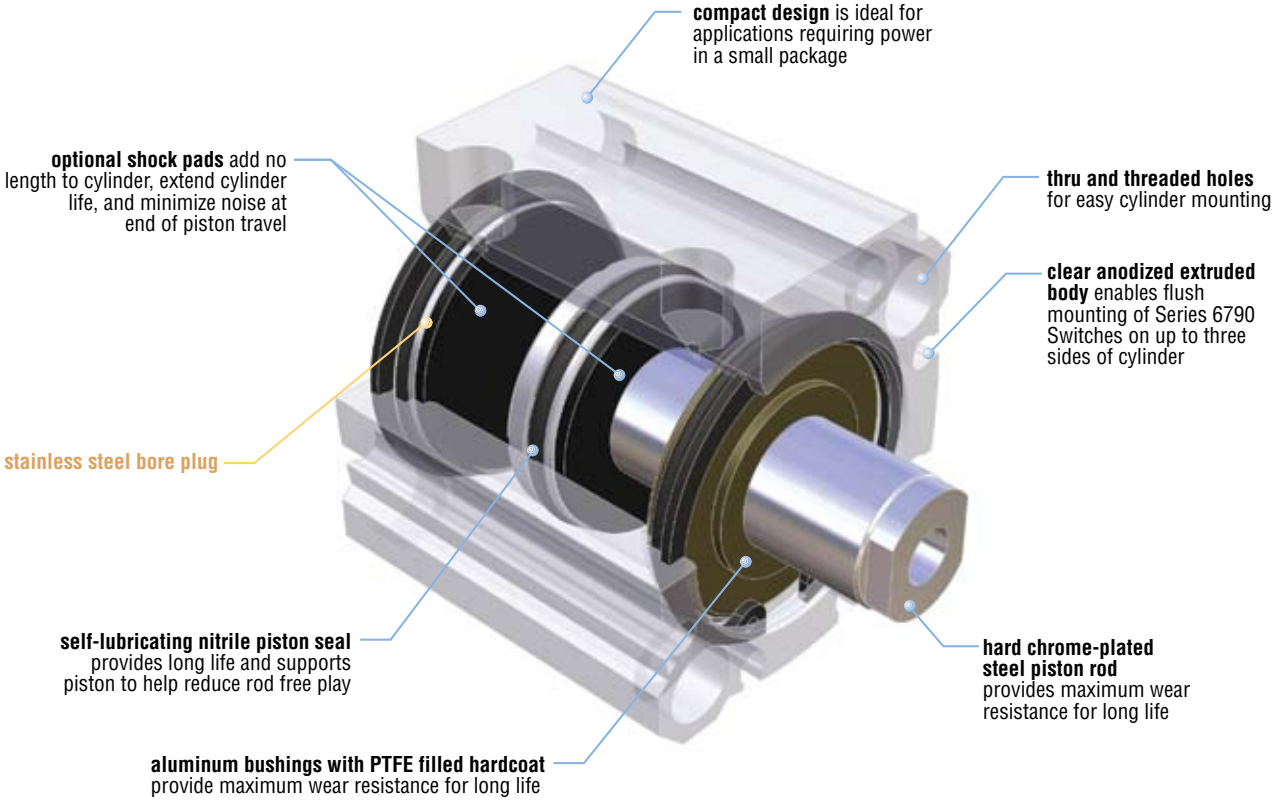
page 1-120

CRS

COMPACT DESIGN IDEAL FOR CRITICAL CYLINDER LENGTH APPLICATIONS



Major Benefits

- Compact design for applications where space is limited
- Up to six switch slots for flush switch mounting
- Self-lubricating nitrile piston seal for long cylinder life
- Multiple mounting options

Industry Uses

- Material handling
- Conveyors
- Packaging
- Assembly machines
- General industrial automation

ORDERING DATA: SERIES CRS COMPACT CYLINDERS

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

PRODUCT
C - Cylinder

TYPE
S - Single Rod, Double Acting (Standard)
D - Double Rod, Double Acting (See note 4.)

MOUNTING STYLE
All units have 4 thru holes
U - Universal (Standard) Thread and C'bore 8 Places, 4 Each End

IMPERIAL STROKE (CRx3)
STANDARD STROKE LENGTHS
1/4" = Minimum stroke in 1/8" increments (See Note 5)

BORE mm	MAXIMUM STROKE (in)
12	3.25
16	3.25
20	4.00
25	4.00
32	4.50
40	4.50
50	5.00
63	7.00

METRIC STROKE (CRx6)
STANDARD STROKE LENGTHS
5 mm = Minimum stroke in 5 mm increments (See Note 5)

BORE mm	MAXIMUM STROKE [mm]
12	80
16	80
20	100
25	100
32	115
40	115
50	125
63	175

C R S 3 U 32 x 1/2 - M-T22

SERIES
R - Compact Round Bore

DESIGN NO.
3 - Imperial
6 - Metric

BORE SIZE

BORE mm	BORE in	AREA mm²	AREA in²
12	.47	113	.175
16	.63	201	.312
20	.79	314	.486
25	.98	490	.760
32	1.26	804	1.247
40	1.57	1256	1.948
50	1.97	1963	3.045
63	2.48	3117	4.831

Options may affect unit length. See unit dimension and options pages for adders.

IMPERIAL OPTIONS (CRx3)
BB - Shock Pads in both directions (No additional cylinder length)
M - Magnetic piston for use with PHD Miniature Reed Switches. See Notes 1 and 7.
WP - Wide piston for extra rod support (Standard with -M). See Note 1.
F11 - Extended length wrench flats
K_ - Extra Rod Extension in 1/8" increments. Length code example: K1 = 1/8", K3 = 3/8", etc.
T11 - Male Rod End, fine thread
T22 - Male Rod End, coarse thread
T44 - Female Rod End, coarse thread (Available on 20 mm through 63 mm sizes only)
T55 - Plain Rod End with wrench flats
T88 - Extended Male Rod End, fine thread
T99 - Extended Male Rod End, coarse thread
V1 - Fluoro-Elastomer Seals. See Note 2.
Z1 - Corrosion resistant, stainless steel rod and electroless nickel plated retaining rings. See Note 3.

METRIC OPTIONS (CRx6)
BB - Shock Pads in both directions (No additional cylinder length)
M - Magnetic piston for use with PHD Miniature Reed Switches. See Note 1 and 7.
WP - Wide piston for extra rod support (Standard with -M). See Note 1.
F11 - Extended length wrench flats
K_ - Extra Rod Extension in 5 mm increments. Length code example: K5 = 5 mm, K15 = 15 mm, etc.
T22 - Male Rod End
T55 - Plain Rod End with wrench flats
T99 - Extended Male Rod End
V1 - Fluoro-Elastomer Seals. See Note 2.
Z1 - Corrosion resistant, stainless steel rod and electroless nickel plated retaining rings. See Note 3.

NOTES:
1) Options -M and -WP add 1/4" [6.38 mm] to the overall length.
2) Option -V1 may reduce cylinder lifespan due to fluorocarbon seal material.
3) Option -Z1 may reduce cylinder lifespan due to stainless steel rod in place of chrome plated steel.
4) Double rod units' rear rod will receive same rod option as single rod.
5) For longer stroke lengths available, consult PHD.
6) See pages 1-13 through 1-18 for accessories.
7) PHD recommends the use of stainless steel or de-magnetized fasteners on units with this option.

SPECIFICATIONS	SERIES CRS
OPERATING PRESSURE	10 psi min to 150 psi max at zero load [0.7 bar min to 10 bar max] air
STROKE TOLERANCE	± 0.031 inch [± 0.8 mm]
TEMPERATURE LIMITS	-20° to +180°F [-28° to +82°C]
VELOCITY	20 in/sec [.5 m/sec] typical min, zero load at 100 psi [7 bar]
LIFE EXPECTANCY	70 million linear inches [1.77 million linear meters] minimum at operating temperatures under 120°F [49°C] (-V1 & -Z1 options may reduce life)
LUBRICATION	Pre-lubricated for use with non-lubricated or lubricated air
MAINTENANCE	Field repairable

CYLINDER FORCE AND WEIGHT TABLE

BORE		ROD DIA.		ROD	EFFECTIVE AREA		BASE WEIGHT		ADDER PER 1" [25 mm] OF STROKE	
mm	in	in	mm	DIRECTION	in²	mm²	lb	kg	lb	kg
12	.472	.250	6.35	EXTEND	.175	113	.11	.05	.085	.04
				RETRACT	.126	81				
16	.630	.250	6.35	EXTEND	.312	201	.17	.08	.10	.05
				RETRACT	.263	169				
20	.787	.375	9.53	EXTEND	.487	314	.25	.11	.15	.07
				RETRACT	.376	242				
25	.984	.375	9.53	EXTEND	.761	490	.26	.12	.16	.07
				RETRACT	.650	419				
32	1.260	.625	15.88	EXTEND	1.247	804	.48	.22	.26	.12
				RETRACT	.940	606				
40	1.575	.625	15.88	EXTEND	1.948	1256	.60	.27	.30	.14
				RETRACT	1.641	1058				
50	1.969	.750	19.05	EXTEND	3.043	1963	.78	.35	.40	.18
				RETRACT	2.602	1678				
63	2.480	.750	19.05	EXTEND	4.832	3117	.95	.43	.48	.22
				RETRACT	4.390	2832				

NOTE: Use retract figures for calculating double rod end cylinder forces in both directions.

CYLINDER FORCE CALCULATIONS

		IMPERIAL F = P x A	METRIC F = 0.1 x P x A
F	= Cylinder Force	lbs	N
P	= Operating Pressure	psi	bar
A	= Effective Area (Extend or Retract)	in²	mm²

APPLICATION

The PHD Series CRS Cylinders are designed for use as a source of power and motion. As with typical compact cylinders, the Series CRS Cylinder is not intended for applications where side loads or impact with attached loads are present. PHD recommends the use of external stops to ensure maximum cylinder life. See best application practices on page 1-18.

SHOCK PAD USAGE

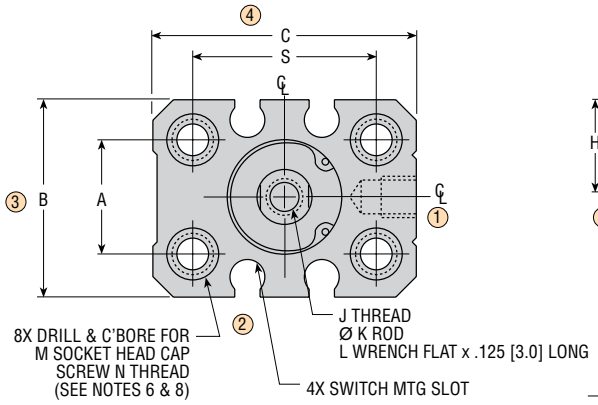
Optional shock pads are recommended for applications where the piston travels the full stroke length and contacts the bushing and plug (with no attached loads). The use of shock pads reduces noise and provides maximum cylinder life in these applications.

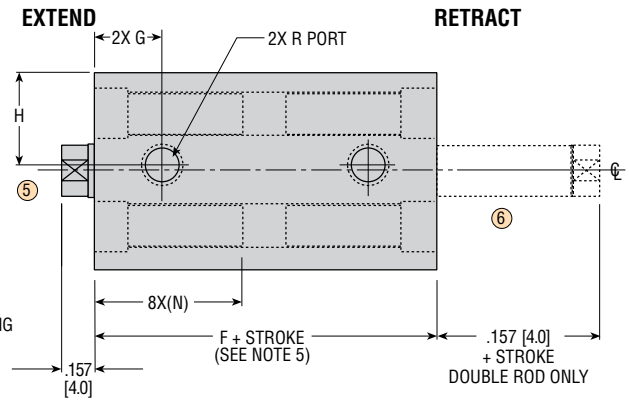
SIZING AND APPLICATION ASSISTANCE

See PHD Product Sizing Catalog for specific and complete sizing information.
Online sizing assistance is available at: ***www.phdinc.com/apps/sizing***

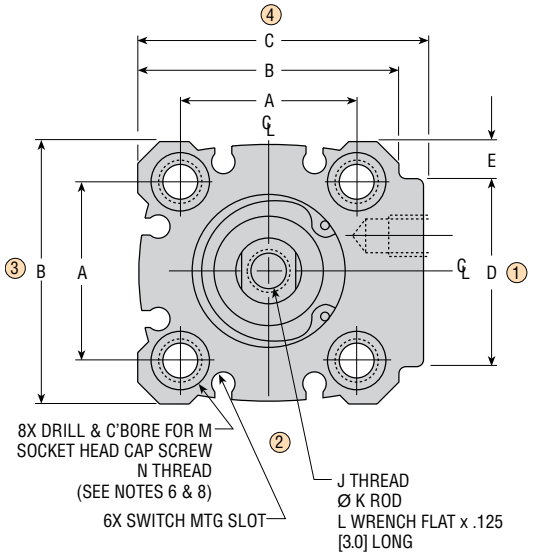
DIMENSIONS: SERIES CRS COMPACT CYLINDERS

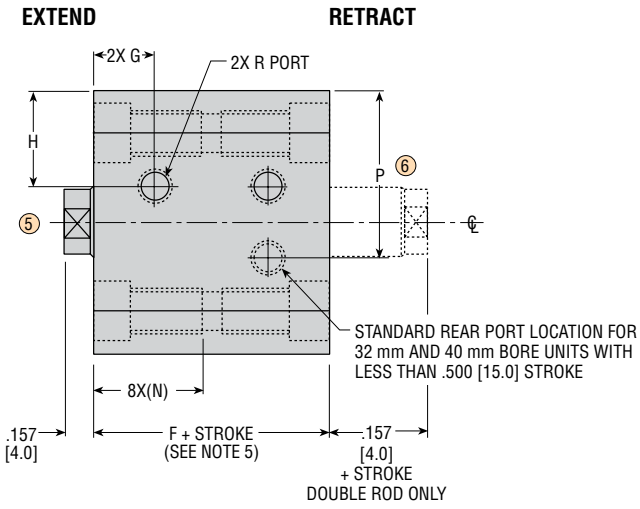
12 mm and 16 mm BORE





20 mm through 63 mm BORE





NOTES:

1) DIMENSIONS SHOWN IN [ ] ARE IN mm OR FOR METRIC UNITS [CRx6]
2) DESIGNATED CENTERLINE IS CENTERLINE OF CYLINDER BORE
3) UNLESS OTHERWISE DIMENSIONED, MOUNTING HOLE PATTERNS ARE CENTERED ON DESIGNATED CYLINDER CENTERLINE
4) 1/4" [5 mm] MINIMUM STROKE REQUIRED
5) SEE DIMENSION CHART ON NEXT PAGE. DIMENSION F IS DIFFERENT FOR "PLAIN" UNIT AND WITH OPTIONS -M AND -WP.
6) C'BORE DEPTH OF MOUNTING HOLES MUST BE CONSIDERED TO DETERMINE PROPER MOUNTING FASTENER LENGTH
7) FOR 32 mm AND 40 mm BORE UNITS WITH STROKES LESS THAN .500 in [15 mm], PHD RECOMMENDS THE USE OF FITTINGS WITH A HEX NO LARGER THAN 7/16 [13 mm]
8) PHD RECOMMENDS THE USE OF STAINLESS STEEL OR DE-MAGNETIZED FASTENERS ON UNITS WITH THE -M OPTION.

All dimensions are reference only unless specifically toleranced.

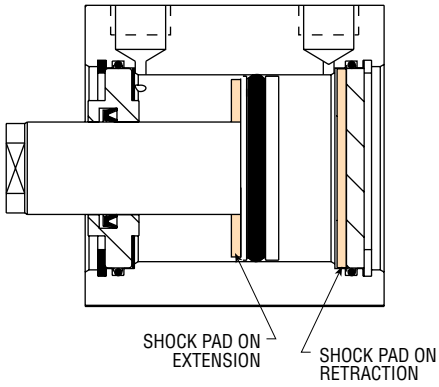
BORE	LETTER DIMENSION									
	A	B	C	D	E	F PLAIN	F W/ OPTIONS -M, -WP	G	H	J THREAD
.472	.550	.944	1.260	—	—	.904	1.154	.325	.472	8-32 x .250
[12]	[14.0]	[24.0]	[32.0]			[23.0]	[29.4]	[8.25]	[12.0]	[M4 x .7 x 6]
.630	.710	1.104	1.340	—	—	.904	1.154	.325	.454	8-32 x .250
[16]	[18.0]	[28.0]	[34.0]			[23.0]	[29.4]	[8.25]	[11.5]	[M4 x .7 x 6]
.787	1.000	1.476	1.576	.788	.344	.920	1.170	.350	.531	1/4-28 x .375
[20]	[25.4]	[37.5]	[40.0]	[20.0]	[8.75]	[23.4]	[29.8]	[9.0]	[13.5]	[M6 x 1.0 x 9]
.984	1.100	1.576	1.746	1.000	.288	.920	1.170	.350	.552	1/4-28 x .375
[25]	[28.0]	[40.0]	[44.5]	[25.4]	[7.3]	[23.4]	[29.8]	[9.0]	[14.0]	[M6 x 1.0 x 9]
1.260	1.339	1.870	2.037	1.340	.266	1.022	1.272	.375	.610	5/16-24 x .470
[32]	[34.0]	[47.5]	[52.0]	[34.0]	[6.75]	[25.6]	[32.0]	[9.5]	[15.5]	[M8 x 1.25 x 11]
1.575	1.575	2.205	2.363	1.420	.392	1.022	1.272	.360	.738	5/16-24 x .470
[40]	[40.0]	[56.0]	[60.0]	[36.0]	[10.0]	[25.6]	[32.0]	[9.0]	[18.75]	[M8 x 1.25 x 11]
1.969	1.969	2.598	2.795	1.600	.497	1.300	1.550	.470	.823	3/8-24 x .563
[50]	[50.0]	[66.0]	[71.0]	[40.6]	[12.6]	[33.0]	[39.4]	[12.0]	[21.0]	[M10 x 1.5 x 13]
2.480	2.360	3.070	3.266	2.094	.488	1.420	1.670	.500	.865	3/8-24 x .563
[63]	[60.0]	[78.0]	[83.0]	[53.2]	[12.4]	[36.0]	[42.4]	[12.75]	[22.0]	[M10 x 1.5 x 13]

BORE	LETTER DIMENSION						
	K	L	M	N THREAD	P	R	S
.472	.250	.219	#6	10-24 x .550	—	10-32 x .15	.866
[12]	[6.35]	[5.5]	[M4]	[M5 x .8 x 14.5]		[M5 x .8 x 4]	[22.0]
.630	.250	.219	#6	10-24 x .550	—	10-32 x .15	.946
[16]	[6.35]	[5.5]	[M4]	[M5 x .8 x 14.5]		[M5 x .8 x 4]	[24.0]
.787	.375	.312	#10	1/4-20 x .875	—	10-32 x .15	—
[20]	[9.5]	[8.0]	[M5]	[M6 x 1.0 x 22.5]		[M5 x .8 x 4]	
.984	.375	.312	#10	1/4-20 x .875	—	10-32 x .15	—
[25]	[9.5]	[8.0]	[M5]	[M6 x 1.0 x 22.5]		[M5 x .8 x 4]	
1.260	.625	.500	#10	1/4-20 x .875	.900	1/8 NPT	—
[32]	[15.9]	[13.0]	[M5]	[M6 x 1.0 x 22.5]	[22.8]	[1/8 BSP]	
1.575	.625	.500	#10	1/4-20 x .875	1.072	1/8 NPT	—
[40]	[15.9]	[13.0]	[M5]	[M6 x 1.0 x 22.5]	[27.2]	[1/8 BSP]	
1.969	.750	.625	1/4	5/16-18 x .900	—	1/8 NPT	—
[50]	[19.0]	[16.0]	[M6]	[M8 x 1.25 x 22.5]		[1/8 BSP]	
2.480	.750	.625	1/4	5/16-18 x .900	—	1/4 NPT	—
[63]	[19.0]	[16.0]	[M6]	[M8 x 1.25 x 22.5]		[1/4 BSP]	

Numbers in [ ] are in mm or for metric units [CRx6].

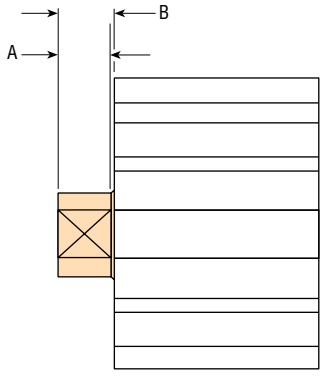
BB SHOCK PADS ON EXTENSION AND RETRACTION

Shock pads eliminate metal-to-metal contact and minimize piston impact. Shock pads are recommended for applications where the piston travels the full stroke length and contacts the head and/or cap (with no attached loads). The use of shock pads reduces noise and provides maximum cylinder life in these applications.



F11 EXTENDED LENGTH WRENCH FLATS

The design of a compact cylinder requires the length to be as short as possible. The standard wrench flat length is .125" [3 mm]. The option -F11 provides wrench flats which allow standard wrench access.



BORE [mm]	A EXTENDED WRENCH FLATS		B ROD EXTENSION	
12/16	.200	[5.25]	.250	[6.5]
20/25	.200	[5.25]	.250	[6.5]
32/40	.290	[8.00]	.344	[9.0]
50/63	.290	[8.00]	.344	[9.0]

Numbers in [ ] are in mm or for metric units [CRx6].

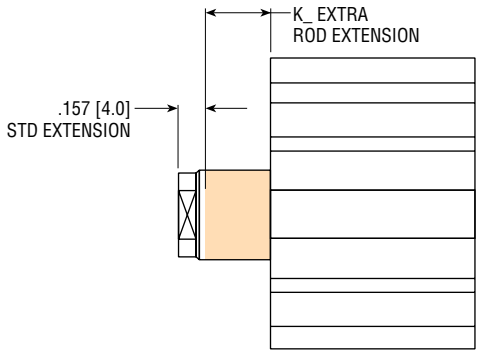
K_ EXTRA ROD EXTENSION

Extra rod extension can be achieved by specifying the option -K followed by the length code.

Length code example (for imperial CRx3 units)
K1 = 1/8" of extra rod extension
K3 = 3/8", etc.

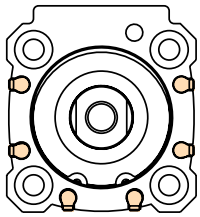
Length code example (for metric CRx6 units)
K5 = 5 mm of extra rod extension
K15 = 15 mm, etc.

.157" [4 mm] of rod extension is standard. Available in 1/8" [5 mm] increments only.



All dimensions are reference only unless specifically toleranced.

M MAGNET FOR PHD SERIES 6790 SWITCHES



This option equips the cylinder with a magnetic band on the piston for use with PHD Series 6790 Switches. These switches mount easily into the integral slots in the body. PHD recommends the use of stainless steel or de-magnetized fasteners on units with this option.

NOTE: Option -M adds 1/4" [6.38 mm] to the overall length of the cylinder of a plain unit.

PART NO.	DESCRIPTION
67902-1-02	NPN (Sink) or PNP (Source) DC Reed, 2 m cable
67902-1-05	NPN (Sink) or PNP (Source) DC Reed, 5 m cable
67903-1-02	NPN (Sink) DC Solid State, 2 m cable
67903-1-05	NPN (Sink) DC Solid State, 2 m cable
67904-1-02	PNP (Source) DC Solid State, 2 m cable
67904-1-05	PNP (Source) DC Solid State, 5 m cable
67922-1	NPN (Sink) or PNP (Source) DC Reed, Quick Connect
67929-2	AC Reed, Current Limited, Quick Connect
67923-1	NPN (Sink) DC Solid State, Quick Connect
67924-1	PNP (Source) DC Solid State, Quick Connect
63549-02	2 m Cordset with Quick Connect
63549-05	5 m Cordset with Quick Connect

NOTES:
1) Switch set screw torque to 16 in-oz [.11 Nm] max.
2) See switches and sensors section for additional switch information and complete specification.

WP WIDE PISTON FOR EXTRA ROD END SUPPORT

This option provides additional rod end stability. All units with magnetic pistons will automatically receive a wide piston to accommodate the magnet.

NOTE: Option -WP, adds 1/4" [6.38 mm] to the overall length of the cylinder of a plain unit.

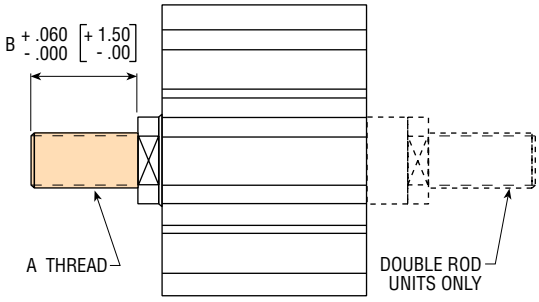
V1 FLUORO-ELASTOMER SEALS

Fluoro-Elastomer seals are compatible with certain fluids which degrade standard Nitrile seals. Seal compatibility should be checked with the fluid manufacturer for correct application. Consult PHD for high temperature use.

T11 MALE ROD END, FINE THREAD
(NOT AVAILABLE ON CRx6 UNITS)

T22 MALE ROD END, COARSE THREAD

These options provide a studded male rod end in place of the standard female threaded rod end. The metric CRS is available with coarse threads only. See pages 1-8 and 1-9 for specifications of standard rod ends.

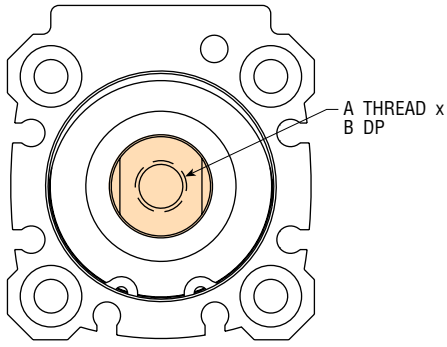


BORE [mm]	-T11 FINE A THREAD	-T22 COARSE A THREAD		B	
12/16	N/A	8-32	[M4 x .7]	.325	[10.0]
20/25	1/4-28	1/4-20	[M6 x 1.0]	.580	[16.0]
32/40	5/16-24	5/16-18	[M8 x 1.25]	.625	[19.0]
50/63	3/8-24	3/8-16	[M10 x 1.5]	.810	[22.0]

NOTES: 1) Numbers in [ ] are in mm or for metric units [CRx6].
2) On double rod units, rear rod receives same rod end as single rod.

T44 FEMALE ROD END, COARSE THREAD (CRx3 20-63 UNITS ONLY)

This option provides a female coarse thread rod end. This option can be applied to imperial 20 mm through 63 mm bore units. The imperial 12 mm and 16 mm bore units have an 8-32 coarse thread as standard. See pages 1-8 and 1-9 for standard thread sizes. The metric 12 mm through 63 mm bore units have coarse threads as standard.



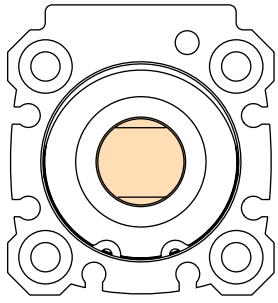
BORE [mm]	-T44 COARSE A THREAD	B
12/16	(STD)	(STD)
20/25	1/4-20	.375
32/40	5/16-18	.470
50/63	3/8-16	.562

NOTE: On double rod units, rear rod receives same rod end as single rod.

T55 PLAIN ROD END

This option provides a plain rod end with wrench flats. Standard PHD Compact Cylinders are supplied with a female rod end.

NOTE: On double rod units, rear rod receives same rod end as single rod.

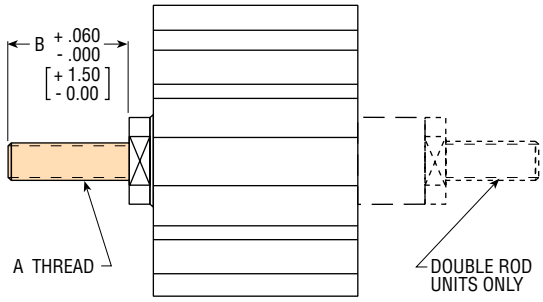


All dimensions are reference only unless specifically toleranced.

T88 EXTENDED MALE ROD END, FINE THREAD
(NOT AVAILABLE ON CRx6 UNITS)

T99 EXTENDED MALE ROD END, COARSE THREAD

These options provide a studded male rod end with extended length threads. Metric CRS units are available with coarse threads only. See page 1-12 for standard length male rod end options.



BORE [mm]	-T88 FINE	-T99 COARSE A THREAD		B	
12/16	N/A	8-32	[M4 x .7]	.700	[19.0]
20/25	1/4-28	1/4-20	[M6 x 1.0]	1.200	[31.0]
32/40	5/16-24	5/16-18	[M8 x 1.25]	1.250	[34.0]
50/63	3/8-24	3/8-16	[M10 x 1.5]	1.690	[37.0]

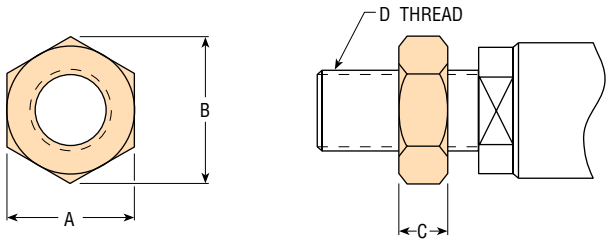
NOTES: 1) Numbers in [ ] are in mm or for metric units [CRx6].
2) On double rod units, rear rod receives same rod end as single rod.

Z1 CORROSION RESISTANT

Electroless nickel plating is applied to the retaining rings and a stainless steel piston rod is supplied. Male rod ends are not plated when this option is specified. This option may reduce seal life.

HEXAGONAL NUT KIT

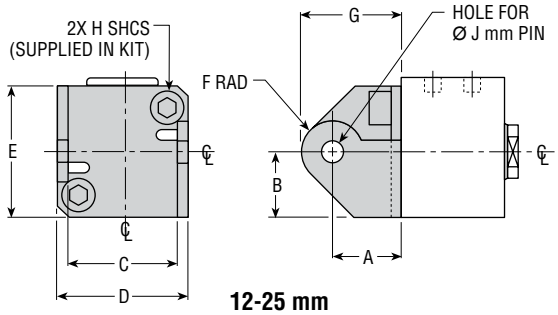
Nut kits include a hexagonal nut for use with male studded rod ends. All male rod end options are shipped without hexagonal nuts.



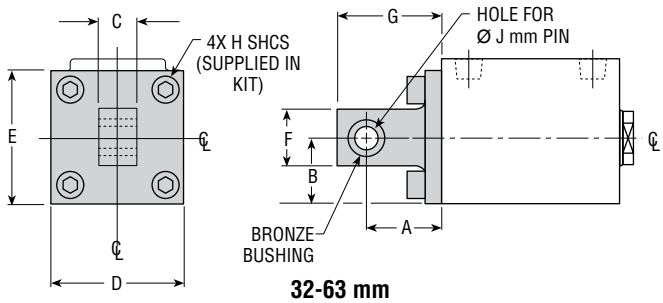
BORE [mm]	DIMENSIONS A	B	C	D THREAD FINE	KIT NO.	D THREAD COARSE	KIT NO. COARSE
12/16	.335 [7.0]	.385 [7.7]	.125 [2.2]	N/A [N/A]	N/A [N/A]	8-32 [M4 x .7]	1972-039 [3204-035]
20/25	.432 [10.0]	.487 [11.0]	.157 [3.2]	1/4-28 [N/A]	1972-015 [N/A]	1/4-20 [M6 x 1.0]	1972-014 [3204-001]
32/40	.500 [13.0]	.577 [14.4]	.187 [4.0]	5/16-24 [N/A]	1972-017 [N/A]	5/16-18 [M8 x 1.25]	1972-016 [3204-002]
50/63	.562 [17.0]	.650 [18.9]	.215 [5.0]	3/8-24 [N/A]	1972-019 [N/A]	3/8-16 [M10 x 1.5]	1972-018 [3204-025]

Numbers in [ ] are in mm or for metric units [CRx6].

CYLINDER PIVOT KIT



12-25 mm



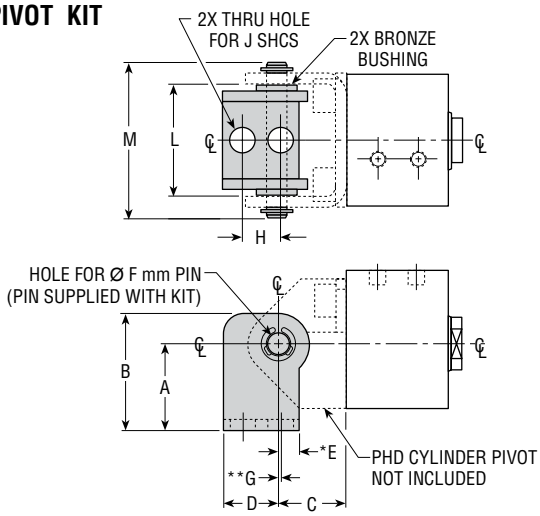
32-63 mm

BORE [mm]	DIMENSIONS									KIT NO. IMPERIAL CRx3	KIT NO. METRIC CRx6
	A	B	C	D	E	F	G	H	J		
12	.650 [16.5]	.638 [16.5]	.905 [23.0]	1.064 [27.0]	1.276 [33.0]	.281 [7.5]	.931 [24.0]	10-24 [M5 x .8]	.197 [5.0]	60278-1	60286-1
16	.650 [16.5]	.678 [17.5]	.905 [23.0]	1.064 [27.0]	1.356 [35.0]	.281 [7.5]	.931 [24.0]	10-24 [M5 x .8]	.197 [5.0]	60279-1	60287-1
20	.790 [20.0]	.750 [19.0]	1.250 [31.75]	1.500 [38.0]	1.500 [38.0]	.355 [9.0]	1.145 [29.0]	1/4-20 [M6 x 1.0]	.237 [6.0]	60280-1	60288-1
25	.790 [20.0]	.800 [20.5]	1.250 [31.75]	1.500 [38.0]	1.600 [41.0]	.355 [9.0]	1.145 [29.0]	1/4-20 [M6 x 1.0]	.237 [6.0]	60281-1	60289-1
32	1.065 [27.0]	.935 [24.0]	.526 [13.5]	1.870 [48.0]	1.870 [48.0]	.820 [21.0]	1.475 [37.5]	1/4-20 [M6 x 1.0]	.394 [10.0]	60282-1	60290-1
40	1.065 [27.0]	1.105 [28.0]	.526 [13.5]	2.210 [56.0]	2.210 [56.0]	.820 [21.0]	1.475 [37.5]	1/4-20 [M6 x 1.0]	.394 [10.0]	60283-1	60291-1
50	1.460 [37.0]	1.300 [33.0]	.646 [16.5]	2.600 [66.0]	2.600 [66.0]	1.000 [25.5]	1.970 [50.0]	5/16-18 [M8 x 1.25]	.473 [12.0]	60284-1	60292-1
63	1.460 [37.0]	1.500 [38.0]	.646 [16.5]	3.000 [76.0]	3.000 [76.0]	1.000 [25.5]	1.970 [50.0]	5/16-18 [M8 x 1.25]	.473 [12.0]	60285-1	60293-1

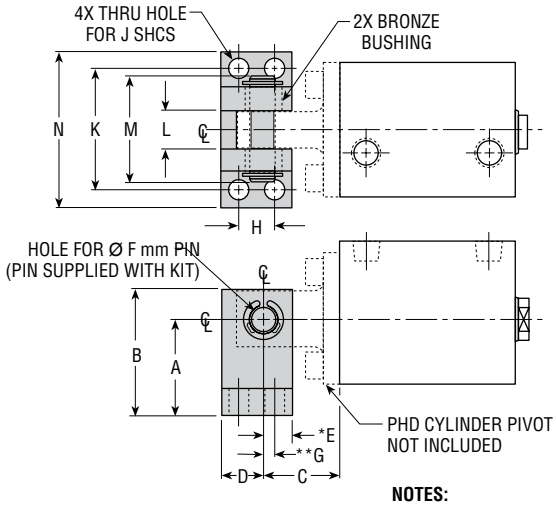
Numbers in [ ] are in mm or for metric units [CRx6].

NOTES:
1) 12-25 mm IS BRITE ZINC PLATED STEEL
2) 32-63 mm IS ANODIZED ALUMINUM WITH LUBRICATED BRONZE BUSHINGS
3) FULCRUM PIN NOT INCLUDED (SEE "FULCRUM PIN KITS" TO PURCHASE)

BASE PIVOT KIT



12-25 mm



32-63 mm

BORE [mm]	DIMENSIONS													KIT: CRx3x, CRx6x IMPERIAL/METRIC
	A	B	C	D	E	F	G	H	J	K	L	M	N	
12/16	.865 [22.0]	1.145 [29.0]	.650 [16.5]	.490 [12.5]	.220 [5.6]	.197 [5.0]	.060 [1.5]	.375 [9.5]	#10 [M5]	N/A	.905 [23.0]	1.300 [33.0]	N/A	60294-1
20/25	1.000 [25.5]	1.355 [34.5]	.790 [20.0]	.630 [16.0]	.260 [6.5]	.237 [6.0]	.040 [1.0]	.435 [11.0]	1/4 [M6]	N/A	1.250 [31.75]	1.730 [44.0]	N/A	60295-1
32/40	1.375 [35.0]	1.800 [46.0]	1.065 [27.0]	.600 [15.2]	.400 [10.2]	.394 [10.0]	.156 [4.0]	.510 [13.0]	1/4 [M6]	1.695 [43.0]	.530 [13.5]	1.490 [38.0]	2.165 [55.0]	60296-1
50/63	1.890 [48.0]	2.365 [60.0]	1.460 [37.0]	.755 [19.2]	.505 [13.0]	.473 [12.0]	.236 [6.0]	.709 [18.0]	5/16 [M8]	2.265 [57.5]	.650 [16.5]	1.970 [50.0]	2.835 [72.0]	60297-1

Numbers in [ ] are in mm or for metric units [CRx6].

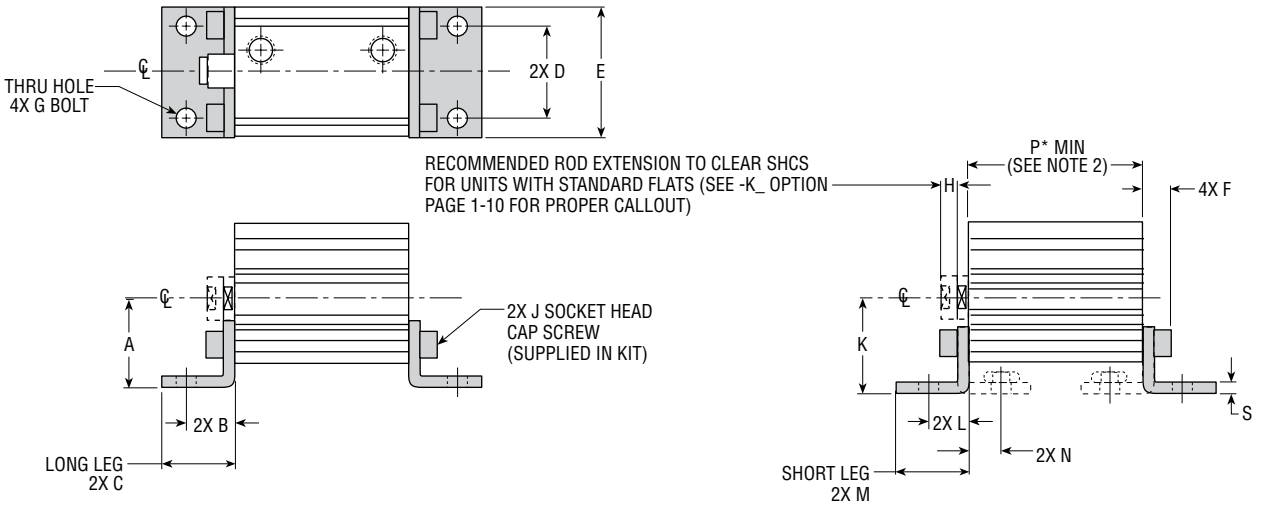
NOTES:
1) 12-25 mm IS BRITE ZINC PLATED STEEL WITH LUBRICATED BRONZE BUSHINGS
2) 32-63 mm IS ANODIZED ALUMINUM WITH LUBRICATED BRONZE BUSHINGS
3) FULCRUM PIN INCLUDED. DOES NOT INCLUDE CYLINDER PIVOT.
4) *E IS TO CENTER OF PIVOT PIN
5) **G IS FROM CENTER OF PIVOT PIN TO CENTER OF FIRST MOUNTING HOLE

All dimensions are reference only unless specifically toleranced.

F MOUNT KIT (Must be ordered separately)

Plated steel for use where front or rear mounting is not feasible. Brackets are narrow allowing units to be used where space to the side of the cylinder is limited.

NOTE: Brackets may be mounted in different configurations. Each kit includes 1 bracket and cylinder mounting hardware. Two kits recommended per unit!



THIS VIEW WITH LONG LEG AS MOUNTING SURFACE

THIS VIEW WITH SHORT LEG AS MOUNTING SURFACE

BORE [mm]	DIMENSIONS														KIT NO.	
	A	B	C	D	E	F	G	H	J	K	L	M	N	P* MIN	S	IMPERIAL CRx3	METRIC CRx6
12	.874 [22.0]	.553 [14.0]	.770 [19.50]	.550 [14.0]	.950 [24.00]	.295 [7.5]	#10 [M5]	.250 [5.0]	10-24 [M5 x .8]	.986 [25.0]	.441 [11.25]	.660 [17.0]	.336 [8.5]	3/8 [10.0]	.105 [2.70]	58904-1	60302-1
16	.945 [24.0]	.589 [15.0]	.850 [21.50]	.710 [18.0]	1.110 [28.25]	.310 [8.0]	#10 [M5]	.250 [10.0]	10-24 [M5 x .8]	1.062 [27.0]	.475 [12.0]	.730 [18.5]	.355 [9.0]	3/8 [10.0]	.120 [3.00]	58905-1	60303-1
20	1.000 [25.5]	.680 [17.25]	.940 [24.00]	1.000 [25.5]	1.560 [39.75]	.370 [9.5]	1/4 [M6]	.375 [10.0]	1/4-20 [M6 x 1.0]	1.180 [30.0]	.500 [12.75]	.760 [19.3]	.380 [9.7]	1/2 [15.0]	.120 [3.00]	58906-1	60304-1
25	1.100 [28.0]	.690 [17.5]	.950 [24.00]	1.100 [28.0]	1.610 [41.00]	.390 [10.0]	1/4 [M6]	.375 [10.0]	1/4-20 [M6 x 1.0]	1.240 [31.5]	.550 [14.0]	.825 [21.0]	.415 [10.5]	1/2 [15.0]	.135 [3.40]	58907-1	60305-1
32	1.280 [32.5]	.730 [18.5]	1.035 [26.25]	1.340 [34.0]	1.890 [48.00]	.414 [10.5]	1/4 [M6]	.375 [10.0]	1/4-20 [M6 x 1.0]	1.400 [35.5]	.610 [15.5]	.915 [23.25]	.446 [11.3]	5/8 [20.0]	.164 [4.20]	58908-1	60306-1
40	1.415 [36.0]	.807 [20.5]	1.180 [30.00]	1.575 [40.0]	2.205 [56.00]	.429 [11.0]	1/4 [M6]	.375 [10.0]	1/4-20 [M6 x 1.0]	1.595 [40.5]	.625 [16.0]	.975 [25.0]	.446 [11.3]	5/8 [20.0]	.179 [4.50]	58909-1	60307-1
50	1.750 [44.5]	.905 [23.0]	1.420 [36.00]	1.970 [50.0]	2.600 [66.00]	.531 [13.5]	5/16 [M8]	.500 [15.0]	5/16-18 [M8 x 1.25]	1.885 [48.0]	.765 [19.5]	1.250 [32.0]	.556 [14.1]	7/8 [25.0]	.209 [5.30]	58910-1	60308-1
63	2.010 [51.0]	.985 [25.0]	1.520 [38.50]	2.360 [60.0]	3.070 [78.00]	.570 [14.5]	5/16 [M8]	.500 [15.0]	5/16-18 [M8 x 1.25]	2.165 [55.0]	.830 [21.0]	1.325 [33.7]	.580 [14.7]	7/8 [25.0]	.250 [6.40]	58911-1	60309-1

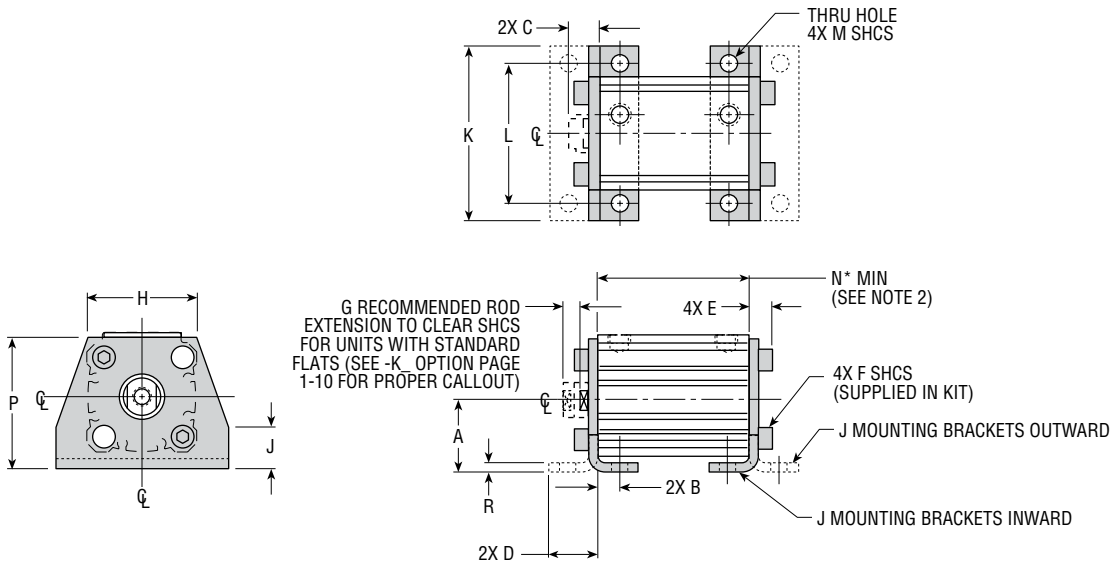
NOTES:

1) NUMBERS IN [ ] ARE IN mm OR FOR METRIC UNITS [CRx5].
2) *MINIMUM STROKE REQUIRED FOR LEGS OF BOTH BRACKETS TO BE UNDER UNIT (SUBTRACT .250 [5.0] FROM P FOR MAGNETIC UNITS)

J MOUNT KIT (Must be ordered separately)

Plated steel for use where height is critical, but room is available to sides of unit.

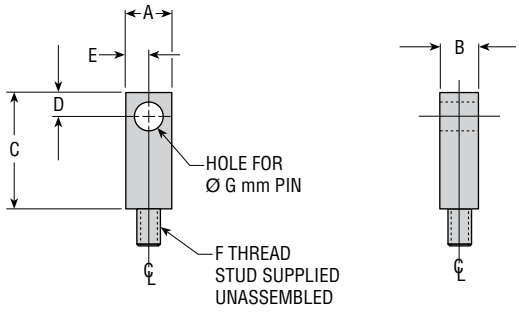
NOTE: Brackets may be mounted in different configurations. Kit includes 2 brackets and cylinder mounting hardware.



BORE [mm]	DIMENSIONS															KIT NO.	
	A	B	C	D	E	F	G	H	J	K	L	M	N* MIN	P	R	IMPERIAL CRx3	METRIC CRx6
12	.830 [21.0]	.275 [7.0]	.380 [9.65]	.600 [15.3]	.295 [7.5]	10-24 [M5 x .8]	.250 [5.0]	.945 [24.0]	.390 [10.0]	1.810 [46.0]	1.380 [35.0]	#10 [M5]	.250 [5.0]	1.510 [38.4]	.105 [2.70]	60310-1	60318-1
16	.870 [22.0]	.275 [7.0]	.395 [10.0]	.610 [15.5]	.310 [8.0]	10-24 [M5 x .8]	.250 [10.0]	1.122 [28.5]	.450 [11.5]	1.970 [50.0]	1.535 [39.0]	#10 [M5]	.250 [5.0]	1.620 [41.2]	.120 [3.00]	60311-1	60319-1
20	.945 [24.0]	.315 [8.0]	.435 [11.0]	.710 [18.0]	.370 [9.5]	1/4-20 [M6 x 1.0]	.375 [10.0]	1.470 [37.4]	.450 [11.5]	2.520 [64.0]	1.969 [50.0]	1/4 [M6]	.375 [10.0]	1.750 [44.5]	.120 [3.00]	60312-1	60320-1
25	1.005 [25.5]	.315 [8.0]	.450 [11.4]	.725 [18.5]	.390 [10.0]	1/4-20 [M6 x 1.0]	.375 [10.0]	1.581 [40.2]	.490 [12.5]	2.600 [66.0]	2.047 [52.0]	1/4 [M6]	.375 [10.0]	1.890 [48.0]	.135 [3.40]	60313-1	60321-1
32	1.220 [31.0]	.355 [9.0]	.519 [13.2]	.834 [21.2]	.414 [10.5]	1/4-20 [M6 x 1.0]	.375 [10.0]	1.873 [47.6]	.630 [16.0]	2.950 [75.0]	2.362 [60.0]	1/4 [M6]	.375 [10.0]	2.240 [57.0]	.164 [4.20]	60314-1	60322-1
40	1.400 [35.5]	.355 [9.0]	.534 [13.5]	.885 [22.5]	.429 [11.0]	1/4-20 [M6 x 1.0]	.375 [10.0]	2.190 [55.7]	.670 [17.0]	3.310 [84.0]	2.677 [68.0]	1/4 [M6]	.500 [10.0]	2.560 [65.0]	.179 [4.50]	60315-1	60323-1
50	1.730 [44.0]	.492 [12.5]	.701 [17.8]	1.114 [28.3]	.531 [13.5]	5/16-18 [M8 x 1.25]	.500 [15.0]	2.577 [65.5]	.850 [21.5]	3.940 [100.0]	3.189 [81.0]	5/16 [M8]	.625 [15.0]	3.150 [80.0]	.209 [5.30]	60316-1	60324-1
63	2.010 [51.0]	.514 [13.0]	.760 [19.3]	1.250 [32.0]	.570 [14.5]	5/16-18 [M8 x 1.25]	.500 [15.0]	3.055 [77.6]	1.000 [25.5]	4.530 [115.0]	3.661 [93.0]	5/16 [M8]	.750 [20.0]	3.660 [93.0]	.250 [6.40]	60317-1	60325-1

NOTES:
1) NUMBERS IN [ ] ARE IN mm OR FOR METRIC UNITS [CRx5].
2) *MINIMUM STROKE REQUIRED FOR LEGS OF BOTH BRACKETS TO BE UNDER UNIT (SUBTRACT .250 [5.0] FROM P FOR MAGNETIC UNITS)

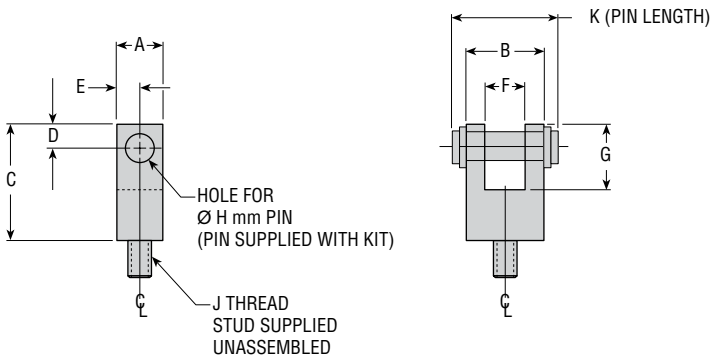
ROD EYE KIT



BORE [mm]	DIMENSIONS							KIT: CRx3x	KIT: CRx6x
	A	B	C	D	E	F	G	IMPERIAL	METRIC
12/16	.438 [11.0]	.250 [6.5]	.885 [22.5]	.215 [5.5]	.219 [5.5]	8-32 [M4 x .7]	.196 [5.0]	59069-1	60234-1
20/25	.500 [12.7]	.375 [9.5]	1.065 [27.0]	.255 [6.5]	.250 [6.5]	1/4-28 [M6 x 1.0]	.235 [6.0]	59070-1	60235-1
32/40	.625 [16.0]	.500 [12.5]	1.495 [38.0]	.355 [9.0]	.313 [8.0]	5/16-24 [M8 x 1.25]	.394 [10.0]	59071-1	60236-1
50/63	.875 [22.2]	.625 [16.0]	1.610 [41.0]	.430 [11.0]	. 438 [11.0]	3/8-24 [M10 x 1.5]	.471 [12.0]	59072-1	60237-1

NOTES:
1) UNIT **MUST** BE ORDERED WITH STANDARD FEMALE THREADS
2) UNLESS OTHERWISE DIMENSIONED, HOLE IS CENTERED ON DESIGNATED CYLINDER CENTERLINE
3) STANDARD PLATING IS BRITE ZINC
4) NUMBERS IN [ ] ARE IN mm OR FOR METRIC UNITS [CRx6]

ROD CLEVIS KIT



BORE [mm]	DIMENSIONS										KIT: CRx3x	KIT: CRx6x
	A	B	C	D	E	F	G	H	J	K	IMPERIAL	METRIC
12/16	.438 [11.0]	.625 [16.0]	1.000 [25.5]	.215 [5.5]	.219 [5.5]	.262 [6.5]	.610 [15.5]	.196 [5.0]	8-32 [M4 x .7]	.845 [21.5]	59073-1	60238-1
20/25	.500 [12.7]	.750 [19.0]	1.255 [32.0]	.255 [6.5]	.250 [6.5]	.387 [10.0]	.738 [19.0]	.235 [6.0]	1/4-28 [M6 x 1.0]	.965 [24.5]	59074-1	60239-1
32/40	.625 [16.0]	1.000 [25.5]	1.615 [41.0]	.315 [8.0]	.313 [8.0]	.514 [13.0]	.925 [23.5]	.393 [10.0]	5/16-24 [M8 x 1.25]	1.300 [33.0]	59075-1	60240-1
50/63	.875 [22.2]	1.250 [32.0]	1.815 [46.0]	.435 [11.0]	. 438 [11.0]	.640 [16.0]	1.165 [29.5]	.471 [12.0]	3/8-24 [M10 x 1.5]	1.575 [40.0]	59076-1	60241-1

NOTES:
1) UNIT **MUST** BE ORDERED WITH STANDARD FEMALE THREADS
2) UNLESS OTHERWISE DIMENSIONED, HOLE IS CENTERED ON DESIGNATED CYLINDER CENTERLINE
3) STANDARD PLATING IS BRITE ZINC (PIN & CLEVIS)
4) NUMBERS IN [ ] ARE IN mm OR FOR METRIC UNITS [CRx6]

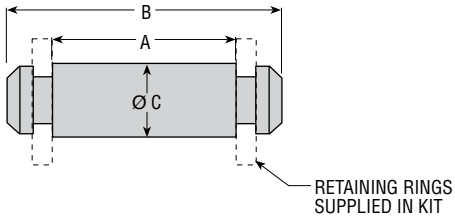
ACCESSORIES: SERIES CRS COMPACT CYLINDERS

ROD FULCRUM PIN KIT

Replacement for Rod Clevis pin or for use with PHD Rod Eye. Pin is Brite Zinc plated. Retaining rings are supplied.

BORE [mm]	DIMENSIONS A	B	ØC	KIT: CRx3x, CRx6x IMPERIAL/METRIC
12/16	1.120 [28.5]	1.300 [33.0]	.196 [5.0]	60330-1
20/25	1.550 [39.5]	1.730 [44.0]	.235 [6.0]	60331-1
32/40	1.240 [31.5]	1.490 [38.0]	.393 [10.0]	60332-1
50/63	1.690 [43.0]	1.970 [50.0]	.471 [12.0]	60333-1

Numbers in [ ] are in mm or for metric units [CRx6].

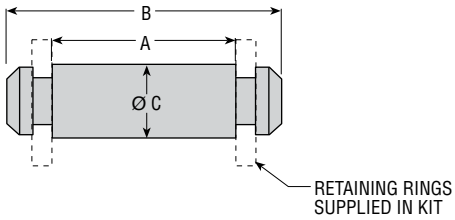


CYLINDER FULCRUM PIN KIT

Replacement for base pivot pin or for use with PHD Cylinder Pivot. Pin is Brite Zinc plated. Retaining rings are supplied.

BORE [mm]	DIMENSIONS A	B	ØC	KIT: CRx3x, CRx6x IMPERIAL/METRIC
12/16	1.120 [28.5]	1.300 [33.0]	.196 [5.0]	60330-1
20/25	1.550 [39.5]	1.730 [44.0]	.235 [6.0]	60331-1
32/40	1.240 [31.5]	1.490 [38.0]	.393 [10.0]	60332-1
50/63	1.690 [43.0]	1.970 [50.0]	.471 [12.0]	60333-1

Numbers in [ ] are in mm or for metric units [CRx6].



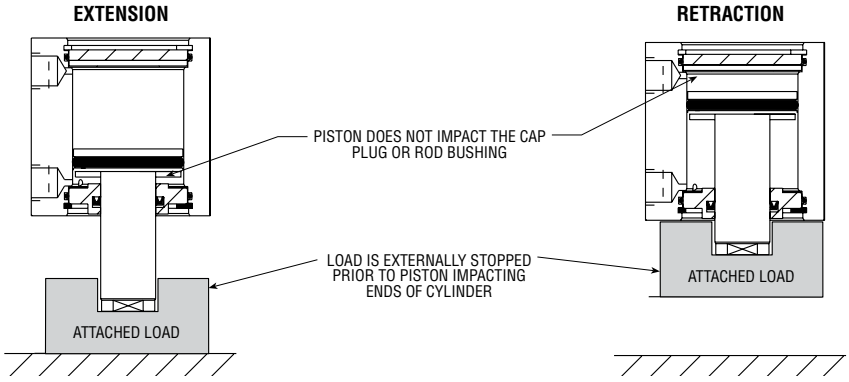
APPLICATION: SERIES CRS COMPACT CYLINDERS

BEST PRACTICES FOR MAXIMUM CYLINDER LIFE

Shown below are the best ways to apply PHD Series CRS Cylinders. The key to proper application and long cylinder life is using the cylinder to provide power and motion while externally stopping any attached loads.

APPLICATION #1 - ATTACHED LOAD

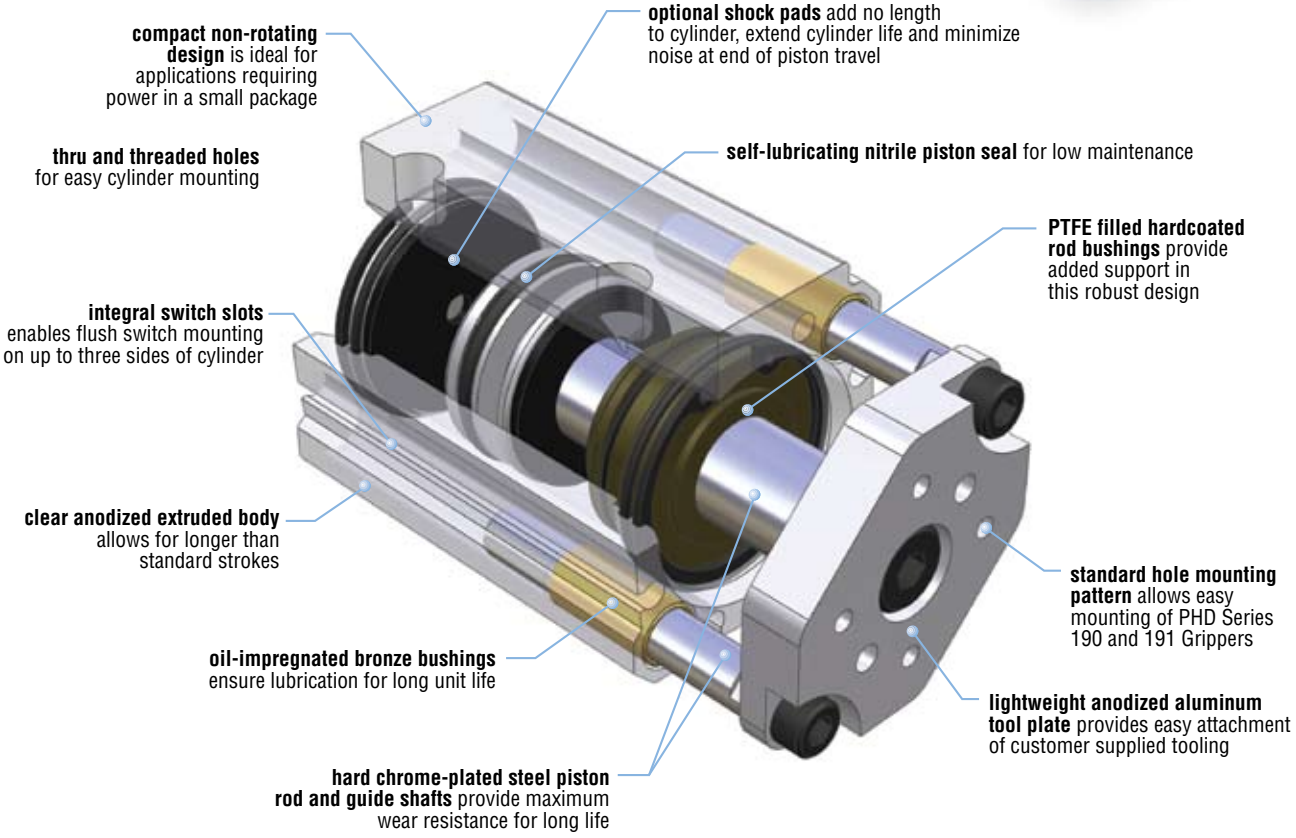
Loads connected to the cylinder rod must always be stopped externally. Strokes, rod lengths, and attached loads should be designed so that the piston never impacts the head or cap. For vertical applications only.



All dimensions are reference only unless specifically toleranced.

CTS

COMPACT NON-ROTATING GUIDE ROD CYLINDER



Major Benefits

- Compact design for applications where space is limited.
- Hard chrome plated guide shafts for anti-rotation and increased side load capacity.
- Oil-impregnated bronze bushings for long cylinder life.
- Multiple mounting options.
- Easy mounting of other PHD components.
- Up to six switch slots for flush switch mounting.

Industry Uses

- Material handling
- Conveyors
- Assembly machines
- General industrial automation
- Automotive

ORDERING DATA: SERIES CTS COMPACT GUIDE ROD CYLINDERS

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

PRODUCT
C - Cylinder

TYPE
S - Single Rod, Double Acting (Standard)
D - Double Rod, Double Acting
Double rod units include tool plate on one end only.

MOUNTING STYLE
All units have 2 thru holes
U - Universal (Standard)
Thread and C'bore 4 Places, 2 Each End
J - Foot Mounting
Foot Inward, 1 each end
K - Foot Mounting
Foot Outward, 1 each end

IMPERIAL STROKE (CTx2)
STANDARD STROKE LENGTHS
1/8" = Minimum stroke
in 1/8" increments

BORE mm	MAXIMUM STROKE (in)
12	2-3/4
16	2-3/4
20	3-1/2
25	3-1/2
32	4
40	4
50	4-1/2
63	6

METRIC STROKE (CTx6)
STANDARD STROKE LENGTHS
5 mm = Minimum stroke
in 5 mm increments

BORE mm	MAXIMUM STROKE [mm]
12	70
16	70
20	90
25	90
32	100
40	100
50	115
63	150

C T S 2 U 32 x 1/2 - M-BB

SERIES
T - Compact Guide Rod

DESIGN NO.
2 - Imperial
6 - Metric

BORE SIZE

BORE mm	BORE in	AREA mm²	AREA in²
12	.47	113	.175
16	.63	201	.312
20	.79	314	.487
25	.98	490	.761
32	1.26	804	1.247
40	1.57	1256	1.948
50	1.97	1963	3.043
63	2.48	3117	4.832

OPTIONS
BB - Shock Pads in both directions (Option does not add any extra length)
M - Magnetic piston for use with PHD Series 6790 Switches. See Note 2.
F11 - Extended length wrench flats
K_ - Extra Tool Plate Extension in 1/8" [5 mm] increments up to 1" [25 mm] maximum. Length code example: K1 = 1/8", K3 = 3/8", or K5 = 5 mm, K15 = 15 mm, etc.
V1 - Fluoro-Elastomer seals
WB - Blank Tool Plate (shipped with tool plate unassembled)
WR - Rectangular tool plate (12-16 mm units only)
WRB - Blank rectangular tool plate (12-16 mm units only)(shipped with tool plate unassembled)
Z1 - Corrosion-resistant, stainless steel rod and guideshafts, electroless nickel plated retaining rings, fasteners, and brackets (with J & K mounting)

NOTES:
1) See page 1-27 for accessories.
2) PHD recommends the use of stainless steel or de-magnetized fasteners on units with -M option.
3) Longer stroke lengths are available. Consult PHD.

Options may affect unit length. See unit dimension and options pages for adders.

SPECIFICATIONS	SERIES CTS
OPERATING PRESSURE	20 psi min to 150 psi max at zero load [1.4 bar min to 10 bar max] air
STROKE TOLERANCE	± 0.031 inch [± 0.8 mm]
TEMPERATURE LIMITS	-20° to +180°F [-28° to +82°C]
VELOCITY	20 in/sec [.5 m/sec] typical min, zero load at 100 psi [7 bar]
LIFE EXPECTANCY	30 million linear inches [762000 linear meters] min (-V1 & -Z1 options may reduce life)
LUBRICATION	Pre-lubricated for use with non-lubricated or lubricated air
MAINTENANCE	Field repairable

CYLINDER FORCE AND WEIGHT TABLE

BORE		ROD DIA.		ROD	EFFECTIVE AREA		BASE WEIGHT		ADDER PER 1" [25 mm] OF STROKE	
mm	in	in	mm	DIRECTION	in²	mm²	lb	kg	lb	kg
12	.472	.250	6.35	EXTEND	.175	113	.17	.08	.11	.05
				RETRACT	.126	81				
16	.630	.250	6.35	EXTEND	.312	201	.20	.09	.12	.05
				RETRACT	.263	169				
20	.787	.375	9.53	EXTEND	.487	314	.37	.17	.19	.09
				RETRACT	.376	242				
25	.984	.375	9.53	EXTEND	.761	490	.43	.19	.20	.09
				RETRACT	.650	419				
32	1.260	.625	15.88	EXTEND	1.247	804	.72	.33	.31	.14
				RETRACT	.940	606				
40	1.575	.625	15.88	EXTEND	1.948	1256	.96	.44	.37	.17
				RETRACT	1.641	1058				
50	1.969	.750	19.05	EXTEND	3.043	1963	1.65	.75	.49	.22
				RETRACT	2.602	1678				
63	2.480	.750	19.05	EXTEND	4.832	3117	2.36	1.07	.58	.26
				RETRACT	4.390	2832				

NOTE: Use retract figures for calculating double rod end cylinder forces in both directions.

APPLICATION

The PHD Series CTS Compact Guide Rod Cylinders are designed for use as compact non-rotating cylinders and as light duty slides where precise location is not required and side loading is minimal. On double rod units, rear rod increases stability of the tool plate. Rear rod thread not intended as a load attach point. Shock pads are intended for use where there is end-of-stroke impact with an attached load. For maximum cylinder life with attached load, PHD recommends the use of external stops or shock absorbers. See best application practices on page 1-28.

Proper application of CTS Cylinders in horizontal applications is dependent upon travel and attached load. In addition, where there is end-of-stroke impact with an attached load, cylinder speed must be considered. Refer to sizing catalog.

Proper application of CTS Cylinders in vertical applications is dependent upon both attached load and cylinder speed. Refer to sizing catalog.

SIZING AND APPLICATION ASSISTANCE
See PHD Product Sizing Catalog for specific and complete sizing information.
Online sizing assistance is available at:
www.phdinc.com/apps/sizing

CYLINDER FORCE CALCULATIONS

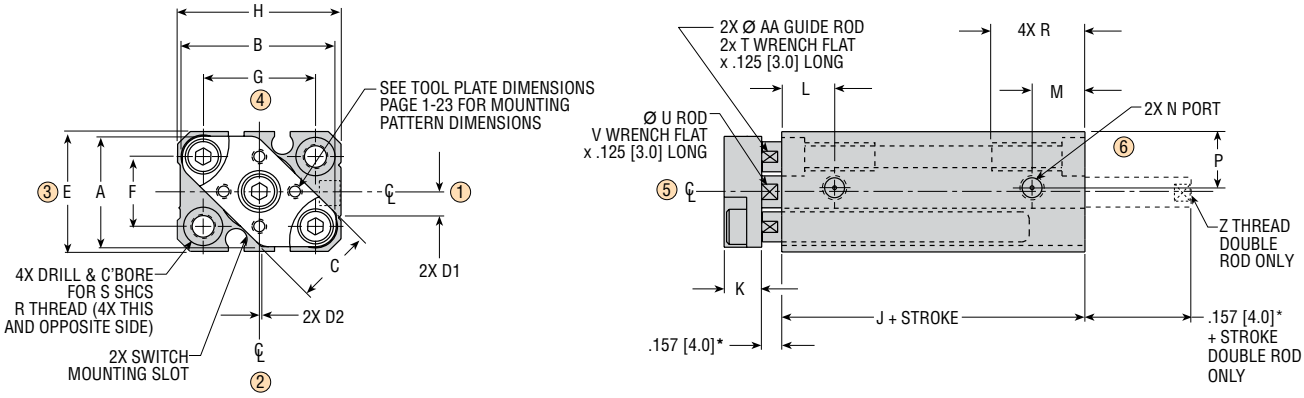
	IMPERIAL F = P x A	METRIC F = 0.1 x P x A
F = Cylinder Force	lbs	N
P = Operating Pressure	psi	bar
A = Effective Area (Extend or Retract)	in²	mm²

SHOCK PAD USAGE

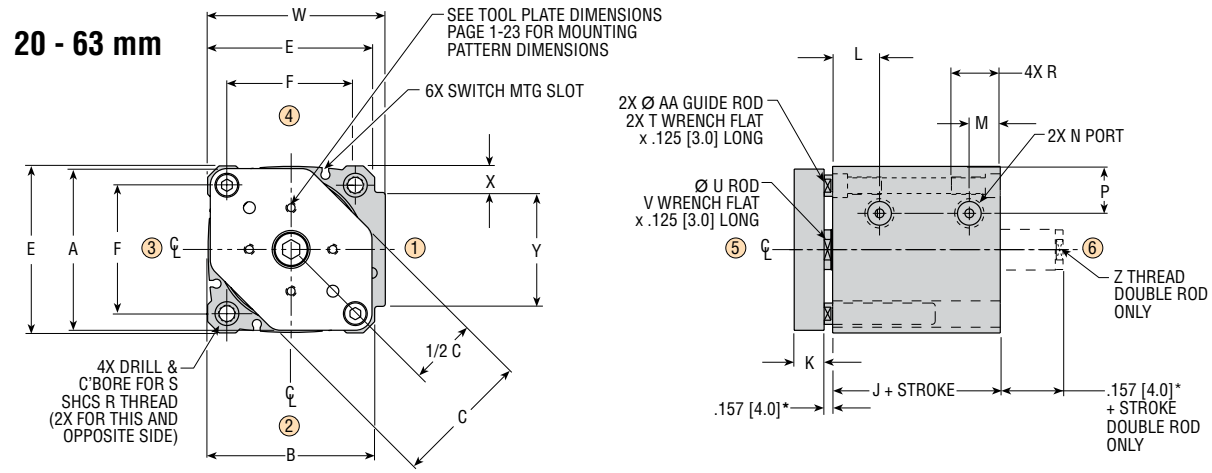
Optional shock pads are recommended for applications where the piston contacts the bushing and plug ends with an attached load. The use of shock pads reduces noise and provides maximum cylinder life in these applications. Shock pads are not required for applications where external stops prevent end-of-stroke impact or where end impact occurs without an attached load. See best application practices on page 1-28.

DIMENSIONS: SERIES CTS COMPACT GUIDE ROD CYLINDERS

12 - 16 mm



20 - 63 mm

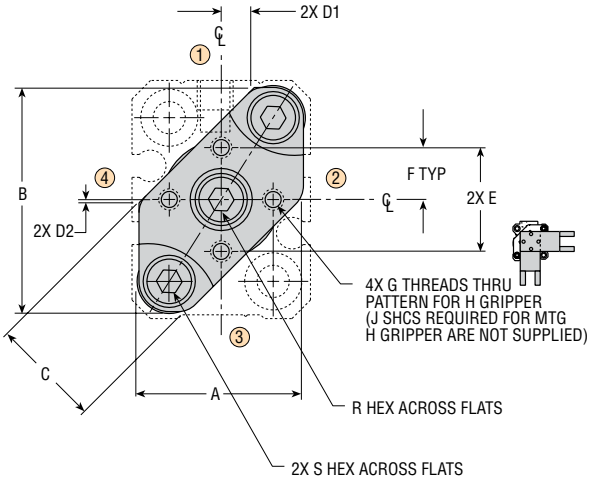


BORE [mm]	DIMENSIONS																								
	A	B	C	D1	D2	E	F	G	H	J	K	L	M	N	P	R THREAD	S	T	U	V	W	X	Y	Z THREAD	AA
12	.876 [22.25]	1.200 [30.50]	.591 [15]	.182 [4.6]	.020 [0.5]	.944 [24.0]	.550 [14.0]	.866 [22.0]	1.260 [32.0]	1.380 [35.0]	.295 [7.5]	.415 [10.5]	.415 [10.5]	10-32 x .15 [M5 x .8 x 4]	.440 [11.0]	10-24 x .550 [M5 x .8 x 14.5]	#6 [M4]	.219 [5.5]	.250 [6.35]	.219 [5.5]	—	—	—	6-32 x .210 [M4 x 0.7 x 7]	.236 [6.0]
16	1.000 [25.50]	1.250 [31.75]	.710 [18]	.025 [0.64]	.075 [1.9]	1.104 [28.0]	.710 [18.0]	.946 [24.0]	1.340 [34.0]	1.380 [35.0]	.295 [7.5]	.415 [10.5]	.415 [10.5]	10-32 x .15 [M5 x .8 x 4]	.454 [11.5]	10-24 x .550 [M5 x .8 x 14.5]	#6 [M4]	.219 [5.5]	.250 [6.35]	.219 [5.5]	—	—	—	6-32 x .210 [M4 x 0.7 x 7]	.236 [6.0]
20	1.375 [35.00]	—	.906 [23]	—	—	1.476 [37.5]	1.000 [25.4]	—	—	1.615 [41.0]	.394 [10.0]	.670 [17.0]	.415 [10.5]	10-32 x .15 [M5 x .8 x 4]	.531 [13.5]	1/4-20 x .875 [M6 x 1.0 x 22.5]	#10 [M5]	.250 [7.0]	.375 [9.5]	.312 [8.0]	1.576 [40.0]	.344 [8.75]	.788 [20.0]	10-32 x .285 [M5 x 0.8 x 7]	.314 [8.0]
25	1.500 [38.00]	—	1.024 [26]	—	—	1.576 [40.0]	1.100 [28.0]	—	—	1.615 [41.0]	.394 [10.0]	.670 [17.0]	.398 [10.1]	10-32 x .15 [M5 x .8 x 4]	.552 [14.0]	1/4-20 x .875 [M6 x 1.0 x 22.5]	#10 [M5]	.250 [7.0]	.375 [9.5]	.312 [8.0]	1.746 [44.5]	.288 [7.30]	1.000 [25.4]	10-32 x .285 [M5 x 0.8 x 7]	.314 [8.0]
32	1.750 [44.50]	—	1.378 [35]	—	—	1.870 [47.5]	1.339 [34.0]	—	—	1.790 [45.5]	.394 [10.0]	.710 [18.0]	.450 [11.5]	1/8 NPT [1/8 BSP]	.610 [15.5]	1/4-20 x .875 [M6 x 1.0 x 22.5]	#10 [M5]	.250 [7.0]	.625 [15.9]	.500 [13.0]	2.037 [52.0]	.266 [6.75]	1.340 [34.0]	1/4-28 x .375 [M6 x 1.0 x 9]	.314 [8.0]
40	2.000 [51.00]	—	1.650 [42]	—	—	2.205 [56.0]	1.575 [40.0]	—	—	1.790 [45.5]	.394 [10.0]	.710 [18.0]	.450 [11.5]	1/8 NPT [1/8 BSP]	.738 [18.75]	1/4-20 x .875 [M6 x 1.0 x 22.5]	#10 [M5]	.250 [7.0]	.625 [15.9]	.500 [13.0]	2.363 [60.0]	.393 [10.0]	1.420 [36.0]	1/4-28 x .375 [M6 x 1.0 x 9]	.314 [8.0]
50	2.500 [63.50]	—	2.086 [53]	—	—	2.598 [66.0]	1.969 [50.0]	—	—	1.970 [50.0]	.551 [14.0]	.790 [20.0]	.535 [13.5]	1/8 NPT [1/8 BSP]	.823 [21.0]	5/16-18 x .900 [M8 x 1.25 x 22.5]	1/4 [M6]	.312 [8.0]	.750 [19.0]	.625 [16.0]	2.795 [71.0]	.499 [12.7]	1.600 [40.6]	5/16-24 x .312 [M8 x 1.25 x 8]	.394 [10.0]
63	2.972 [75.50]	—	2.560 [65]	—	—	3.070 [78.0]	2.360 [60.0]	—	—	2.090 [53.0]	.551 [14.0]	.865 [22.0]	.570 [14.5]	1/4 NPT [1/4 BSP]	.865 [22.0]	5/16-18 x .900 [M8 x 1.25 x 22.5]	1/4 [M6]	.312 [8.0]	.750 [19.0]	.625 [16.0]	3.266 [83.0]	.488 [12.4]	2.094 [53.2]	5/16-24 x .312 [M8 x 1.25 x 8]	.394 [10.0]

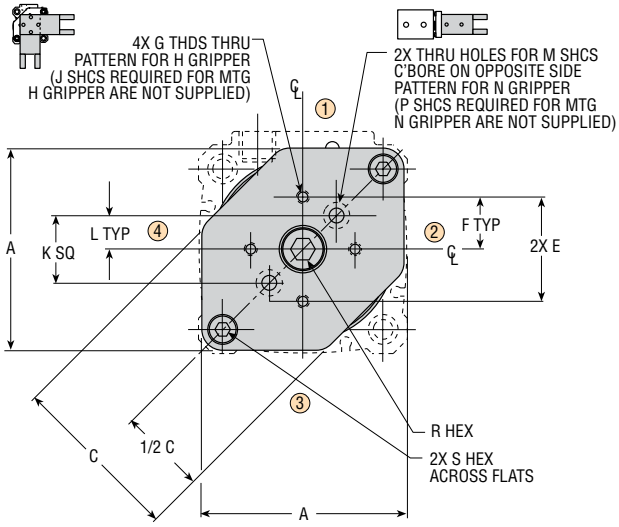
NOTES:
1) Dimension shown in [ ] are in mm or for metric units [CTx6].
2) Designated centerline is centerline of cylinder bore.
3) Unless otherwise dimensioned, mounting hole patterns are centered on designated cylinder centerline.
4) 1/8" [5 mm] minimum stroke required
5) *See J & K mounting dimensions for standard extension with those options.
6) PHD recommends the use of stainless steel or de-magnetized fasteners on units with the -M option.

All dimensions are reference only unless specifically toleranced.

TOOL PLATE



12 - 16 mm

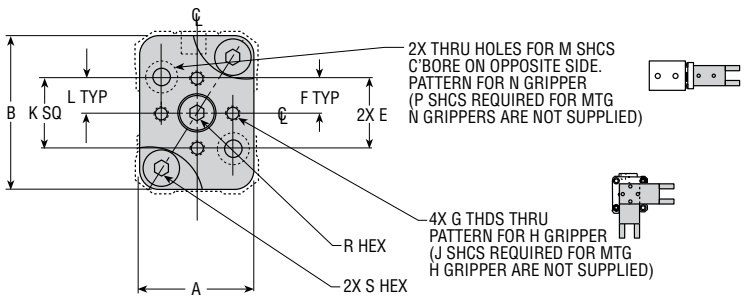


20 - 63 mm

BORE [mm]	DIMENSIONS																		
									H (SERIES 190)*						N (SERIES 19x)*				
	A	B	C	D1	D2	E	F	G	ANGULAR	PARALLEL	J	K	L	M	ANGULAR	PARALLEL	P	R	S
12	.876 [22.25]	1.200 [30.5]	.591 [15.0]	.182 [4.60]	.020 [0.50]	.550 [14.0]	.275 [7.0]	4-40 [M3 x .5]	— [19002]	1906x [1906x]	4-40 x 1 [M3 x .5 x 20]	—	—	—	—	—	—	[3.0]	[3.0]
16	1.000 [25.5]	1.250 [31.75]	.710 [18.0]	.025 [0.64]	.075 [1.90]	.550 [14.0]	.275 [7.0]	4-40 [M3 x .5]	— [19002]	1906x [1906x]	4-40 x 1 [M3 x .5 x 20]	—	—	—	—	—	—	[3.0]	[3.0]
20	1.375 [35.0]	—	.906 [23.0]	—	—	.710 [18.0]	.355 [9.0]	6-32 [M3 x .5]	— [19012]	1907x [1907x]	6-32 x 1-1/4 [M3 x .5 x 30]	0.550 [14.0]	.275 [7.0]	#4 [M3]	— [19x02]	19x6x [19x6x]	4-40 x 3/8 [M3 x .5 x 10]	[5.0]	[4.0]
25	1.500 [38.0]	—	1.024 [26.0]	—	—	0.710 [18.0]	.355 [9.0]	6-32 [M3 x .5]	— [19012]	1907x [1907x]	6-32 x 1-1/4 [M3 x .5 x 30]	0.550 [14.0]	.275 [7.0]	#4 [M3]	— [19x02]	19x6x [19x6x]	4-40 x 3/8 [M3 x .5 x 10]	[5.0]	[4.0]
32	1.750 [44.5]	—	1.378 [35.0]	—	—	1.100 [28.0]	.55 [14.0]	8-32 [M4 x .7]	— [19022]	1908x [1908x]	8-32 x 1-5/8 [M4 x .7 x 40]	0.710 [18.0]	.355 [9.0]	#6 [M3]	— [19x12]	19x7x [19x7x]	6-32 x 3/8 [M3 x .5 x 8]	[6.0]	[4.0]
40	2.000 [51.0]	—	1.650 [42.0]	—	—	1.100 [28.0]	.55 [14.0]	8-32 [M4 x .7]	— [19022]	1908x [1908x]	8-32 x 1-5/8 [M4 x .7 x 40]	0.710 [18.0]	.355 [9.0]	#6 [M3]	— [19x12]	19x7x [19x7x]	6-32 x 3/8 [M3 x .5 x 8]	[6.0]	[4.0]
50	2.500 [63.5]	—	2.086 [53.0]	—	—	1.535 [39.0]	.768 [19.5]	10-24 [M5 x .8]	— [19032]	1909x [1909x]	10-24 x 2-1/4 [M5 x .8 x 55]	1.100 [28.0]	.550 [14.0]	#8 [M4]	— [19x22]	19x8x [19x8x]	8-32 x 5/8 [M4 x .7 x 12]	[8.0]	[5.0]
63	2.972 [75.5]	—	2.560 [65.0]	—	—	1.535 [39.0]	.768 [19.5]	10-24 [M5 x .8]	— [19032]	1909x [1909x]	10-24 x 2-1/4 [M5 x .8 x 55]	1.535 [39.0]	.768 [19.5]	#10 [M5]	— [19x32]	19x9x [19x9x]	10-24 x 3/4 [M5 x .8 x 12]	[8.0]	[5.0]

NOTES:
1) Numbers in [ ] are in mm or for metric units [CTx6].
2) *Imperial grippers mount to CTx2 only. Metric grippers mount to CTx6 only.

OPTIONAL RECTANGULAR TOOL PLATE (12-16 mm ONLY) -WR OPTION

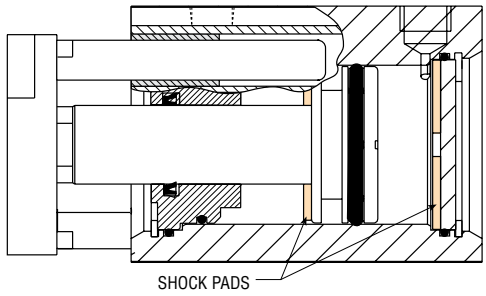


BORE [mm]	DIMENSIONS															
						H (SERIES 190*)						N (SERIES 19x)*				
	A	B	E	F	G	ANGULAR	PARALLEL	J	K	L	M	ANGULAR	PARALLEL	P	R	S
12	.876 [22.25]	1.200 [30.5]	.550 [14.0]	.275 [7.0]	4-40 [M3 x .5]	— [19002]	1906x [1906x]	4-40 x 1 [M3 x .5 x 20]	.550 [14.0]	.275 [7.0]	#4 [M3]	— [19x02]	19x6x [19x6x]	4-40 x 3/8 [M5 x .5 x 8]	[3.0]	[3.0]
16	1.000 [25.5]	1.250 [31.75]	.550 [14.0]	.275 [7.0]	4-40 [M3 x .5]	— [19002]	1906x [1906x]	4-40 x 1 [M3 x .5 x 20]	.550 [14.0]	.275 [7.0]	#4 [M3]	— [19x02]	19x6x [19x6x]	4-40 x 3/8 [M3 x .5 x 8]	[3.0]	[3.0]

NOTES:
1) Numbers in [ ] are in mm or for metric units [CTx6].
2) *Imperial grippers mount to CTx2 only. Metric grippers mount to CTx6 only.
3) See J & K mounting dimensions for standard rod extension with those options.

BB SHOCK PADS ON EXTENSION AND RETRACTION

Shock pads eliminate metal-to-metal contact and minimize piston impact. Shock pads are recommended for applications where the piston contacts the head and/or cap (with attached loads). The use of shock pads reduces noise and provides maximum cylinder life in these applications.

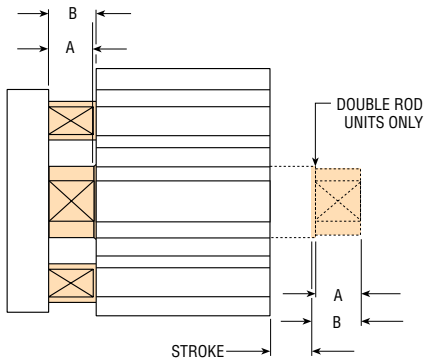


F11 EXTENDED LENGTH WRENCH FLATS

The design of a compact guide rod cylinder requires the length to be as short as possible. The standard wrench flat length is .125" [3 mm]. The option -F11 provides wrench flats which allow standard wrench access. On double rod units, rear rod also receives extended flats with option -F11.

BORE [mm]	A EXTENDED ROD & GUIDE SHAFT WRENCH FLATS		B ROD EXTENSION	
12/16	.207	[5.25]	.250	[6.5]
20/25	.207	[5.25]	.250	[6.5]
32/40	.315	[8.00]	.344	[9.0]
50/63	.315	[8.00]	.344	[9.0]

Numbers in [ ] are in mm or for metric units [CTx6].



K_ EXTRA TOOL PLATE EXTENSION

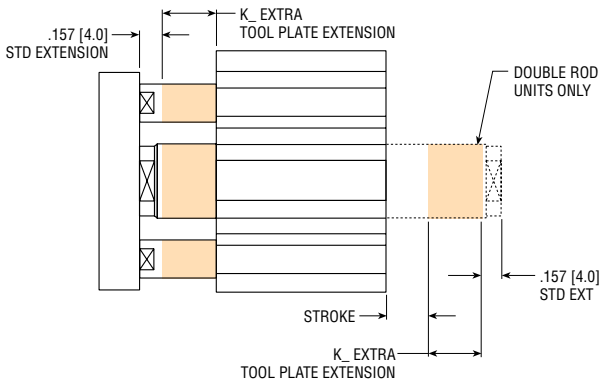
Extra tool plate extension can be specified by calling out the -K option followed by the length code.

Length code example (for imperial CTx2 units)
K1 = 1/8" of extra tool plate extension
K3 = 3/8", etc.

Length code example (for metric CTx6 units)
K5 = 5 mm of extra tool plate extension
K15 = 15 mm, etc.

.157" [4 mm] of tool plate extension is standard. Available in 1/8" [5 mm] increments only. Maximum extension is 1" [25 mm].

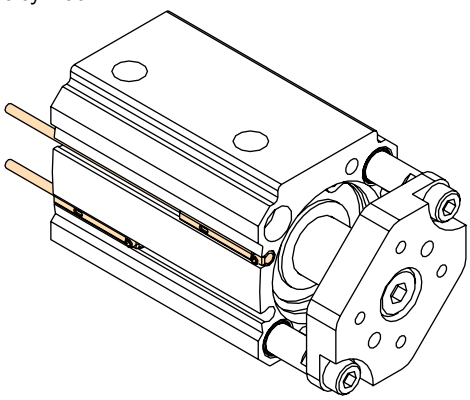
NOTE: On double rod units, rear rod receives same extension as tool plate (tool plate on front end only).



All dimensions are reference only unless specifically toleranced.

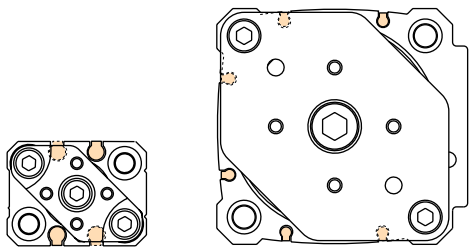
M MAGNET FOR PHD MINIATURE REED AND SOLID-STATE SWITCHES

This option equips the cylinder with a magnetic band on the piston for use with PHD Series 6790 Switches. These switches mount easily into the integral slots in the body and are locked into place with a set screw. PHD recommends the use of stainless steel or de-magnetized fasteners when mounting Series CTx Cylinders equipped with the -M option. The design of a compact guide rod cylinder requires the length to be as short as possible. Installation of switches on units with J or K mounts will require temporary removal of the rear bracket prior to mounting the cylinder.



PART NO.	DESCRIPTION
67902-1-02	NPN (Sink) or PNP (Source) DC Reed, 2 m cable
67902-1-05	NPN (Sink) or PNP (Source) DC Reed, 5 m cable
67903-1-02	NPN (Sink) DC Solid State, 2 m cable
67903-1-05	NPN (Sink) DC Solid State, 2 m cable
67904-1-02	PNP (Source) DC Solid State, 2 m cable
67904-1-05	PNP (Source) DC Solid State, 5 m cable
67922-1	NPN (Sink) or PNP (Source) DC Reed, Quick Connect
67929-2	AC Reed, Current Limited, Quick Connect
67923-1	NPN (Sink) DC Solid State, Quick Connect
67924-1	PNP (Source) DC Solid State, Quick Connect
63549-02	2 m Cordset with Quick Connect
63549-05	5 m Cordset with Quick Connect

NOTES:
1) Switch set screw torque to 16 in-oz [.11 Nm] max.
2) See switches and sensors section for additional switch information and complete specification.



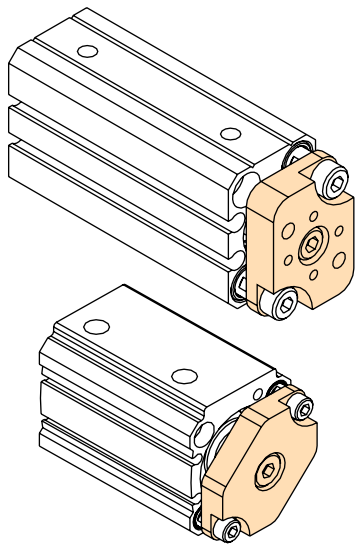
WR RECTANGULAR TOOL PLATE

With this option, available only on the 12-16 mm cylinders, the unit is assembled with a rectangular tool plate. This provides an additional mounting orientation for Series 190 and 191 Grippers. This option with J or R mounting affects tool plate extension. See page 1-26.

WB BLANK TOOL PLATE

WRB BLANK RECTANGULAR TOOL PLATE

With these options, PHD provides a tool plate without mounting threads and counterbores. The tool plate is supplied unassembled for easy modification by the customer. Assembly and torque specifications are furnished with each unit. When assembling the unit, a threadlocking adhesive is required on tool plate mounting screws. This option with J or K mounting affects tool plate extension. See page 1-26.



NOTE: Blank tool plates are shipped unassembled.

V1 FLUORO-ELASTOMER SEALS

Fluoro-Elastomer seals are compatible with certain fluids which degrade standard Nitrile seals. Seal compatibility should be checked with the fluid manufacturer for correct application. Consult PHD for high temperature use.

Z1 CORROSION RESISTANT

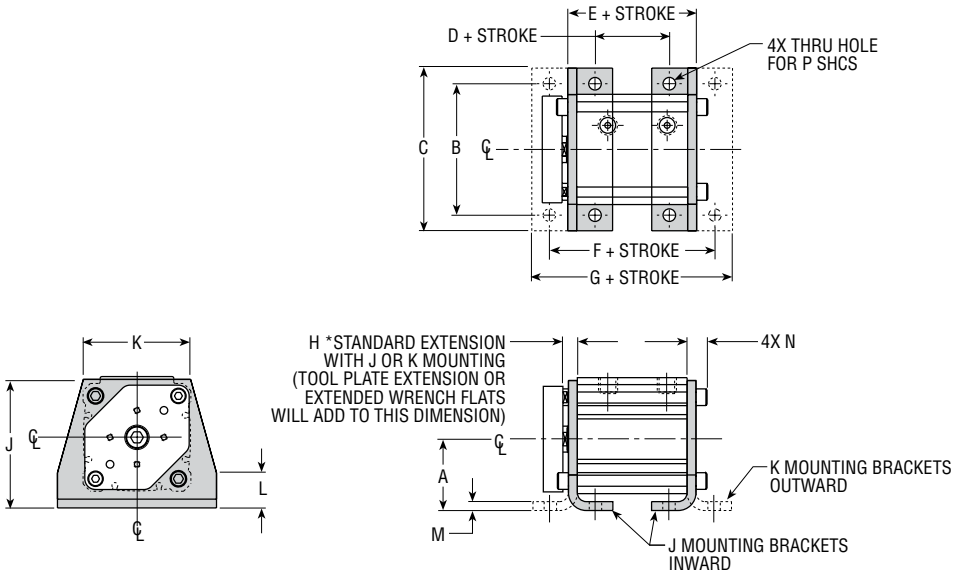
Electroless nickel plating is provided on the retaining rings, tool plate mounting screws, “J” and “K” brackets, and bracket mounting screws. Stainless steel rod and guideshafts are also supplied. This option may reduce unit life.

J MOUNTS (Must be ordered separately)

J mounting provides foot brackets (with mounting feet under the cylinder) with minimal distance between the cylinder and mounting surface. This mounting comes preassembled by PHD with proper tool plate extension. **NOTE:** Double rods will also receive H standard extension.

K MOUNTS (Must be ordered separately)

K mounting provides foot brackets (with mounting feet extended outward from the cylinder.) Mounting is simplified with mounting holes away from the body. This mounting comes preassembled by PHD with proper tool plate extension.
NOTE: Double rods will also receive H standard extension.

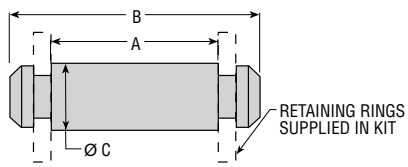


BORE [mm]	DIMENSIONS													
	A	B	C	D	E	F	G	H	J	K	L	M	N	P
12	.830 [21.0]	1.380 [35.0]	1.810 [46.0]	.830 [21.0]	1.590 [40.5]	2.140 [54.4]	2.580 [65.5]	.282 [9.0]	1.510 [38.4]	.945 [24.0]	.390 [10.0]	.105 [2.7]	.295 [7.5]	#10 [M5]
16	.870 [22.0]	1.535 [39.0]	1.970 [50.0]	.830 [21.0]	1.620 [41.0]	2.169 [55.0]	2.610 [66.5]	.282 [9.0]	1.620 [41.2]	1.122 [28.5]	.450 [11.5]	.120 [3.0]	.310 [8.0]	#10 [M5]
20	.945 [24.0]	1.969 [50.0]	2.520 [64.0]	.985 [25.0]	1.855 [47.0]	2.484 [63.0]	3.035 [77.0]	.282 [9.0]	1.750 [44.5]	1.470 [37.4]	.450 [11.5]	.120 [3.0]	.370 [9.5]	1/4 [M6]
25	1.005 [25.5]	2.047 [52.0]	2.600 [66.0]	.985 [25.0]	1.885 [48.0]	2.514 [63.9]	3.065 [78.0]	.282 [9.0]	1.890 [48.0]	1.581 [40.2]	.490 [12.5]	.135 [3.4]	.390 [10.0]	1/4 [M6]
32	1.220 [31.0]	2.362 [60.0]	2.950 [75.0]	1.080 [27.5]	2.120 [54.0]	2.829 [71.9]	3.460 [89.0]	.282 [9.0]	2.240 [57.0]	1.873 [47.6]	.630 [16.0]	.164 [4.2]	.414 [10.5]	1/4 [M6]
40	1.400 [35.5]	2.677 [68.0]	3.310 [84.0]	1.080 [27.5]	2.150 [54.6]	2.860 [72.6]	3.570 [91.0]	.282 [9.0]	2.560 [65.0]	2.190 [55.7]	.670 [17.0]	.179 [4.5]	.429 [11.0]	1/4 [M6]
50	1.730 [44.0]	3.189 [81.0]	3.940 [100.0]	.985 [25.0]	2.390 [60.5]	3.372 [85.6]	4.200 [107.0]	.407 [11.0]	3.150 [80.0]	2.577 [65.5]	.850 [21.5]	.209 [5.3]	.531 [13.5]	5/16 [M8]
63	2.010 [51.0]	3.661 [93.0]	4.530 [115.0]	1.062 [27.0]	2.590 [66.0]	3.618 [91.9]	4.590 [117.0]	.407 [11.0]	3.660 [93.0]	3.055 [77.6]	1.000 [25.5]	.250 [6.4]	.570 [14.5]	5/16 [M8]

NOTES:
1) Numbers in [ ] are in mm or for metric units [CTx6].
2) *Standard rod extension on units with J or K mounts and -WR or -WRB option is .407 [10.0]
3) Installation of switches on units with J or K mounts will require temporary removal of the rear bracket prior to the mounting cylinder.

CYLINDER FULCRUM PIN KIT

Cylinder Fulcrum Pin Kit replacement for base pivot or for use with PHD cylinder pivot. Pin is Brite Zinc plated. Retaining rings supplied.

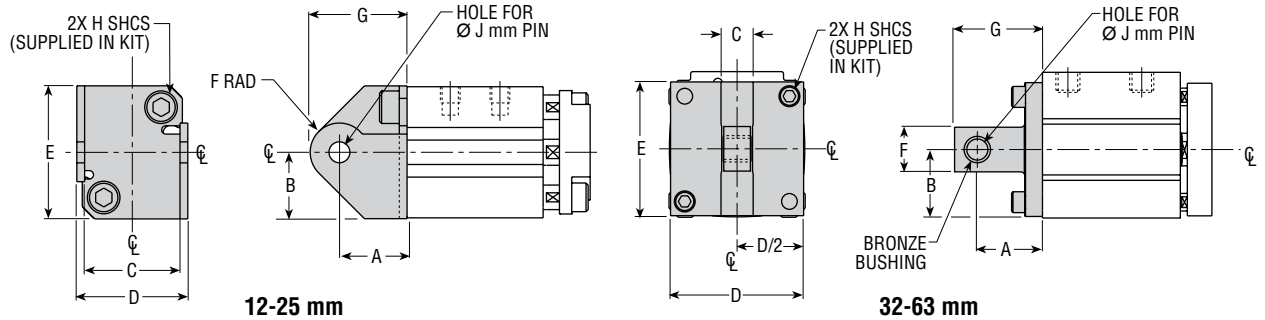


BORE	DIMENSIONS			KIT: CTx2x, CTx6x IMPERIAL/METRIC
	A	B	ØC	
12/16	1.120 [28.5]	1.300 [33.0]	.196 [5.0]	60330-1
20/25	1.550 [39.5]	1.730 [44.0]	.235 [6.0]	60331-1
32/40	1.240 [31.5]	1.490 [38.0]	.393 [10.0]	60332-1
50/63	1.690 [43.0]	1.970 [50.0]	.471 [12.0]	60333-1

Numbers in [ ] are in mm or for metric units [CTx6].

All dimensions are reference only unless specifically toleranced.

CYLINDER PIVOT KIT

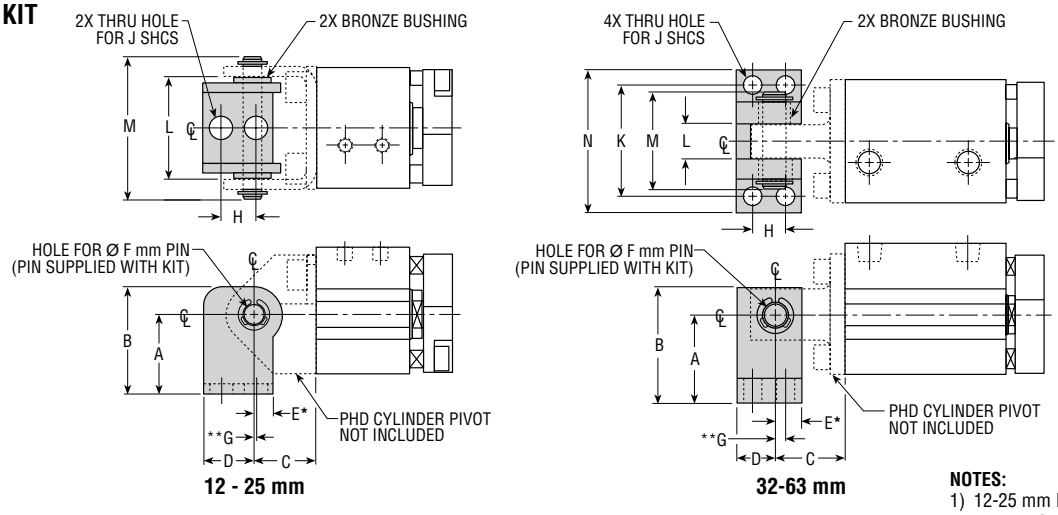


BORE [mm]	DIMENSIONS A	B	C	D	E	F	G	H	J	KIT NO. IMPERIAL CTx2	KIT NO. METRIC CTx6
12	.650 [16.5]	.638 [16.5]	.915 [23.25]	1.064 [27.0]	1.276 [33.0]	.281 [7.5]	.931 [24.0]	10-24 [M5 x .8]	.197 [5.0]	60278-1	60286-1
16	.650 [16.5]	.678 [17.5]	.915 [23.25]	1.064 [27.0]	1.356 [35.0]	.281 [7.5]	.931 [24.0]	10-24 [M5 x .8]	.197 [5.0]	60279-1	60287-1
20	.790 [20.0]	.750 [19.0]	1.261 [32.0]	1.500 [38.0]	1.500 [38.0]	.355 [9.0]	1.145 [29.0]	1/4-20 [M6 x 1.0]	.237 [6.0]	60280-1	60288-1
25	.790 [20.0]	.800 [20.5]	1.261 [32.0]	1.500 [38.0]	1.600 [41.0]	.355 [9.0]	1.145 [29.0]	1/4-20 [M6 x 1.0]	.237 [6.0]	60281-1	60289-1
32	1.065 [27.0]	.935 [24.0]	.490 [12.45]	1.870 [48.0]	1.870 [48.0]	.820 [21.0]	1.475 [37.5]	1/4-20 [M6 x 1.0]	.394 [10.0]	60282-1	60290-1
40	1.065 [27.0]	1.105 [28.0]	.490 [12.45]	2.210 [56.0]	2.210 [56.0]	.820 [21.0]	1.475 [37.5]	1/4-20 [M6 x 1.0]	.394 [10.0]	60283-1	60291-1
50	1.460 [37.0]	1.300 [33.0]	.630 [16.0]	2.600 [66.0]	2.600 [66.0]	1.000 [25.5]	1.970 [50.0]	5/16-18 [M8 x 1.25]	.473 [12.0]	60284-1	60292-1
63	1.460 [37.0]	1.500 [38.0]	.630 [16.0]	3.000 [76.0]	3.000 [76.0]	1.000 [25.5]	1.970 [50.0]	5/16-18 [M8 x 1.25]	.473 [12.0]	60285-1	60293-1

Numbers in [ ] are in mm or for metric units [CTx6].

NOTES:
1) 12-25 mm IS BRITE ZINC PLATED STEEL
2) 32-63 mm IS ANODIZED ALUMINUM WITH LUBRICATED BRONZE BUSHINGS
3) FULCRUM PIN NOT INCLUDED (SEE "FULCRUM PIN KITS" TO PURCHASE)

BASE PIVOT KIT



BORE [mm]	DIMENSIONS A	B	C	D	E	F	G	H	J	K	L	M	N	KIT: CTx2x, CTx6x IMPERIAL/METRIC
12/16	.865 [22.0]	1.145 [29.0]	.650 [16.5]	.490 [12.5]	.220 [5.6]	.197 [5.0]	.060 [1.5]	.375 [9.5]	#10 [M5]	N/A	.877 [22.3]	1.300 [33.0]	N/A	60294-1
20/25	1.000 [25.5]	1.355 [34.5]	.790 [20.0]	.630 [16.0]	.260 [6.5]	.237 [6.0]	.040 [1.0]	.435 [11.0]	1/4 [M6]	N/A	1.221 [31.0]	1.730 [44.0]	N/A	60295-1
32/40	1.375 [35.0]	1.800 [46.0]	1.065 [27.0]	.600 [15.2]	.400 [10.2]	.394 [10.0]	.156 [4.0]	.510 [13.0]	1/4 [M6]	1.695 [43.0]	.540 [13.7]	1.490 [38.0]	2.165 [55.0]	60296-1
50/63	1.890 [48.0]	2.365 [60.0]	1.460 [37.0]	.755 [19.2]	.505 [13.0]	.473 [12.0]	.236 [6.0]	.709 [18.0]	5/16 [M8]	2.265 [57.5]	.659 [16.7]	1.970 [50.0]	2.835 [72.0]	60297-1

Numbers in [ ] are in mm or for metric units [CTx6].

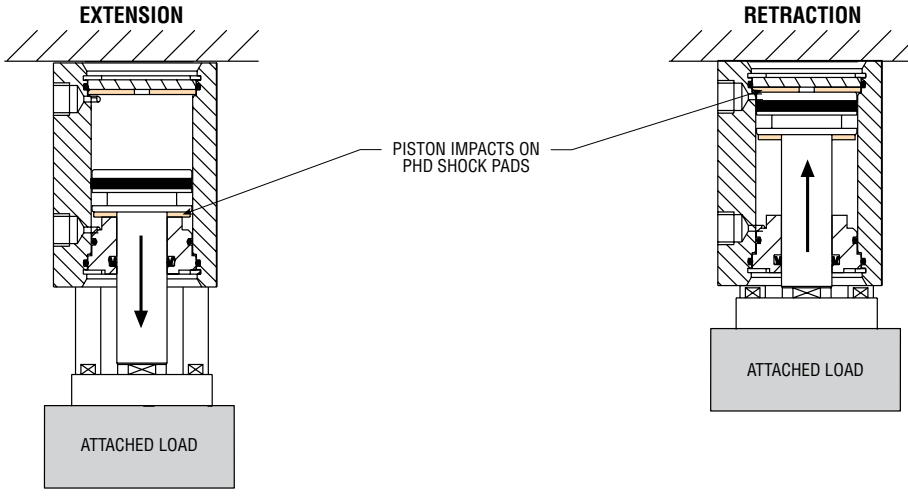
NOTES:
1) 12-25 mm IS BRITE ZINC PLATED STEEL WITH LUBRICATED BRONZE BUSHINGS
2) 32-63 mm IS ANODIZED ALUMINUM WITH LUBRICATED BRONZE BUSHINGS
3) FULCRUM PIN INCLUDED. DOES NOT INCLUDE CYLINDER PIVOT
4) *E IS TO CENTER OF PIVOT PIN
5) **G IS FROM CENTER OF PIVOT PIN TO CENTER OF FIRST MOUNTING HOLE

BEST PRACTICES FOR MAXIMUM CYLINDER LIFE

Maximum cylinder life can be achieved by using the cylinder to provide power and motion while externally stopping any attached loads. Shown below are examples of how to apply the Series CTS Cylinder.

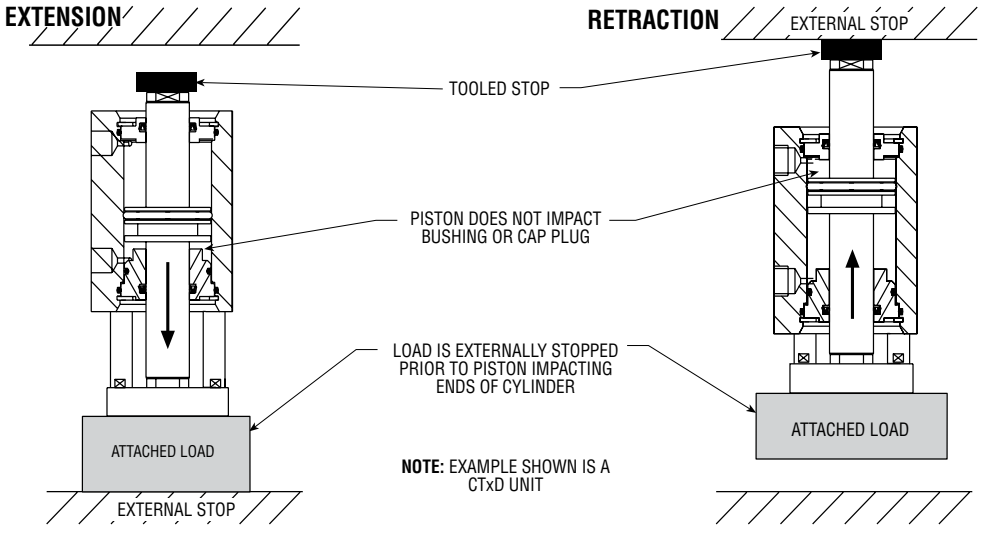
APPLICATION #1 - ATTACHED LOAD (WITH INTERNAL SHOCK PADS)

When attached loads cannot be stopped externally, optional internal shock pads are required for maximum cylinder life. It is also recommended that flow controls are used to regulate the velocity of the load and limit the kinetic energy at end of stroke.



APPLICATION #2 - ATTACHED LOADS EXTERNALLY STOPPED (WITHOUT INTERNAL SHOCK PADS)

Shock pads are not required if an attached load is externally stopped to prevent piston from contacting the bushings or cap plugs.



APPLICATION #3 - UNATTACHED LOADS (WITHOUT INTERNAL SHOCK PADS)

Shock pads are not required on units with unattached loads.

CV

FULL FEATURE ISO/VDMA CYLINDERS PROVIDING EXCEPTIONAL PERFORMANCE

Series CVA
32-100 mm Bores

ports, cushion controls, and port controls are available in any combination on any side of head (extend end) and cap (retract end) See the Hushcontrol® Advantage on the next page.

rugged and lightweight anodized aluminum alloy heads, caps, and tube

CVA and CVB cylinders feature urethane piston and rod seals for long life. CVC Cylinders feature urethane rod seal and long life nitrile piston seal

ENHANCED
PTFE wear ring (CVA, CVB) provides piston support and enhances durability. Design 2 [6] increases the width for superior support (sizes 25-50)

ENHANCED
increased piston seal retention for higher speed applications

cylinders, including port and cushion controls, are easily field repairable, maximizing your investment

effective cushion up to 1.19 in [30.2 mm] for smooth deceleration at end of stroke

built-in shock pads are standard on all sizes, absorbing impact energy and eliminating metal to metal contact

imperial design available with imperial ports, stroke length, and rod for easy integration (mounting is metric)

PHD'S PORT CONTROL® is a built-in flow control valve for regulating speed of cylinder through its entire stroke

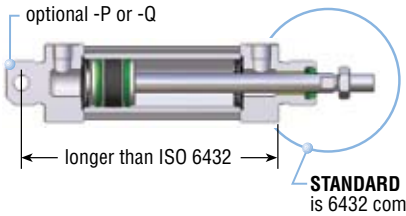
integrated standard female threads and a variety of mounting accessories provide ease of integration

NEW
rod seal retention ring for extreme applications

standard alloy steel and optional corrosion resistant stainless steel piston rods are hard chrome plated for maximum life and durability

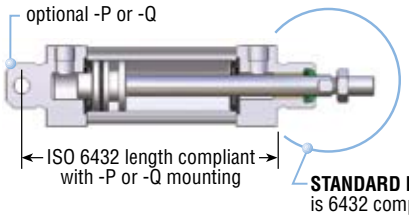
ENHANCED
now retained for extreme applications

internally lubricated engineered polymer bearing for long service life



CVB

- Available in 20 & 25 mm bores
- Same construction as CVA
- ISO 6432 compliant rod and mountings (metric unit)
- Longer strokes and lower breakaway than CVC
- Distance between mountings is longer than ISO 6432 specifications (metric unit)



CVC

- Available in 20 & 25 mm bores
- Same construction as CVA and CVB, uses compression piston seal
- ISO 6432 compliant rod and mountings (metric unit)
- ISO 6432 compliant length between mountings (metric unit)
- Shorter length than CVB

Major Benefits

- ISO/VDMA interchange for easy mounting (metric unit).
- Imperial unit provides simplified integration in imperial facilities.
- PTFE wear ring and built-in shock pads for long cylinder life.
- Rodlok® option for easy and dependable locking of piston rod
- Optional built-in port controls and cushions for superior speed and deceleration control.

Industry Uses

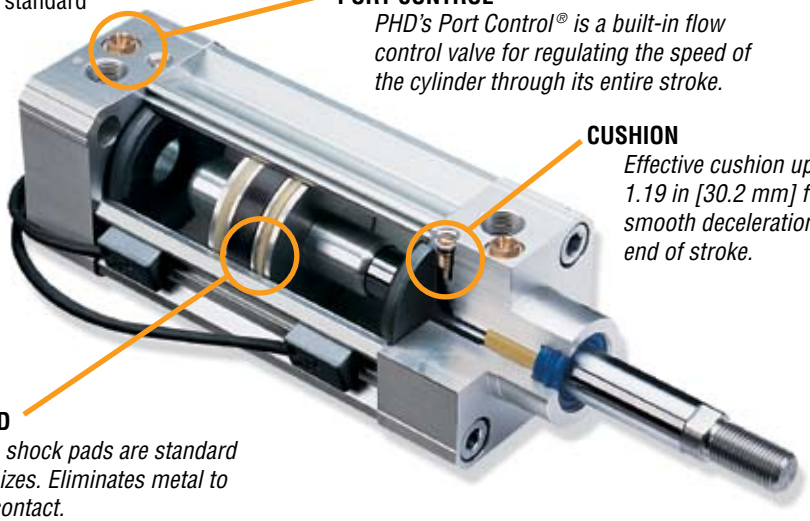
- Automotive
- Material handling/conveyors
- Assembly machines
- General industrial automation

The cylinder features...

The HUSHCONTROL® Advantage (-PB, -DB)

Only PHD Series CV Cylinders are offered with the Hushcontrol® Advantage. Hushcontrol® is achieved when optional cushions and Port Controls® are ordered with the standard shock pads. This combination provides:

- Superior speed and deceleration control of piston rod and attached loads.
- Significantly lowers noise levels even at high cycle speeds.



PORT CONTROL®
PHD's Port Control® is a built-in flow control valve for regulating the speed of the cylinder through its entire stroke.

CUSHION
Effective cushion up to 1.19 in [30.2 mm] for smooth deceleration at end of stroke.

SHOCK PAD
Built-in shock pads are standard on all sizes. Eliminates metal to metal contact.

Optional Rodlok®

- Optional Rodlok® securely holds a static piston rod in place at any point of stroke desired. Ideal for applications where rod drift is unacceptable due to system leakage, line rupture, or power loss.
- Options -H46 = Rodlok® ready cylinder (CVxS only)
  -H47 = Rodlok® unit includes locking device adaptor and cylinder preassembled (CVxS only) (See ordering data on page 1-32)

Rodlok®
Kits and dimensions can be found on pages 1-37 and 1-38.

PRODUCT SELECTION GUIDE: SERIES CV CYLINDERS

SERIES CVC CYLINDERS
20 & 25 mm ISO 6432

- Available in bore sizes 20 mm and 25 mm. Conforms to ISO 6432 customer interface and overall unit length when specified with optional -P or -Q mounting. (metric units)

SERIES CVB CYLINDERS
20 & 25 mm

- Available in bore sizes 20 mm and 25 mm. Customer interface conforms to ISO 6432 for rod and mounting. (metric units)

SERIES CVA CYLINDERS
32-100 mm ISO 6431

- Standard 32 mm through 100 mm bore units conform to ISO 6431 and VDMA 24562 specifications.

SERIES CVA OR CVB
3 position CYLINDERS

- Series CVA and CVB are available as 3 position units.

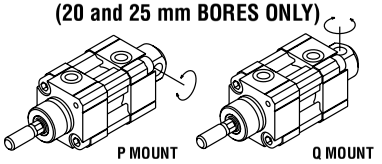
SERIES CVA OR CVB DOUBLE
ROD END CYLINDERS

- Series CVA and CVB are available as double rod end units.

ORDERING DATA: SERIES CV CYLINDERS

TO ORDER, SPECIFY:
Product, Series, Type, Design No., Mounting style, Bore size, Stroke, and any Options.

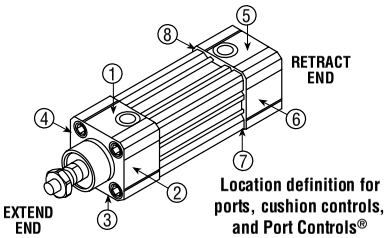
REAR PIVOT MOUNTING STYLES (20 and 25 mm BORES ONLY)



STROKE LENGTHS
(15 mm (5/8") = minimum stroke in 1 mm (1/8") increments)

BORE [mm]	METRIC MAXIMUM STROKE mm	IMPERIAL MAXIMUM STROKE in
CVC20	500	20
CVC25	500	20
CVB20	750	30
CVB25	750	30
32	1000	40
40	1000	40
50	1000	40
63	1000	40
80	1000	40
100	1000	40

Contact PHD for shorter or longer strokes.



MOUNTING STYLE
P - Rear pivot in position 5
Q - Rear pivot in position 6
V - Standard mounting 4 female threads each end per ISO 6431/VDMA 24562 & ISO 6432*
(-P and -Q available on 20 & 25 mm bores only)

CUSHION CONTROL
DB - Cushion Controls Both Ends
DE - Cushion Control Extend Only
DR - Cushion Control Retract Only
Standard cushion control locations are 1 & 5.
See note 7.

OPTIONAL PORT LOCATION
UB00 - Ports on all sides, both ends (Not available with Port Controls on same end) Contact PHD For other combinations. Standard port locations are 1 & 5.
See note 7.

PRODUCT
C - Cylinder

TYPE
S - Single Rod, double acting (Standard)
D - Double Rod, ⊕ double acting (Not available on 3 position units.)

THREE POSITION UNIT
(Specify only if needed)
(Not available on Series CVC)
See note 7.

MODEL NUMBER: **C VB S E 6 P 20 x 25 - 25 - PB DB - UB00 - M-Z1**

SERIES
SIZES 20 & 25 mm ONLY
VB - ISO 6432
150 psi [10 bar] Air
See note 8.
VC - ISO 6432
150 psi [10 bar] Air
See note 9.

SERIES
SIZES 32-100 mm
VA - VDMA 24562
ISO 6431
150 psi [10 bar] Air

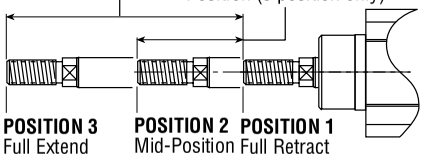
DESIGN NO.
2 -Imperial ⊕
(See note 5.)
6 - Metric

BORE SIZE

BORE mm	BORE in	PISTON AREA sq mm	PISTON AREA sq in
20	.787	314	.486
25	.984	491	.760
32	1.26	804	1.25
40	1.58	1257	1.95
50	1.97	1963	3.05
63	2.48	3117	4.83
80	3.15	5027	7.79
100	3.94	7854	12.17

STROKE CYLINDER 1
Total Stroke

STROKE CYLINDER 2
From Retract to Mid Position (3 position only)



PORT CONTROL® ⊕
BUILT-IN METER OUT FLOW CONTROL VALVE
PB - Port Controls Both Ends
PE - Port Control Extend Only
PR - Port Control Retract Only
Standard port control locations are 1 & 5.
See note 7.

CYLINDER OPTIONS
F22 - 4 Wrench Flats on Rod
F44 - No Wrench Flats on Rod ⊕
H46 - Rodlok® ready cylinder (CVxS only) ⊕ See Note 2.
H47 - Rodlok® unit includes locking device ⊕ Adaptor and Cylinder preassembled (CVxS only) See Note 2.
K_ - Extra Rod Extension ⊕ in 5 mm (1/8") increments. Length code is K5 = 5 mm (1"), K15 = 15 mm(1-7/8"), etc.
L7 - G Port (BSPP) on imperial units
L9 - NPT Ports ⊕ on metric units
M - Magnetic piston for use with PHD Miniature Reed and Solid State Switches
T44 - Female Rod End Undersized Thread ⊕
T55 - Plain Rod End ⊕
TEE - Male Rod with Oversized Thread (CVAx only) ⊕
Z1 - Corrosion Resistant, chrome-plated Stainless Steel Rod, and appropriate coating on ferrous parts.

NOTES:
1) -Z1 option may have reduced cylinder performance due to chrome-plated stainless steel rod in place of chrome-plated alloy steel.
2) -H46 & -H47 is not available in -Z1.
3) *For mounting accessories and dimensions, see Accessories Section.
4) ⊕ Marked options provide additional cylinder flexibility, but do not dimensionally comply with the ISO 6431/VDMA 24562 or ISO 6432 specifications.
5) Imperial unit provides imperial ports, rod ends, and stroke. Mountings are metric.
6) For switch information, see switch option page and Switches Section.
7) On 3 position units, ports, options -DB and/or -PB are available in locations 1 and 5 only. Contact PHD for other configurations. See option pages.
8) Customer interface conforms to ISO 6432, but longer length than ISO 6432.
9) Customer interface and lengths conform to ISO 6432 with optional -P or -Q mounting specified on CVC only.

Options may affect unit length. See unit dimension and options pages for adders.

SPECIFICATIONS	SERIES CVA, CVB	SERIES CVC
OPERATING PRESSURE	7.5 to 150 psi [0.5 bar to 10 bar]	10 to 150 psi [0.67 bar to 10 bar]
TEMPERATURE LIMITS	-20° to +180°F [-28° to +82°C]	
VELOCITY	20 in/sec [.5 m/sec] typical min, zero load at 100 psi [7 bar]	
LIFE EXPECTANCY	130 million linear inches [3.3 million linear meters] min	100 million linear inches [2.5 million linear meters] minimum
LUBRICATION	Factory lubricated for rated life	
MAINTENANCE	Field repairable	

BORE mm	NOMINAL STROKE (L) in	NOMINAL STROKE (L) mm	NOMINAL STROKE CYL. 1 FULL STROKE TOLERANCE* in	NOMINAL STROKE CYL. 1 FULL STROKE TOLERANCE* mm	NOMINAL STROKE 3 POSITION STROKE TOLERANCE* in	NOMINAL STROKE 3 POSITION STROKE TOLERANCE* mm
20 & 25	L ≤ 4	L ≤ 100	+ 0.059/-0	+ 1.5/-0	+ 0.059/-.046	+ 1.5/-1.2
	L > 4	L > 100	+ 0.079/-0	+ 2.0/-0	+ 0.079/-.046	+ 2.0/-1.2
32, 40, & 50	L ≤ 20	L ≤ 500	+ 0.079/-0	+ 2.0/-0	+ 0.079/-.050	+ 2.0/-1.3
	L > 20	L > 500	+ 0.126/-0	+ 3.2/-0	+ 0.126/-.050	+ 3.2/-1.3
63, 80, & 100	L ≤ 20	L ≤ 500	+ 0.098/-0	+ 2.5/-0	+ 0.098/-.070	+ 2.5/-1.8
	L > 20	L > 500	+ 0.157/-0	+ 4.0/-0	+ 0.157/-.070	+ 4.0/-1.8

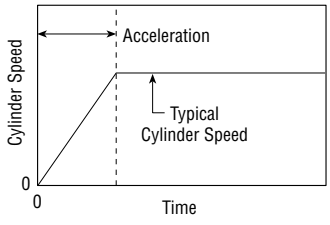
NOTE: *Stroke tolerances/values measured at 60 ± 4 psi [4 ± .27 bar] due to impact seal design.

BORE DIA in	BORE DIA mm	ROD DIA in	ROD DIA mm	ROD DIRECTION	EFFECTIVE AREA in²	EFFECTIVE AREA mm²	CYLINDER WEIGHTS BASE WEIGHT lb	BASE WEIGHT kg	ADDER PER 1" [25 mm]		TYPICAL CYLINDER SPEED** STD & CUSHION UNITS in/sec	STD & CUSHION UNITS m/sec	PORT CONTROL UNITS in/sec	PORT CONTROL UNITS m/sec
0.787	20	0.315	8	EXTEND	0.49	314	0.55	0.25	0.1	0.04	200	5.08	35	0.89
				RETRACT	0.41	264								
0.984	25	0.394	10	EXTEND	0.76	491	0.69	0.31	0.12	0.05	150	3.81	24	0.61
				RETRACT	0.64	412								
1.260	32	0.472	12	EXTEND	1.25	804	1.45	0.66	0.17	0.08	105	2.67	33	0.84
				RETRACT	1.07	691								
1.575	40	0.630	16	EXTEND	1.95	1257	2.08	0.94	0.23	0.10	80	2.03	36	0.91
				RETRACT	1.64	1056								
1.969	50	0.787	20	EXTEND	3.04	1964	3.28	1.49	0.32	0.15	80	2.03	21	0.53
				RETRACT	2.56	1649								
2.480	63	0.787	20	EXTEND	4.83	3117	4.87	2.21	0.36	0.16	35	0.89	25	0.64
				RETRACT	4.34	2803								
3.150	80	0.984	25	EXTEND	7.79	5027	7.78	3.53	0.52	0.24	25	0.64	18	0.46
				RETRACT	7.03	4536								
3.937	100	0.984	25	EXTEND	12.17	7854	11.03	5.00	0.6	0.27	25	0.64	20	0.51
				RETRACT	11.41	7363								

NOTE: **See diagram 1. The above speed data is based on:

A) No attached load with a line pressure of 80 psi [5.5 bar] with a valve rated at Cv = 9.0.
B) 20 mm and 25 mm cylinders tested with 0.17" ID tubing.
C) 32 mm and 40 mm cylinders tested with 0.28" ID tubing.
D) 50 mm, 63 mm, and 80 mm cylinders tested with 0.38" ID tubing.
E) 100 mm cylinders tested with two 0.38" ID tubes to each port from the valve.
F) Use the retract figures for calculating double rod end cylinder forces in both directions.

DIAGRAM 1
IDEALIZED CYLINDER SPEED



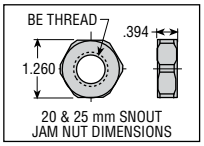
CYLINDER FORCE CALCULATIONS

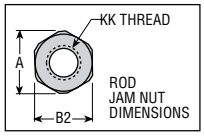
	IMPERIAL F = P x A	METRIC F = 0.1 x P x A
F = Cylinder Force	lbs	N
P = Operating Pressure	psi	bar
A = Effective Area (Extend or Retract)	in²	mm²

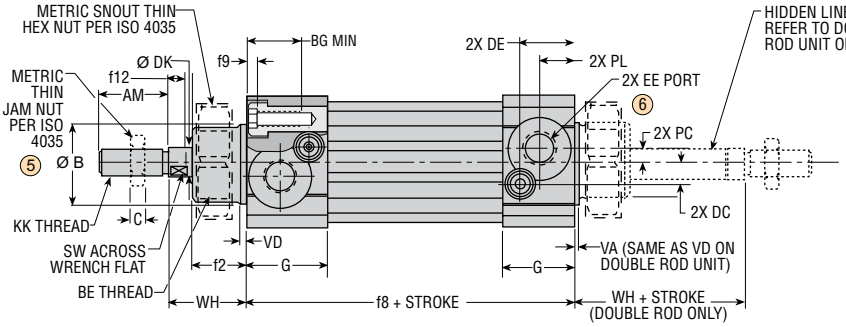
SIZING AND APPLICATION ASSISTANCE
See PHD Product Sizing Catalog for specific and complete sizing information.
Online sizing assistance is available at:
www.phdinc.com/apps/sizing

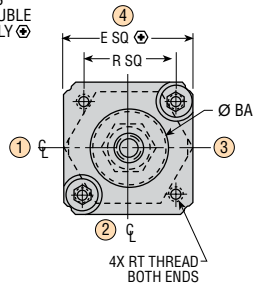
DIMENSIONS: SERIES CV CYLINDERS

SIZES 20 & 25 mm

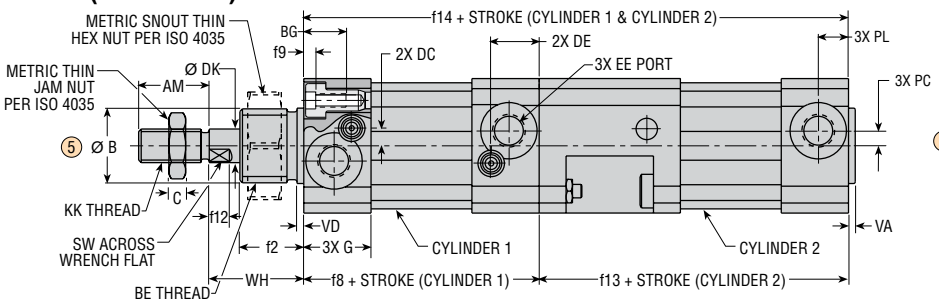


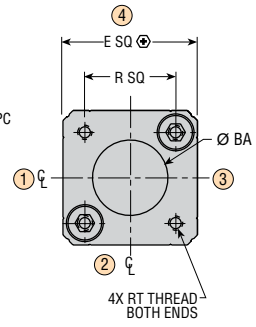




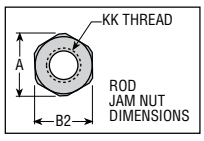


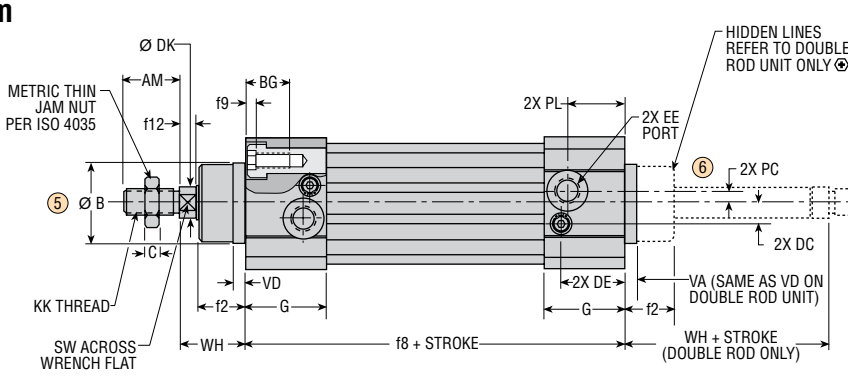
3 POSITION (CVB ONLY)

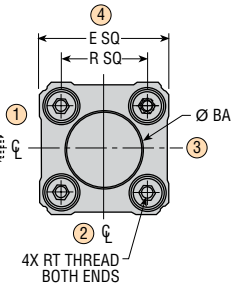




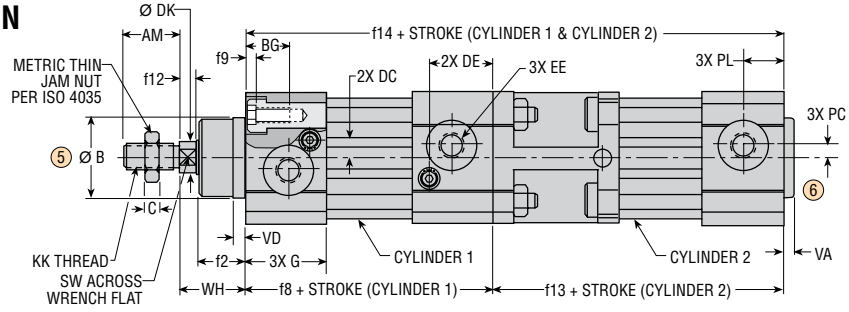
SIZES 32-100 mm

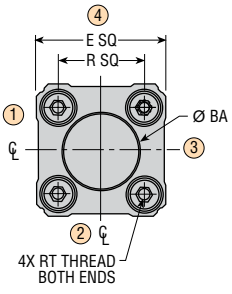






3 POSITION





All dimensions are reference only unless specifically toleranced.

LETTER DIM	BORE SIZE															
	20 mm		25 mm		32 mm		40 mm		50 mm		63 mm		80 mm		100 mm	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
A	.577	14.4	.650	18.9	.650	18.9	.866	21.1	1.083	26.8	1.083	26.75	1.299	33.0	1.299	33.0
AM	.748	19.0	.827	21.0	.827	21.0	.906	23.0	1.220	31.0	1.220	31.0	1.535	39.0	1.535	39.0
Ø B	.866	22.0	.866	22.0	1.181	30.0	1.378	35.0	1.575	40.0	1.772	45.0	1.772	45.0	2.165	55.0
B2	.500	13.0	.562	17.0	.562	17.0	.750	19.0	.938	24.0	.938	24.0	1.125	30.0	1.125	30.0
BA	.866	22.0	.866	22.0	1.181	30.0	1.378	35.0	1.575	40.0	1.772	45.0	1.772	45.0	2.165	55.0
BE	M22 x 1.5		M22 x 1.5		—		—		—		—		—		—	
BG min	.472	12.0	.472	12.0	.709	18.0	.709	18.0	.787	20.0	.787	20.0	.787	20.0	.787	20.0
C	.195	4.0	.210	5.0	.210	5.0	.323	6.0	.387	8.0	.387	8.0	.446	10.0	.446	10.0
DC***	.190	4.8	.226	5.7	.276	7.0	.374	9.5	.394	10.0	.354	9.0	.591	15.0	.630	16.0
DE***	.581	14.8	.559	14.2	.965	24.5	1.083	27.5	1.043	26.5	1.201	30.5	1.181	30.0	1.339	34.0
DK	.315	8.0	.394	10.0	.472	12.0	.630	16.0	.787	20.0	.787	20.0	.984	25.0	.984	25.0
E	1.457	37.0	1.575	40.0	1.949	49.5	2.205	56.0	2.697	68.5	3.150	80.0	3.858	98.0	4.528	115.0
EE PORT**	1/8 NPT	G 1/8	1/8 NPT	G 1/8	1/8 NPT	G 1/8	1/4 NPT	G 1/4	1/4 NPT	G 1/4	3/8 NPT	G 3/8	3/8 NPT	G 3/8	1/2 NPT	G 1/2
EE G PORT DEPTH	—	8.0	—	8.0	—	8.0	—	9.0	—	9.0	—	12.0	—	12.0	—	14.0
f2	.669	17.0	.748	19.0	.728	18.5	.807	20.5	1.083	27.5	1.083	27.5	1.319	33.5	1.437	36.5
f8 CVA	—	—	—	—	3.701	94.0	4.134	105.0	4.173	106.0	4.764	121.0	5.039	128.0	5.433	138.0
f8 CVB	2.638	67.0	2.756	70.0	—	—	—	—	—	—	—	—	—	—	—	—
f8 CVC	2.323	59.0	2.520	64.0	—	—	—	—	—	—	—	—	—	—	—	—
f9	.142	3.6	.142	3.6	.165	4.2	.169	4.3	.224	5.7	.224	5.7	.268	6.8	.268	6.8
f12	.196	5.0	.236	6.0	.236	6.0	.256	6.5	.315	8.0	.315	8.0	.394	10.0	.394	10.0
f13	3.504	89.0	3.622	92.0	4.370	111.0	4.823	122.5	5.728	145.5	6.181	157.0	6.772	172.0	7.008	178.0
f14	6.142	156.0	6.378	162.0	8.071	205.0	8.957	227.5	9.902	251.5	10.945	278.0	11.811	300.0	12.441	316.0
G	.787	20.0	.787	20.0	1.220	31.0	1.358	34.5	1.358	34.5	1.496	38.0	1.496	38.0	1.654	42.0
KK	5/16-24	M8 x 1.25	3/8-24	M10 x 1.25	3/8-24	M10 x 1.25	1/2-20	M12 x 1.25	5/8-18	M16 x 1.5	5/8-18	M16 x 1.5	3/4-16	M20 x 1.5	3/4-16	M20 x 1.5
PC***	.167	4.2	.177	4.5	.197	5.0	.236	6.0	.236	6.0	.394	10.0	.394	10.0	.472	12.0
PL***	.354	9.0	.354	9.0	.630	16.0	.728	18.5	.728	18.5	.787	20.0	.709	18.0	.866	22.0
R	1.024	26.0	1.063	27.0	1.280	32.5	1.496	38.0	1.831	46.5	2.224	56.5	2.835	72.0	3.504	89.0
RT	M4 x 0.7		M4 x 0.7		M6 x 1		M6 x 1		M8 x 1.25		M8 x 1.25		M10 x 1.5		M10 x 1.5	
SW	.276	7.0	.315	8.0	.394	10.0	.512	13.0	.630	16.0	.630	16.0	.827	21.0	.827	21.0
VA	.079	2.0	.079	2.0	.157	4.0	.157	4.0	.157	4.0	.157	4.0	.157	4.0	.157	4.0
VD	.079	2.0	.079	2.0	.177	4.5	.177	4.5	.177	4.5	.177	4.5	.177	4.5	.177	4.5
WH*	.945	24.0	1.102	28.0	1.024	26.0	1.181	30.0	1.457	37.0	1.457	37.0	1.811	46.0	2.008	51.0

NOTES:

1) Unless otherwise dimensioned, mounting hole patterns are centered on the cylinder.
2) Ports and cushions may appear on either side of the cylinder centerline based on option combinations.
3) **All metric (CVxx6) units, except port with Port Control® on same side, comply with ISO 16030 and DIN 3852 part 2 port specifications for short stud and large sealing surface. See Port Control® option sheet for port and Port Control® dimensions on units with ports and Port Controls® on the same side.
4) *WH values are determined with cylinder at 60 ± 4 psi [4 ± .27 bar] due to impact seal design.
5) ***⊕ Marked dimensions on the previous page provide additional flexibility, but do not dimensionally comply with ISO 6431/VDMA 24562 or ISO 6432 specifications.

All dimensions are reference only unless specifically toleranced.

DB CUSHION CONTROL IN BOTH DIRECTIONS

(standard location 1 & 5, see note)

DE CUSHION CONTROL ON EXTEND ONLY

(standard location 1, not available on 3 position units)

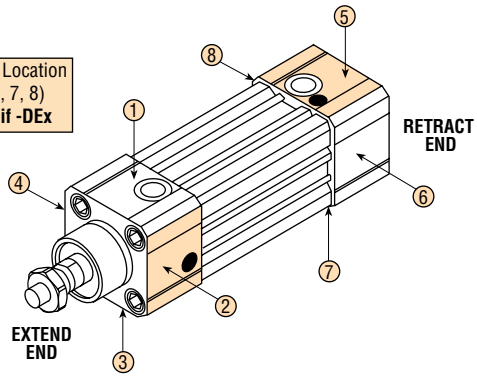
DR CUSHION CONTROL ON RETRACT ONLY

(standard location 5, not available on 3 position units)

CUSHION CONTROL OPTIONS

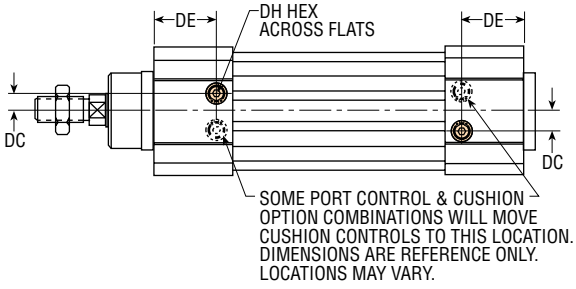
-D x x x

- Cushion Control Locations: B - Both ends; E - Extend end only; R - Retract end only
- Retract Location (5, 6, 7, 8) **Omit if -DEx**
- Extend Location (1, 2, 3, 4) **Omit if -DRx**

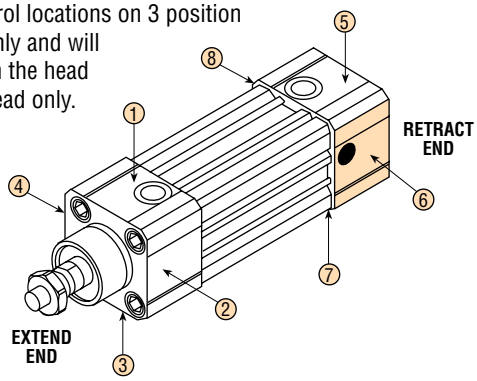


PHD cushions are designed for smooth deceleration at the end of stroke. When the cushion is activated, the remaining volume in the cylinder must exhaust past an adjustable needle which controls the amount of deceleration. The effective cushion lengths for each bore size are shown in the table below. To specify different cushion control locations on the head or cap, see option code above.

Note: Cushion controls on 3 position units are available only with -DB option in locations 1 and 5 only. 3 position units will have cushion on full extend and full retract.



Unit shown is -DB25, cushion in location 2 on extend end and cushion in location 5 on retract end. (Ports are shown in standard locations 1 & 5.) Cushion control locations on 3 position units are 1 and 5 only and will receive a control on the head and intermediate head only.



Unit shown is -DR6, cushion in location 6 on retract end and none on extend end. (Ports are shown in standard locations 1 & 5.)

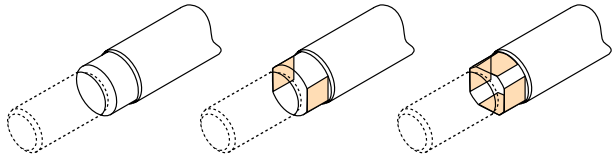
LETTER DIM	BORE SIZE															
	20 mm		25 mm		32 mm		40 mm		50 mm		63 mm		80 mm		100 mm	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
DC	.190	4.8	.226	5.7	.276	7.0	.374	9.5	.394	10.0	.354	9.0	.591	15.0	.630	16.0
DE	.581	14.8	.561	14.2	.965	24.5	1.083	27.5	1.043	26.5	1.201	30.5	1.181	30.0	1.339	34.0
DH	—	2.5	.561	2.5	—	2.5	—	2.5	—	2.5	—	2.5	—	3.0	—	3.0
EFFECTIVE CUSHION LENGTH	.441	11.2	.469	11.9	.598	15.2	.807	20.5	.870	22.1	.870	20.4	.894	22.7	1.189	30.2

F22 4 WRENCH FLATS ON ROD END ⊕

With this option, the rod is supplied with four rod end flats instead of the standard two flats. If this option is specified on double rod units, both rod ends will be supplied with four wrench flats.

F44 NO WRENCH FLATS ON ROD END ⊕

This option omits rod end wrench flats. If this option is specified on double rod units, both rod ends will be supplied without wrench flats.



⊕ For metric units (CVxx6). This option does not dimensionally comply with the ISO 6431/VDMA 24562 or ISO 6432 specifications.

All dimensions are reference only unless specifically toleranced.

H46 RODLOK® READY CYLINDER

Available on single rod units only.
(Rodlok® sold separately) ⊕

H47 RODLOK® CYLINDER & RODLOK®

Available on single rod units only.
(preassembled) ⊕

PHD's Rodlok® is ideal for locking the piston rod while in a static/stationary position. When the pressure is removed from the port of the Rodlok®, the mechanism will grip the rod and prevent it from moving. The loads are held indefinitely without power. Rodlok® performance is application and environment sensitive (cleanliness of rod or Rodlok® will also affect performance). THE RODLOK® IS NOT DESIGNED TO BE USED AS A PERSONNEL SAFETY DEVICE.

Option -H46 provides a Rodlok® ready cylinder with appropriate rod extension and materials for use with PHD's Rodlok®.
Option -H47 provides a cylinder and Rodlok® pre-assembled. The port for the Rodlok® will be assembled in the same position as the port on the extend end of the cylinder.

The Rodlok® locking device and adaptor can be purchased separately as kits. See chart at right. The locking device and adaptor are **not available with the -Z1 corrosion resistant finish.**

Dimensions continued on next page.

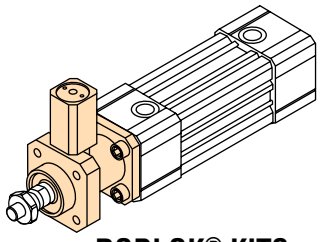
BORE	STATIC LOCKING FORCE*	
mm	lb	N
20	79	350
25	90	400
32	135	600
40	225	1000
50	337	1500
63	495	2200
80	674	3000
100	1124	5000

NOTE: *Locking force given in table is the actual locking force with a dry, clean rod and does not include any safety factor.

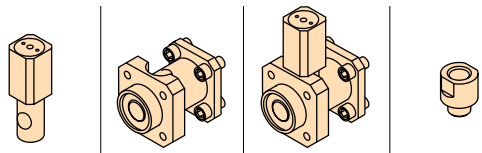
OPERATING PRESSURE

The operating pressure for the locking device is different than the operating pressure for the cylinder with the Rodlok® attached. The locking device of the Rodlok® is designed with an operating pressure range of 60 psi minimum to 150 psi maximum [4 to 10 bar]. The Series CV Cylinder with a Rodlok® attached has an operating pressure range of 22 psi minimum to 150 psi maximum [1.5 to 10 bar].

⊕ For metric units (CVxx6).
This option does not dimensionally comply with the ISO 6431/VDMA 24562 or ISO 6432 specifications.



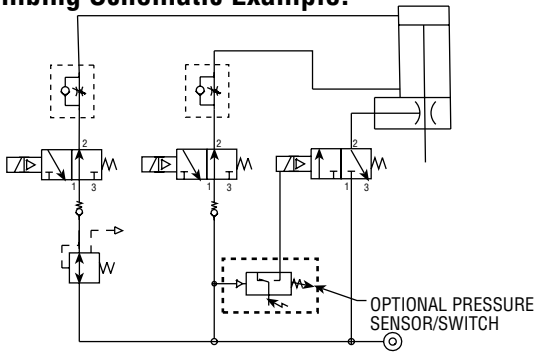
RODLOK® KITS



BORE mm	LOCKING DEVICE KIT	ADAPTOR KIT*	COMPLETE RODLOK®*	IMPERIAL PORT ADAPTOR**
20	63459-07-1	63460-07-1	63461-07-1	—
25	63459-08-1	63460-08-1	63461-08-1	—
32	63459-01-1	63460-01-1	63461-01-1	63465-1
40	63459-02-1	63460-02-1	63461-02-1	63465-1
50	63459-03-1	63460-03-1	63461-03-1	63465-1
63	63459-04-1	63460-04-1	63461-04-1	63465-1
80	63459-05-1	63460-05-1	63461-05-1	63465-1
100	63459-06-1	63460-06-1	63461-06-1	63465-1

NOTES:
1) * Kits ship with cylinder mounting hardware.
2) Rodlok® is intended for use only on -H46 cylinder.
3) Imperial port adaptor converts port from G1/8 to 1/8" NPT for use with -L9 cylinders or imperial units.
4) **Adaptor must be ordered separately. Required to convert to imperial port.

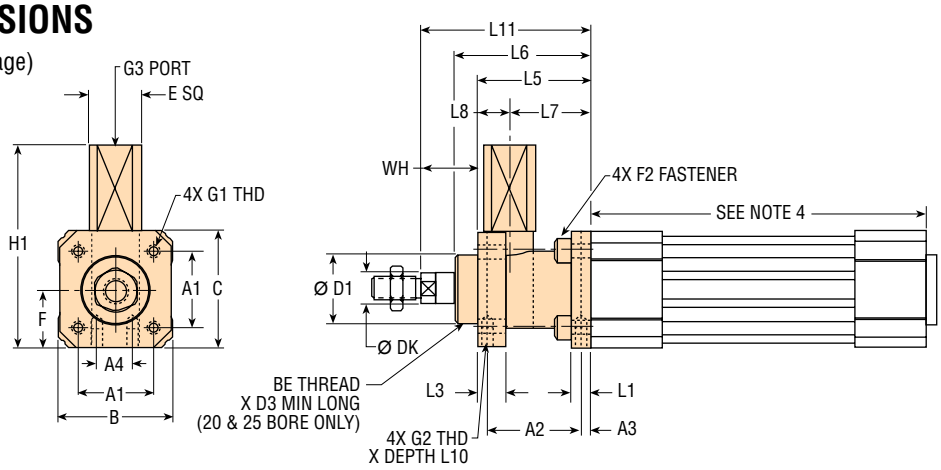
Plumbing Schematic Example:



The pneumatic schematic above shows typical valving for cylinder and Rodlok® for both horizontal and vertical operation. The schematic shows three 3/2 way valves, one for each port on the cylinder and one for the Rodlok® port. The use of two valves on the cylinder allows for both ports to be pressurized when valves are de-energized. The use of an in-line regulator allows the cylinder ports to be pressurized at different pressures. This allows the cylinder to balance out the opposing pressure and force of the attached load. Once piston rod motion has stopped, the Rodlok® can be engaged by de-energizing its valve and releasing its pressure. The use of check valves and built in PHD Port Controls® is recommended. Pressure switch shown is optional and application specific.

RODLOK® DIMENSIONS

(continued from previous page)



LETTER	BORE SIZE															
	20 mm		25 mm		32 mm		40 mm		50 mm		63 mm		80 mm		100 mm	
DIM	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
A1	1.024	26.0	1.063	27.0	1.280	32.5	1.496	38.0	1.831	46.5	2.224	56.5	2.835	72.0	3.504	89.0
A2	—	—	—	—	1.575	40.0	1.811	46.0	2.126	54.0	2.165	55.0	2.756	70.0	2.756	70.0
A3	—	—	—	—	.165	4.2	.177	4.5	.453	11.5	.295	7.5	.394	10.0	.394	10.0
A4	—	—	—	—	.630	16.0	.827	21.0	.945	24.0	1.260	32.0	1.732	44.0	2.362	60.0
B	1.457	37.0	1.575	40.0	1.890	48.0	2.205	56.0	2.677	68.0	3.228	82.0	3.937	100.0	4.724	120.0
BE	M22 x 1.5		M22 x 1.5		—	—	—	—	—	—	—	—	—	—	—	—
C	1.457	37.0	1.575	40.0	1.969	50.0	2.283	58.0	2.756	70.0	3.346	85.0	4.134	105.0	5.118	130.0
D1	.866	22.0	.866	22.0	1.181	30.0	1.378	35.0	1.575	40.0	1.772	45.0	1.772	45.0	2.165	55.0
D3	.590	15.0	.669	17.0	—	—	—	—	—	—	—	—	—	—	—	—
DK	.315	8.0	.394	10.0	.472	12.0	.630	16.0	.787	20.0	.787	20.0	.984	25.0	.984	25.0
E	.807	20.5	.807	20.5	.984	25.0	1.083	27.5	1.280	32.5	1.614	41.0	1.929	49.0	2.087	53.0
F	.728	18.5	.787	20.0	.984	25.0	1.142	29.0	1.378	35.0	1.673	42.5	2.067	52.5	2.559	65.0
F2	M4 x 0.7 x 20		M4 x 0.7 x 20		M6 x 1 x 20		M6 x 1 x 20		M8 x 1.25 x 30		M8 x 1.25 x 30		M10 x 1.5 x 30		M10 x 1.5 x 30	
G1	M4 x 0.7		M4 x 0.7		M6 x 1		M6 x 1		M8 x 1.25		M8 x 1.25		M10 x 1.5		M10 x 1.5	
G2	—		—		M5		M5		M6		M8		M8		M8	
G3	M5 x 0.8		M5 x 0.8		G 1/8*		G 1/8*		G 1/8*		G 1/8*		G 1/8*		G 1/8*	
H1	2.795	71.0	2.854	72.5	3.346	85.0	3.839	97.5	4.626	117.5	5.256	133.5	6.752	171.5	7.441	189.0
L1	.354	9.0	.315	8.0	.315	8.0	.394	10.0	.591	15.0	.591	15.0	.630	16.0	.630	16.0
L3	.354	9.0	.315	8.0	.472	12.0	.472	12.0	.630	16.0	.591	15.0	.630	16.0	.709	18.0
L5	1.575	40.0	1.732	44.0	1.890	48.0	2.165	55.0	2.756	70.0	2.756	70.0	3.543	90.0	3.622	92.0
L6	2.244	57.0	2.480	63.0	2.283	58.0	2.559	65.0	3.228	82.0	3.228	82.0	4.331	110.0	4.528	115.0
L7	1.142	29.0	1.220	31.0	1.260	32.0	1.398	35.5	1.929	49.0	1.929	49.0	2.441	62.0	2.559	65.0
L8	.433	11.0	.512	13.0	.630	16.0	.768	19.5	.827	21.0	.827	21.0	1.102	28.0	1.063	27.0
L10	—	—	—	—	.315	8.0	.394	10.0	.472	12.0	.472	12.0	.630	16.0	.630	16.0
L11	2.520	64.0	2.835	72.0	2.913	74.0	3.346	85.0	4.213	107.0	4.213	107.0	5.354	136.0	5.630	143.0
WH	.945	24.0	1.102	28.0	1.024	26.0	1.181	30.0	1.457	37.0	1.457	37.0	1.811	46.0	2.008	51.0

NOTES:
1) -H47 units have Rodlok® port aligned with cylinder port on extend.
2) See pages 1-34 and 1-35 for complete cylinder dimensions.
3) * = Port supplied on Rodlok® device, requires port adaptor from page 1-37 to convert to 1/8 NPT.
4) All dimensions not noted are standard. See pages 1-34 and 1-35 for complete cylinder dimensions.

L9 NPT PORTS ⊕
(Metric Units)

This option provides NPT ports instead of the standard G (BSPP) ports. The NPT ports are located in the same location as the G (BSPP) ports.

⊕ This option does not dimensionally comply with the ISO 6431/VDMA 24562 or ISO 6432 specifications.

L7 BSPP PORTS
(Imperial Units)

This option provides G (BSPP) ports instead of the standard NPT ports. The G (BSPP) ports are located in the same location as the NPT ports.

BORE [mm]	IMPERIAL NPT PORT	METRIC BSPP PORT
20	1/8*	G 1/8*
25	1/8*	G 1/8*
32	1/8	G 1/8
40	1/4	G 1/4
50	1/4	G 1/4
63	3/8	G 3/8
80	3/8	G 3/8
100	1/2	G 1/2

*When Port Controls® (-PB, -PR, -PE) are specified on the same face as port, the ports change to M5 on metric and 10-32 on imperial.

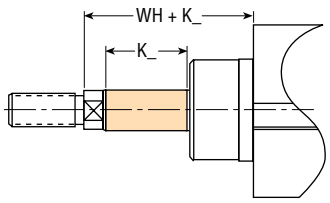
All dimensions are reference only unless specifically toleranced.

K_ EXTRA ROD EXTENSION ⊕

Extra rod extension can be achieved by specifying the option -K followed by the length code. Rod extension is available in 1/8" or 5 mm increments. If this option is specified on double rod units, both rod ends will be supplied with the same extra rod extension. Contact PHD for other combinations.

Length Code

Imperial	Metric
K5 = 5/8" extra rod extension	K5 = 5 mm extra rod extension
K15 = 1-7/8" extra rod extension	K15 = 15 mm extra rod extension



⊕ For metric units (CVxx6). This option does not dimensionally comply with the ISO 6431/VDMA 24562 or ISO 6432 specifications.

BORE [mm]	WH in	WH mm
20	0.945	24.0
25	1.102	28.0
32	1.024	26.0
40	1.181	30.0
50	1.457	37.0
63	1.457	37.0
80	1.811	46.0
100	2.008	51.0

Z1 CORROSION RESISTANT

By specifying this option, a stainless steel rod with hard chrome plating is supplied in place of the standard hard chrome plated steel material. Appropriate coating is supplied on ferrous parts.

M MAGNET FOR PHD MINIATURE REED AND SOLID STATE SWITCHES

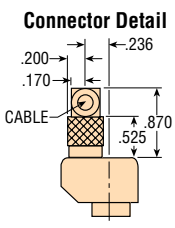
This option equips the cylinder with a magnetic band on the piston for use with PHD Miniature Reed and Solid State Switches listed below. These switches mount easily to the cylinder using "T" slots in the body. See Switches and Sensors section for complete switch information. Three position units will receive a magnet on both cylinder 1 and cylinder 2 when specified with -M option.

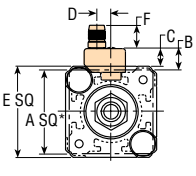
SERIES 6250 SOLID STATE SWITCHES

PART NO.	DESCRIPTION	COLOR
62505-1-02	NPN (Sink) DC Solid State, 2 m cable	Brown
62506-1-02	PNP (Source) DC Solid State, 2 m cable	Tan
62515-1	NPN (Sink) DC Solid State, Quick Connect	Brown
62516-1	PNP (Source) DC Solid State, Quick Connect	Tan

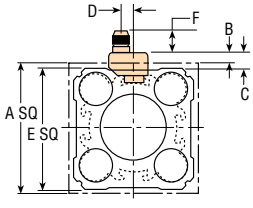
SERIES 6250 REED SWITCHES

PART NO.	DESCRIPTION	COLOR
62507-1-02	AC/DC Reed, 2 m cable	Silver
62517-1	AC/DC Reed, Quick Connect	Silver

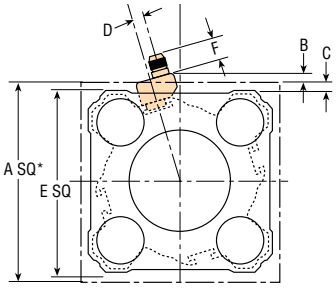




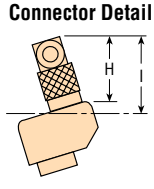
20 & 25 mm units



32, 40, & 50 mm units



63, 80, & 100 mm units



LETTER DIM	BORE SIZE 20 mm in	20 mm mm	25 mm in	25 mm mm	32 mm in	32 mm mm	40 mm in	40 mm mm	50 mm in	50 mm mm	63 mm in	63 mm mm	80 mm in	80 mm mm	100 mm in	100 mm mm
A*	1.339	34.0	1.339	34.0	1.969	50.0	2.283	58.0	2.756	70.0	3.346	85.0	4.134	105.0	5.118	130.0
B	.343	8.7	.441	11.2	.276	7.0	.197	5.0	.236	6.0	.236	6.0	.157	4.0	.020	0.5
C	.283	7.2	.323	8.2	.295	7.5	.256	6.5	.276	7.0	.335	8.5	.295	7.5	.315	8.0
D	.236	6.0	.236	6.0	.236	6.0	.236	6.0	.236	6.0	.236	6.0	.236	6.0	.236	6.0
E	1.457	37.0	1.575	40.0	1.949	49.5	2.205	56.0	2.697	68.5	3.150	80.0	3.858	98.0	4.528	115.0
F	.374	9.5	.374	9.5	.374	9.5	.374	9.5	.374	9.5	.374	9.5	.374	9.5	.374	9.5
G	—	—	—	—	—	—	—	—	—	—	17°	17°	20°	20°	24°	24°
H	.870	22.1	.870	22.1	.870	22.1	.870	22.1	.870	22.1	.831	21.1	.819	20.8	.795	20.2
I	1.213	30.8	1.311	33.3	1.146	29.1	1.087	27.6	1.106	28.1	1.059	26.9	.965	24.5	.811	20.6

NOTE: *ISO/VDMA max square size

PB PORT CONTROLS® ON BOTH ENDS
(standard location 1 & 5, see note) ⊕

PE PORT CONTROLS® ON EXTEND ONLY
(standard location 1, not available on 3 position units) ⊕

PR PORT CONTROLS® ON RETRACT ONLY
(standard location 5, not available on 3 position units) ⊕

PHD's Port Control® is a built-in flow control for regulating the speed of the cylinder through its entire stroke. The Port Control operates on the "meter-out" principle and features an adjustable needle in a cartridge with a check seal. The self-locking needle has micrometer threads and is adjustable under pressure. The needle determines the orifice size which controls the exhaust flow rate of the actuator. The check seal expands while air is exhausting from the actuator, forcing the air to exhaust past the adjustable needle. The check seal collapses to allow a free flow of incoming air. The PHD Port Control saves space and eliminates the cost of fittings and installation for external flow control valves. See engineering data for cylinder speeds with PHD's Port Controls. Refer to option code below to specify port control locations. Three position port control locations are 1 and 5 only and will receive a control on the head, intermediate head, and cap.

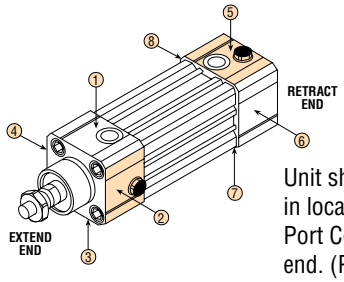
NOTE: Port Controls are not available on same end which has -UB0x or -UBx0 (four ports) specified. Port Controls on 3 position units are available only with -PB option in locations 1 and 5 only.

⊕ For 32, 40, 50, and 63 mm, the Port Control extends beyond VDMA specified square size. See dimension BP.

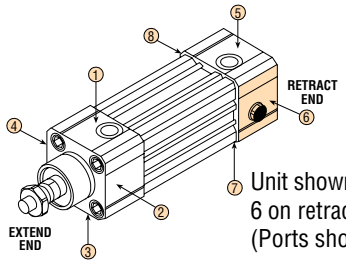
PORT CONTROL OPTIONS

-P x x x

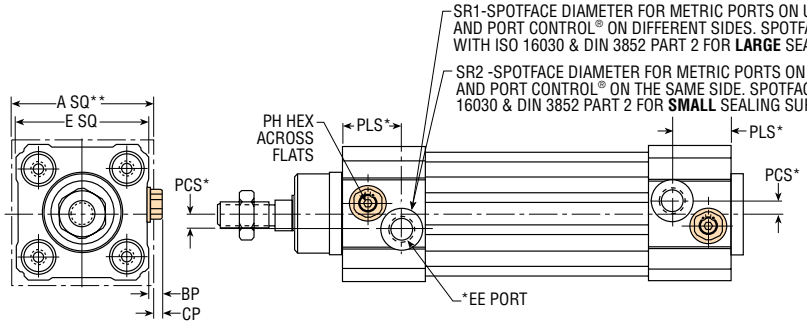
- Port Control Locations: B - Both ends; E - Extend end only; R - Retract end only
- Extend Location (1, 2, 3, 4) **Omit if -PRx**
- Retract Location (5, 6, 7, 8) **Omit if -PEx**



Unit shown is -PB25, Port Control® in location 2 on extend end and Port Control in location 5 on retract end. (Ports shown in standard locations 1 & 5.)



Unit shown is -PR6, Port Control in location 6 on retract end and none on extend end. (Ports shown in standard locations 1 & 5.)



⊕ For metric units (CVxx6). This option does not dimensionally comply with the ISO 6431/VDMA 24562 or ISO 6432 specifications.

LETTER DIM	BORE SIZE															
	20 mm		25 mm		32 mm		40 mm		50 mm		63 mm		80 mm		100 mm	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
A**	1.339	34.0	1.339	34.0	1.969	50.0	2.283	58.0	2.756	70.0	3.346	85.0	4.134	105.0	5.118	130.0
BP	.125	3.2	.153	3.9	.177	4.5	.240	6.1	.110	2.8	.201	5.1	.134	3.4	.205	5.2
CP	.184	4.7	.271	6.9	.169	4.3	.201	5.1	.083	2.1	.102	2.6	-.004	-0.1	-.091	-2.3
E	1.457	37.0	1.575	40.0	1.949	49.5	2.205	56.0	2.697	68.5	3.150	80.0	3.858	98.0	4.528	115.0
EE*	10-32	M5	10-32	M5	1/8 NPT	G1/8	1/4 NPT	G1/4	1/4 NPT	G1/4	3/8 NPT	G3/8	3/8 NPT	G3/8	1/2 NPT	G1/2
PCS*	.276	7.0	.276	7.0	.197	5.0	.236	6.0	.236	6.0	.449	11.4	.512	13.0	.906	23.0
PH	—	2.5	—	2.5	—	2.5	—	2.5	—	2.5	—	3.0	—	3.0	—	6.0
PLS*	.571	14.5	.571	14.5	.866	22.0	.925	23.5	.906	23.0	.984	25.0	1.024	26.0	1.142	29.0
SR1	—	16.5	—	16.5	—	19.0	—	25.0	—	25.0	—	28.0	—	28.0	—	34.0
SR2	.354	9.0	.354	9.0	—	16.5	—	19.0	—	19.0	—	23.0	—	23.0	—	27.0

NOTES:

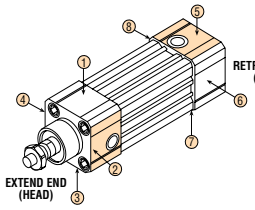
1) *Port dimensions shown are for units with port and Port Control® in the same location. For units with other port and Port Control® combinations, standard port size and location dimensions apply. Ports may be located on either side of the cylinder centerline depending on Port Control® and cushion option combinations.
in = Table information for imperial ports mm = Table information for metric ports

2) **VDMA max square size

All dimensions are reference only unless specifically toleranced.

UB ALTERNATE PORT LOCATION
(not available on 3 position units)

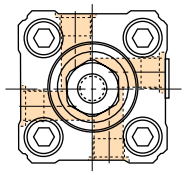
With this option, alternate port locations can be specified, providing increased flexibility and customer convenience. See option code below to specify port locations. Three position units available with ports in standard locations 1 and 5 only.



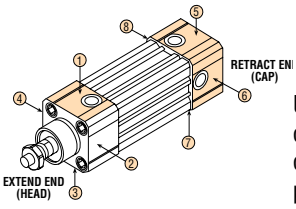
Unit shown is -UB25, port in location 2 on extend end and port in location 5 on retract end.

PORT LOCATION OPTIONS
-UB x x

Extend Location (Head) (0, 1, 2, 3, 4) 0 = All four sides	Retract Location (Cap) (0, 5, 6, 7, 8) 0 = All four sides



PORTS ON ALL 4 SIDES (0 IN PORT OPTION CODE) NOT AVAILABLE WITH PHD PORT CONTROLS ON SAME END



Unit shown is -UB10, port in location 1 on extend end, and ports on all 4 sides on retract end. (Not available with PHD port controls on retract.)

T44 FEMALE ROD END ⊕

This option provides a female rod end in place of the standard male rod end. See catalog dimensional pages for standard rod ends. This rod end deviates from ISO 6431/VDMA 24562 or ISO 6432 on metric units (CVxx6).

Double rod units will receive the same rod end on both rods unless otherwise specified as shown in the double rod option description.

T55 PLAIN ROD END ⊕

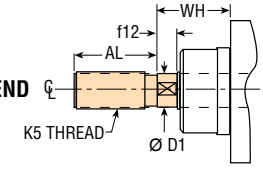
This option provides a plain rod end with wrench flats. Standard PHD Series CV Cylinders are supplied with a male rod end. This rod end deviates from ISO 6431/VDMA 24562 or ISO 6432 on metric units (CVxx6).

Double rod units will receive the same rod end on both rods unless otherwise specified as shown in the double rod option description.

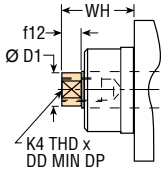
TEE MALE OVERSIZE ROD END ⊕
(N/A on 20 & 25 mm Bores)

This option provides a male oversize thread rod end in place of the standard male rod end. See catalog dimensional pages for standard rod ends. Double rod units will receive the same rod end on both rods unless otherwise specified as shown in the double rod option description.

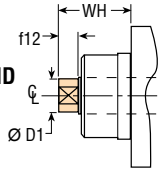
TEE MALE OVERSIZE ROD END



T44 FEMALE ROD END



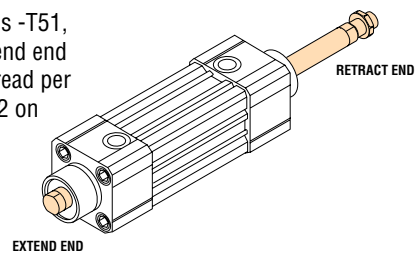
T55 PLAIN ROD END



LETTER DIM	BORE SIZE															
	20 mm		25 mm		32 mm		40 mm		50 mm		63 mm		80 mm		100 mm	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
AL	—	—	—	—	.827	21.0	.906	23.0	1.220	31.0	1.220	31.0	1.535	39.0	1.535	39.0
D1	.315	8.00	.375*	9.53*	.447	11.35	.599	15.22	.757	19.23	.757	19.23	.954	24.23	.954	24.23
f12	.197	5.0	.236	6.0	.236	6.0	.256	6.5	.315	8.0	.315	8.0	.394	10.0	.394	10.0
K4	#10-32	M5 x 0.8	1/4-28	M6 x 1.0	5/16-24	M8 x 1.25	7/16-20	M10 x 1.5	1/2-20	M12 x 1.75	1/2-20	M12 x 1.75	5/8-11	M16 x 2.0	5/8-11	M16 x 2.0
K5	—	—	—	—	7/16-20	M12 x 1.25	5/8-18	M16 x 1.5	3/4-16	M20 x 1.5	3/4-16	M20 x 1.5	1-12	M24 x 3	1-12	M24 x 3
DD min	.413	10.5	.492	12.5	.551	14.0	.669	17.0	.748	19.0	.748	19.0	.827	21.0	.827	21.0
WH	.945	24.0	1.102	28.0	1.024	26.0	1.181	30.0	1.457	37.0	1.457	37.0	1.811	46.0	2.008	51.0

*Dimension shown is for -T44 rod end only. -T55 option dimension is .394 in [10.0 mm].

Unit shown is -T51, plain on extend end and male thread per VDMA 24562 on retract end.



DOUBLE ROD END OPTIONS
-T x x

Extend End	Retract End
1 = Male thread VDMA 24562 (Standard)	1 = Male thread VDMA 24562 (Standard)
4 = Female undersized thread	4 = Female undersized thread
5 = Plain	5 = Plain
E = Male oversized thread	E = Male oversized thread

⊕ For metric units (CVxx6). This option does not dimensionally comply with the ISO 6431/VDMA 24562 or ISO 6432 specifications.

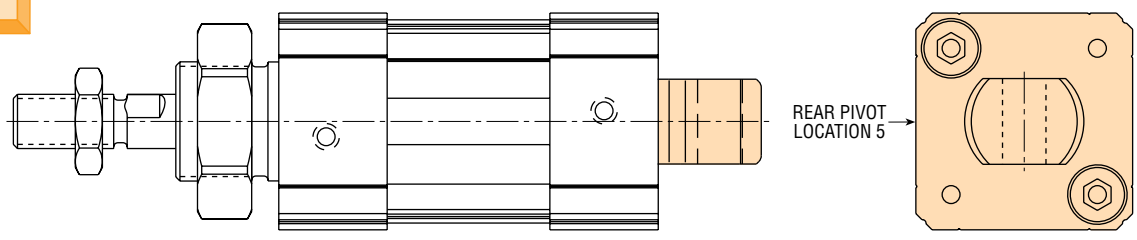
All dimensions are reference only unless specifically toleranced.

P&Q PIVOT MOUNT ON SIZES 20 & 25 ONLY

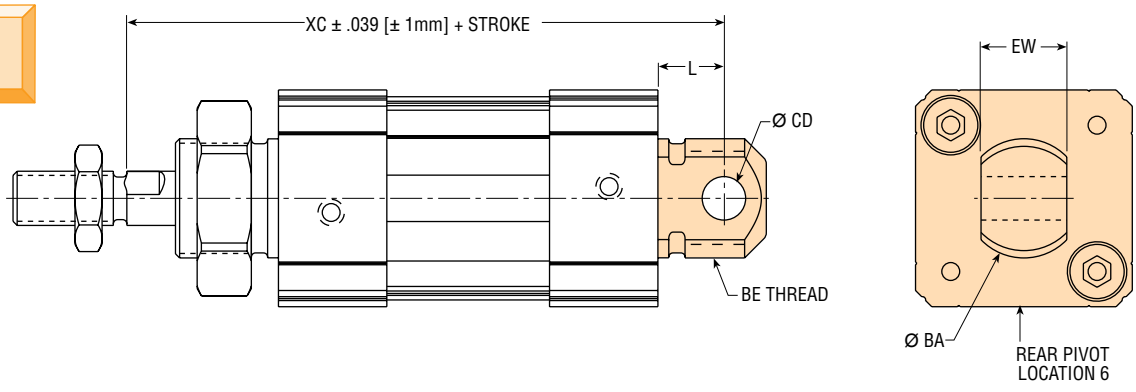
This style specifies a pivot mount cap. This style conforms to ISO 6432 customer interface and overall unit length on metric units (CVxx6) when specified with optional -P or -Q mounting. Pivot pins and base mounting brackets are available, see mounting accessories.

LETTER DIM/ TOLERANCE	BORE SIZE			
	20 mm		25 mm	
	in	mm	in	mm
BA	0.866	22.0	0.866	22.0
BE	M22 x 1.5		M22 x 1.5	
CD/H9	0.315	8.0	0.315	8.0
EW/d13	0.630	16.0	0.630	16.0
L MIN	0.472	12.0	0.472	12.0
XC CVB	4.055	103.0	4.330	110.0
XC CVC	3.740	95.0	4.094	104.0

P



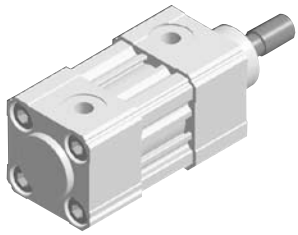
Q

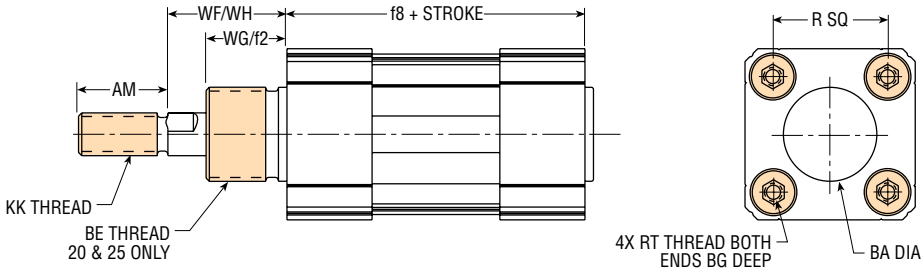


All dimensions are reference only unless specifically toleranced.

V STANDARD MOUNTING

(ISO 6431/VDMA 24562 & ISO 6432 for metric units CVxx6)





LETTER DIM/ TOLERANCE	BORE SIZE															
	20 mm		25 mm		32 mm		40 mm		50 mm		63 mm		80 mm		100 mm	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
AM	0.748	19.0	0.827	21.0	0.827	21.0	0.906	23.0	1.220	31.0	1.220	31.0	1.535	39.0	1.535	39.0
BA	0.866	22.0	0.866	22.0	1.181	30.0	1.378	35.0	1.575	40.0	1.772	45.0	1.772	45.0	2.165	55.0
BE	M22 x 1.5		M22 x 1.5		—		—		—		—		—		—	
BG min	0.472	12.0	0.472	12.0	0.709	18.0	0.709	18.0	0.787	20.0	0.787	20.0	0.787	20.0	0.787	20.0
f8 CVA	—	—	—	—	3.701	94.0	4.134	105.0	4.173	106.0	4.764	121.0	5.039	128.0	5.433	138.0
f8 CVB	2.638	67.0	2.756	70.0	—	—	—	—	—	—	—	—	—	—	—	—
f8 CVC	2.323	59.0	2.520	64.0	—	—	—	—	—	—	—	—	—	—	—	—
KK	5/16-24	M8 x 1.25	3/8-24	M10 x 1.25	3/8-24	M10 x 1.25	1/2-20	M12 x 1.25	5/8-18	M16 x 1.5	5/8-18	M16 x 1.5	3/4-16	M20 x 1.5	3/4-16	M20 x 1.5
R	1.024	26.0	1.063	27.0	1.280	32.5	1.496	38.0	1.831	46.5	2.224	56.5	2.835	72.0	3.504	89.0
RT	M4 x 0.7		M4 x 0.7		M6 x 1		M6 x 1		M8 x 1.25		M8 x 1.25		M10 x 1.5		M10 x 1.5	
WF	0.945	24.0	1.102	28.0	—		—		—		—		—		—	
WH	—		—		1.024	26.0	1.181	30.0	1.457	37.0	1.457	37.0	1.811	46.0	2.008	51.0
WG	0.669	17.0	0.748	19.0	—		—		—		—		—		—	
f2	—		—		0.728	18.5	0.807	20.5	1.083	27.5	1.083	27.5	1.319	33.5	1.437	36.5

All dimensions are reference only unless specifically toleranced.

SELF-ALIGNING PISTON ROD COUPLERS - METRIC

New metric rod couplers are an ideal accessory for use with Series CV ISO/VDMA cylinders.

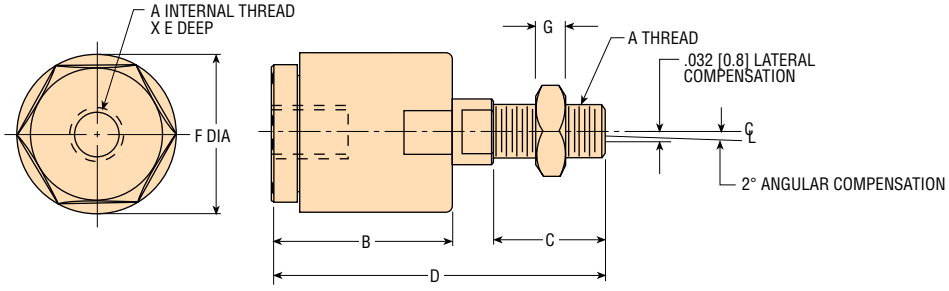
To order, specify the model number.

BENEFITS

- Rod Couplers eliminate expensive precision machining for mounting fixed or rigid cylinder on guide or slide applications.
- Cylinder efficiency is increased by eliminating friction caused by misalignment. Couplers compensate for 2° angular error and 1/32" [0.8 mm] lateral misalignment on push and pull stroke.
- Couplers provide greater reliability and reduce cylinder and component wear, simplifying alignment problems in the field.
- Rod Couplers are manufactured from high tensile and hardened steel components.

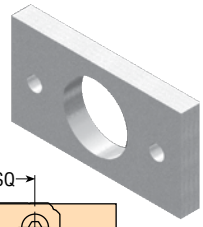
MODEL NO.		LETTER DIMENSION						G		CV CYLINDER BORE*	
IMPERIAL	METRIC	A	B min	C min	D min	E	F	IMPERIAL	METRIC	IMPERIAL	METRIC
312	M8	5/16-24 [M8 x 1.25]	1.00 [25.4]	0.625 [15.9]	1.875 [47.6]	0.500 [12.7]	0.875 [22.2]	.187	.197 [5.0]	20	20
375	M10	3/8-24 [M10 x 1.25]	1.00 [25.4]	.625 [15.9]	1.875 [47.6]	.50 [12.7]	.875 [22.2]	.219	.197 [5.0]	25, 32	25, 32
437	—	7/16-20	1.13	.650	2.187	.50	1.0	.250	—	—	—
500	M12	1/2-20 [M12 x 1.25]	1.13 [28.6]	.650 [16.5]	2.187 [55.5]	.50 [12.7]	1.0 [25.4]	.312	.236 [6.0]	40	40
625	M16	5/8-18 [M16 x 1.5]	1.75 [44.5]	1.125 [28.5]	3.312 [84.1]	.812 [20.6]	1.562 [39.7]	.375	.314 [8.0]	50, 63	50, 63
750	M20	3/4-16 [M20 x 1.5]	1.75 [44.5]	1.125 [28.5]	3.312 [84.1]	.812 [20.6]	1.562 [39.7]	.421	.394 [10.0]	80, 100	80, 100

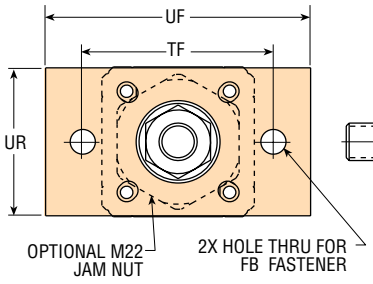
NOTES:
1) NUMBERS IN [ ] ARE mm. IMPERIAL EQUIVALENTS ARE PROVIDED FOR CONVENIENCE.
2) *UNITS SHOWN ARE WITH STANDARD ROD ENDS. OPTIONAL ROD ENDS MAY USE OTHER MODEL NUMBERS.

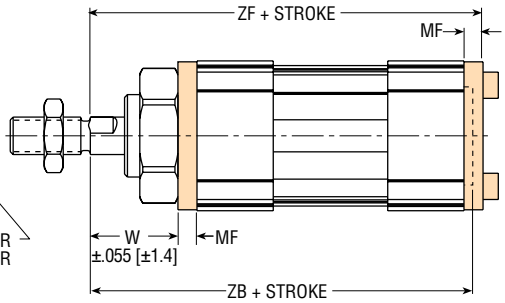


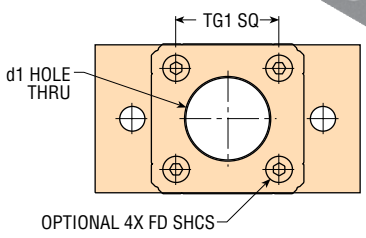
All dimensions are reference only unless specifically toleranced.

RECTANGULAR FLANGE MOUNTING KIT
SIZES 20 & 25 mm (MF8 PER ISO 6432)





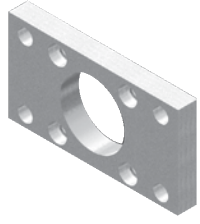


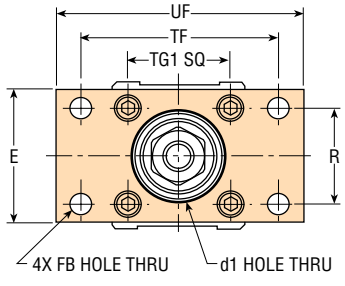


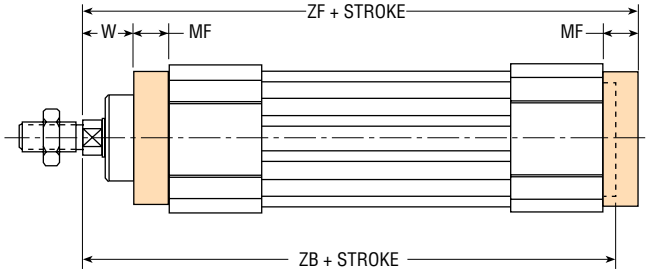
LETTER DIM/ TOLERANCE	BORE SIZE			
	20 mm		25 mm	
	in	mm	in	mm
d1/H11	0.866	22.0	0.866	22.0
FB/H13	M6 x 1.0		M6 x 1.0	
FD	M4 x 0.7 x 18		M4 x 0.7 x 18	
TG1	1.024	26.0	1.063	27.0
MF	0.197	5.0	0.197	5.0
TF/Js14	1.969	50.0	1.969	50.0
UF max	2.756	70.0	2.756	70.0
UR max	1.575	40.0	1.575	40.0
W	0.748	19.0	0.906	23.0
CVB				
ZB max	3.504	89.0	3.858	98.0
ZF	3.701	94.0	4.055	103.0
CVC				
ZB max	3.189	81.0	3.622	92.0
ZF	3.386	86.0	3.819	97.0
Kit No.	52484-07-1		52484-07-1	
-Z1 Kit No.	52484-07-3		52484-07-3	

NOTE: Kits include flange and cylinder mounting hardware for one end only.

SIZES 32-100 mm (MF1/MF2 PER VDMA 24562)



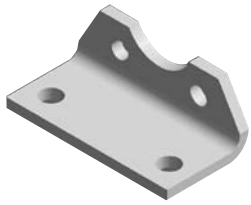




LETTER DIM/ TOLERANCE	BORE SIZE											
	32 mm		40 mm		50 mm		63 mm		80 mm		100 mm	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
d1/H11	1.181	30.0	1.378	35.0	1.575	40.0	1.772	45.0	1.772	45.0	2.165	55.0
FB/H13	.276	7.0	.354	9.0	.354	9.0	.354	9.0	.472	12.0	.551	14.0
TG1	1.280	32.5	1.496	38.0	1.831	46.5	2.224	56.5	2.835	72.0	3.504	89.0
E max	1.969	50.0	2.283	58.0	2.756	70.0	3.346	85.0	4.134	105.0	5.118	130.0
R/JS14	1.260	32.0	1.417	36.0	1.772	45.0	1.969	50.0	2.480	63.0	2.953	75.0
MF	.394	10.0	.394	10.0	.472	12.0	.472	12.0	.630	16.0	.630	16.0
TF/JS14	2.520	64.0	2.835	72.0	3.543	90.0	3.937	100.0	4.961	126.0	5.906	150.0
UF max	3.386	86.0	3.780	96.0	4.528	115.0	5.118	130.0	6.496	165.0	7.362	187.0
Fastener	M6 x 1 x 20		M6 x 1 x 20		M8 x 1.25 x 20		M8 x 1.25 x 20		M10 x 1.25 x 25		M10 x 1.25 x 25	
W	.630	16.0	.787	20.0	.984	25.0	.984	25.0	1.181	30.0	1.378	35.0
ZB max	4.882	124.0	5.591	142.0	5.866	149.0	6.496	165.0	7.165	182.0	7.795	198.0
ZF	5.118	130.0	5.709	145.0	6.102	155.0	6.693	170.0	7.480	190.0	8.071	205.0
Kit No.	52484-01-1		52484-02-1		52484-03-1		52484-04-1		52484-05-1		52484-06-1	
-Z1 Kit No.	52484-01-3		52484-02-3		52484-03-3		52484-04-3		52484-05-3		52484-06-3	

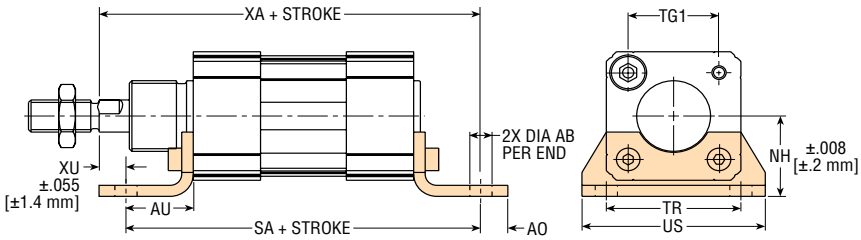
NOTE: Kits include flange and cylinder mounting hardware for one end only.

BASE MOUNTING KIT
SIZES 20 & 25 mm (MS3 PER ISO 6432)



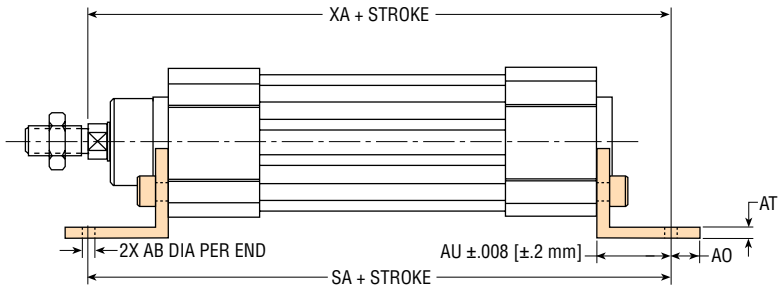
LETTER DIM/ TOLERANCE	BORE SIZE			
	20 mm		25 mm	
	in	mm	in	mm
AB/H13	0.260	6.6	0.260	6.6
AO max	0.315	8.0	0.315	8.0
AU max	0.787	20.0	0.787	20.0
NH	0.984	25.0	0.984	25.0
SA CVB	4.213	107.0	4.330	110.0
SA CVC	3.898	99.0	4.094	104.0
TG1	1.024	26.0	1.063	27.0
TR/Js14	1.575	40.0	1.575	40.0
US max	2.165	55.0	2.165	55.0
XA CVB	4.370	111.0	4.645	118.0
XA CVC	4.055	103.0	4.409	112.0
XU	0.157	4.0	0.315	8.0
Kit No.	52487-07-1		52487-07-1	
-Z1 Kit No.	52487-07-3		52487-07-3	

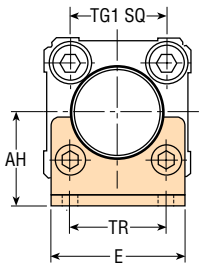
NOTE: Kits include bracket and cylinder mounting hardware for one end only.



Kit can only be mounted in orientation shown.

SIZES 32-100 mm (MS1 PER VDMA 24562)



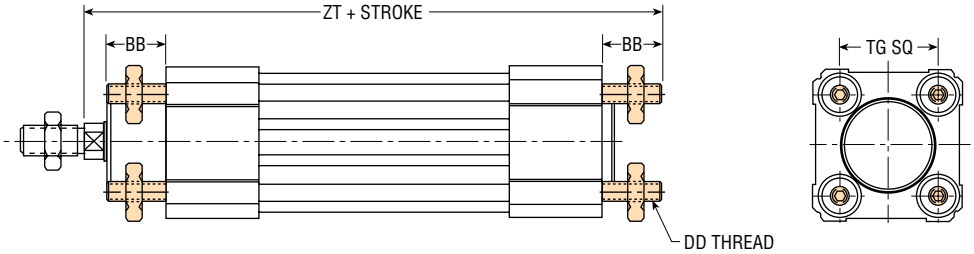


LETTER DIM/ TOLERANCE	BORE SIZE											
	32 mm		40 mm		50 mm		63 mm		80 mm		100 mm	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
AB	.270	6.87	.369	9.37	.369	9.37	.369	9.37	.449	11.41	.538	13.66
TG1	1.280	32.5	1.496	38.0	1.831	46.5	2.224	56.5	2.835	72.0	3.504	89.0
E max	1.969	50.0	2.283	58.0	2.756	70.0	3.346	85.0	4.134	105.0	5.118	130.0
TR	1.260	32.0	1.417	36.0	1.772	45.0	1.969	50.0	2.480	63.0	2.953	75.0
AO max	.433	11.0	.591	15.0	.591	15.0	.591	15.0	.787	20.0	.984	25.0
AU	.945	24.0	1.102	28.0	1.260	32.0	1.260	32.0	1.614	41.0	1.614	41.0
AH	1.260	32.0	1.417	36.0	1.772	45.0	1.969	50.0	2.480	63.0	2.795	71.0
AT	.177	4.5	.177	4.5	.217	5.5	.217	5.5	.256	6.5	.256	6.5
SA	5.591	142.0	6.339	161.0	6.693	170.0	7.283	185.0	8.268	210.0	8.661	220.0
XA	5.669	144.0	6.417	163.0	6.890	175.0	7.480	190.0	8.465	215.0	9.055	230.0
Fastener	M6 x 1 x 20		M6 x 1 x 20		M8 x 1.25 x 25		M8 x 1.25 x 25		M10 x 1.5 x 25		M10 x 1.5 x 25	
Kit No.	52487-01-1		52487-02-1		52487-03-1		52487-04-1		52487-05-1		52487-06-1	
-Z1 Kit No.	52487-01-3		52487-02-3		52487-03-3		52487-04-3		52487-05-3		52487-06-3	

NOTE: Kits include bracket and cylinder mounting hardware for one end only.

All dimensions are reference only unless specifically toleranced.

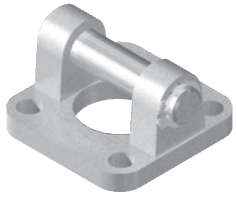
FASTENER MOUNTING KIT
SIZES 20 & 25 mm (MX1)
SIZES 32-100 mm (MX1 PER ISO 6431)

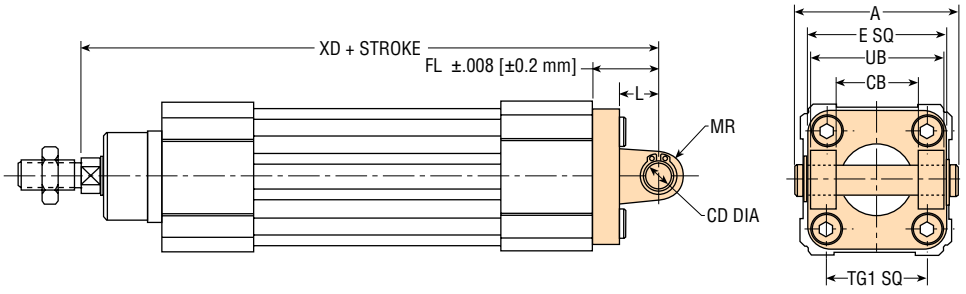


LETTER DIM	BORE SIZE															
	20 mm		25 mm		32 mm		40 mm		50 mm		63 mm		80 mm		100 mm	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
BB min	0.512	13.0	0.512	13.0	.669	17.0	.669	17.0	.906	23.0	.906	23.0	1.102	28.0	1.102	28.0
DD	M4 x 0.7		M4 x 0.7		M6 x 1.0		M6 x 1.0		M8 x 1.25		M8 x 1.25		M10 x 1.5		M10 x 1.5	
ZT CVA	—	—	—	—	5.394	137.0	5.984	152.0	6.535	166.0	7.126	181.0	7.953	202.0	8.543	217.0
ZT CVB	4.095	104.0	4.370	111.0	—	—	—	—	—	—	—	—	—	—	—	—
ZT CVC	3.780	96.0	4.134	105.0	—	—	—	—	—	—	—	—	—	—	—	—
TG	1.024	26.0	1.063	27.0	1.280	32.5	1.496	38.0	1.831	46.5	2.224	56.5	2.835	72.0	3.504	89.0
Kit No.	63480-04-1		63480-04-1		63480-01-1		63480-01-1		63480-02-1		63480-02-1		63480-03-1		63480-03-1	
-Z1 Kit No.	63480-04-3		63480-04-3		63480-01-3		63480-01-3		63480-02-3		63480-02-3		63480-03-3		63480-03-3	

NOTE: Kit includes cylinder mounting hardware for one end only.

REAR FORK MOUNTING KIT
SIZES 32-100 mm (MP2 PER VDMA 24562)





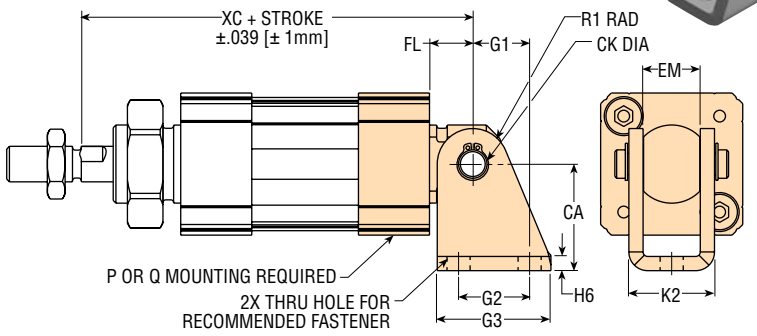
LETTER DIM/ TOLERANCE	BORE SIZE											
	32 mm		40 mm		50 mm		63 mm		80 mm		100 mm	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
A max	2.559	65.0	2.835	72.0	3.150	80.0	3.740	95.0	4.528	115.0	5.315	135.0
E max	1.969	50.0	2.283	58.0	2.756	70.0	3.346	85.0	4.134	105.0	5.118	130.0
UB/h14	1.772	45.0	2.047	52.0	2.362	60.0	2.756	70.0	3.543	90.0	4.331	110.0
CB/H14	1.024	26.0	1.102	28.0	1.260	32.0	1.575	40.0	1.969	50.0	2.362	60.0
TG1	1.280	32.5	1.496	38.0	1.831	46.5	2.224	56.5	2.835	72.0	3.504	89.0
FL	.866	22.0	.984	25.0	1.063	27.0	1.260	32.0	1.417	36.0	1.614	41.0
L min	.472	12.0	.591	15.0	.591	15.0	.787	20.0	.787	20.0	.984	25.0
CD/H9	.394	10.0	.472	12.0	.472	12.0	.630	16.0	.630	16.0	.787	20.0
MR max	.433	11.0	.512	13.0	.512	13.0	.669	17.0	.669	17.0	.827	21.0
XD	5.591	142.0	6.299	160.0	6.693	170.0	7.480	190.0	8.268	210.0	9.055	230.0
Fastener	M6 x 1 x 20		M6 x 1 x 20		M8 x 1.25 x 20		M8 x 1.25 x 20		M10 x 1.5 x 25		M10 x 1.5 x 25	
Kit No.	52485-01-1		52485-02-1		52485-03-1		52485-04-1		52485-05-1		52485-06-1	
-Z1 Kit No.	52485-01-3		52485-02-3		52485-03-3		52485-04-3		52485-05-3		52485-06-3	

NOTES:
1) Kit includes rear fork, cylinder mounting fasteners, pivot pin, and pivot pin retainer clips.
2) Mounting is compatible with MP4 male hinge and BMP4 pillow block.

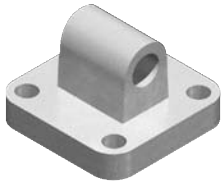
REAR MALE HINGE MOUNTING KIT
SIZES 20 & 25 mm

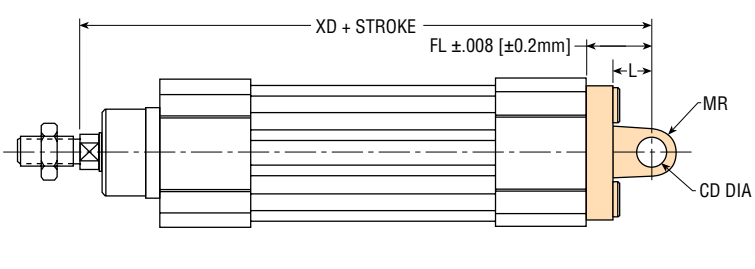
LETTER DIM/ TOLERANCE	BORE SIZE 20 mm in	20 mm mm	25 mm in	25 mm mm
CA	1.181	30.0	1.181	30.0
CK	0.315	8.0	0.315	8.0
EM	0.634	16.1	0.634	16.1
FL min	0.472	12.0	0.472	12.0
G1	0.630	16.0	0.630	16.0
G2	0.787	20.0	0.787	20.0
G3	1.260	32.0	1.260	32.0
H6	0.157	4.0	0.157	4.0
K2	0.949	24.1	0.949	24.1
R1	0.394	10.0	0.394	10.0
XC CVB	4.055	103.0	4.330	110.0
XC CVC	3.740	95.0	4.094	104.0
Fastener	M6		M6	
Kit No.	65778-01-1		65778-01-1	
-Z1 Kit N0.	65778-01-3		65778-01-3	

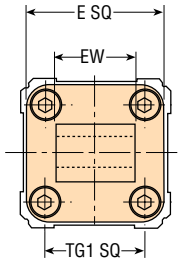
NOTE: Kits include hinge bracket, retaining rings, pivot pins, and cylinder mounting fasteners when required.



SIZES 32-100 mm (MP4 PER VDMA 24562)





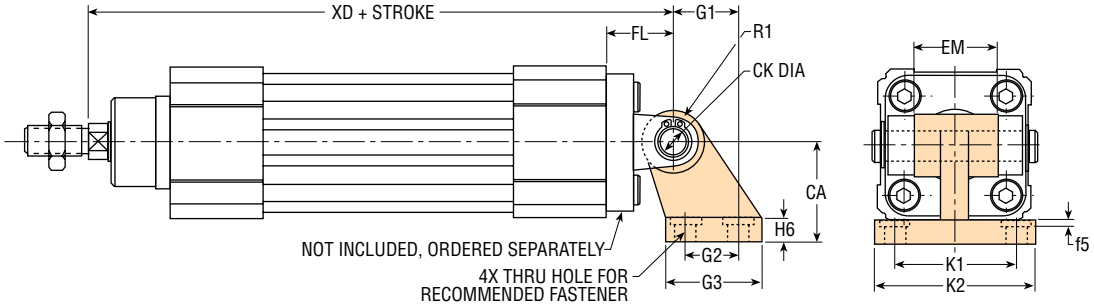


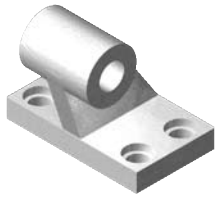
LETTER DIM/ TOLERANCE	BORE SIZE 32 mm in	32 mm mm	40 mm in	40 mm mm	50 mm in	50 mm mm	63 mm in	63 mm mm	80 mm in	80 mm mm	100 mm in	100 mm mm
E max	1.969	50.0	2.283	58.0	2.756	70.0	3.346	85.0	4.134	105.0	5.118	130.0
EW max	1.024	26.0	1.102	28.0	1.260	32.0	1.575	40.0	1.969	50.0	2.362	60.0
TG1	1.280	32.5	1.496	38.0	1.831	46.5	2.224	56.5	2.835	72.0	3.504	89.0
FL	.866	22.0	.984	25.0	1.063	27.0	1.260	32.0	1.417	36.0	1.614	41.0
L min	.472	12.0	.591	15.0	.591	15.0	.787	20.0	.787	20.0	.984	25.0
CD/H9	.394	10.0	.472	12.0	.472	12.0	.630	16.0	.630	16.0	.787	20.0
MR max	.433	11.0	.512	13.0	.512	13.0	.669	17.0	.669	17.0	.827	21.0
XD	5.591	142.0	6.299	160.0	6.693	170.0	7.480	190.0	8.268	210.0	9.055	230.0
Fastener	M6 x 1 x 20		M6 x 1 x 20		M8 x 1.25 x 20		M8 x 1.25 x 20		M10 x 1.5 x 25		M10 x 1.5 x 25	
Kit No.	52486-01-1		52486-02-1		52486-03-1		52486-04-1		52486-05-1		52486-06-1	
-Z1 Kit No.	52486-01-3		52486-02-3		52486-03-3		52486-04-3		52486-05-3		52486-06-3	

NOTES:
1) Rear male hinge is compatible with MP2 mounting.
2) Kit includes hinge and cylinder mounting fasteners.

All dimensions are reference only unless specifically toleranced.

PILLOW BLOCK MOUNTING WITH RIGID BEARINGS KIT (BMP4, CETOP RP 107P)

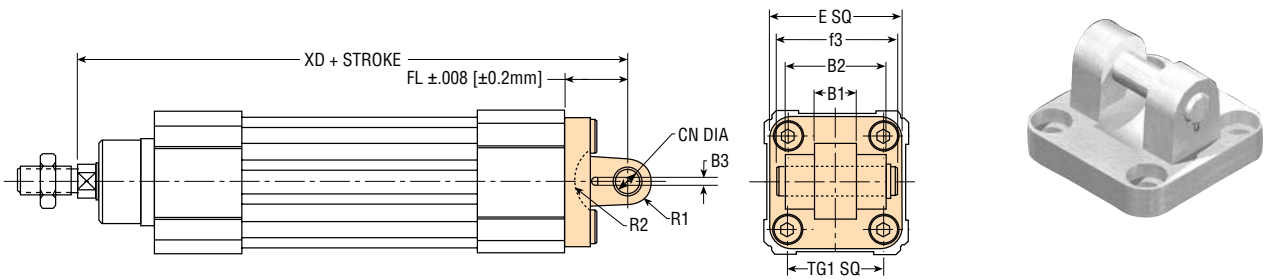




LETTER DIM/ TOLERANCE	BORE SIZE											
	32 mm		40 mm		50 mm		63 mm		80 mm		100 mm	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
CK/H9	.394	10.0	.472	12.0	.472	12.0	.630	16.0	.630	16.0	.787	20.0
K1/JS14	1.496	38.0	1.614	41.0	1.969	50.0	2.047	52.0	2.598	66.0	2.992	76.0
K2 max	2.008	51.0	2.126	54.0	2.559	65.0	2.638	67.0	3.386	86.0	3.780	96.0
G1/JS14	.827	21.0	.945	24.0	1.299	33.0	1.457	37.0	1.850	47.0	2.165	55.0
f5 max	.063	1.6	.063	1.6	.063	1.6	.063	1.6	.098	2.5	.098	2.5
G2	.709	18.0	.866	22.0	1.181	30.0	1.378	35.0	1.575	40.0	1.969	50.0
EM max	1.016	25.8	1.094	27.8	1.252	31.8	1.567	39.8	1.961	49.8	2.354	59.8
G3 max	1.220	31.0	1.378	35.0	1.772	45.0	1.969	50.0	2.362	60.0	2.756	70.0
CA/JS15	1.260	32.0	1.417	36.0	1.772	45.0	1.969	50.0	2.480	63.0	2.795	71.0
H6	.315	8.0	.394	10.0	.472	12.0	.472	12.0	.551	14.0	.591	15.0
R1 max	.394	10.0	.433	11.0	.512	13.0	.591	15.0	.591	15.0	.748	19.0
FL	.866	22.0	.984	25.0	1.063	27.0	1.260	32.0	1.417	36.0	1.614	41.0
XD	5.591	142.0	6.299	160.0	6.693	170.0	7.480	190.0	8.268	210.0	9.055	230.0
Fastener	M6	M6	M6	M6	M8	M8	M8	M8	M10	M10	M10	M10
Kit No.	62818-001-00		62818-002-00		62818-003-00		62818-004-00		62818-005-00		62818-006-00	

NOTES:
1) Kit includes pillow block only (no pin or fasteners).
2) Pillow block is compatible with MP2 rear fork.

REAR FORK MOUNTING FOR SPHERICAL BEARING KIT (PHD MSB2 PER VDMA 24562)

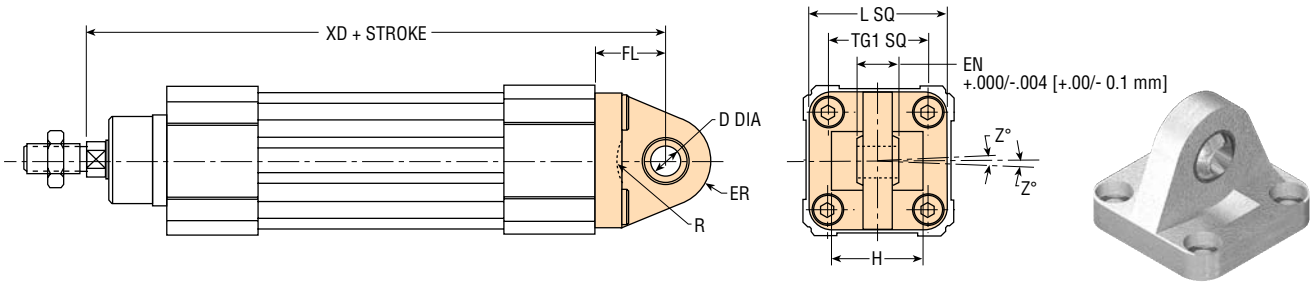


LETTER DIM/ TOLERANCE	BORE SIZE											
	32 mm		40 mm		50 mm		63 mm		80 mm		100 mm	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
E max	1.969	50.0	2.283	58.0	2.756	70.0	3.346	85.0	4.134	105.0	5.118	130.0
B2/d12	1.339	34.0	1.575	40.0	1.772	45.0	2.008	51.0	2.559	65.0	2.953	75.0
B1/H14	.551	14.0	.630	16.0	.827	21.0	.827	21.0	.984	25.0	.984	25.0
TG1	1.280	32.5	1.496	38.0	1.831	46.5	2.224	56.5	2.835	72.0	3.504	89.0
B3/*	.130	3.3	.169	4.3	.169	4.3	.169	4.3	.169	4.3	.248	6.3
R2 min	.669	17.0	.787	20.0	.866	22.0	.984	25.0	1.181	30.0	1.260	32.0
f3	1.811	46.0	2.087	53.0	2.283	58.0	2.598	66.0	3.150	80.0	3.543	90.0
FL	.866	22.0	.984	25.0	1.063	27.0	1.260	32.0	1.417	36.0	1.614	41.0
CN/F7	.394	10.0	.472	12.0	.630	16.0	.630	16.0	.787	20.0	.787	20.0
R1 max	.433	11.0	.512	13.0	.709	18.0	.709	18.0	.866	22.0	.866	22.0
XD	5.591	142.0	6.299	160.0	6.693	170.0	7.480	190.0	8.268	210.0	9.055	230.0
Fastener	M6 x 1 x 20		M6 x 1 x 20		M8 x 1.25 x 20		M8 x 1.25 x 20		M10 x 1.5 x 25		M10 x 1.5 x 25	
Kit No.	52489-01-1		52489-02-1		52489-03-1		52489-04-1		52489-05-1		52489-06-1	
-Z1 Kit No.	52489-01-3		52489-02-3		52489-03-3		52489-04-3		52489-05-3		52489-06-3	

NOTES:
1) Kit includes rear fork cylinder mounting fastener pivot pin and retaining rings.
2) Rear fork is compatible with BSB1 pillow block, rod eye, and MSB1 rear male hinge with spherical bearings per DIN 648 K.

MOUNTING ACCESSORIES: SERIES CV CYLINDERS

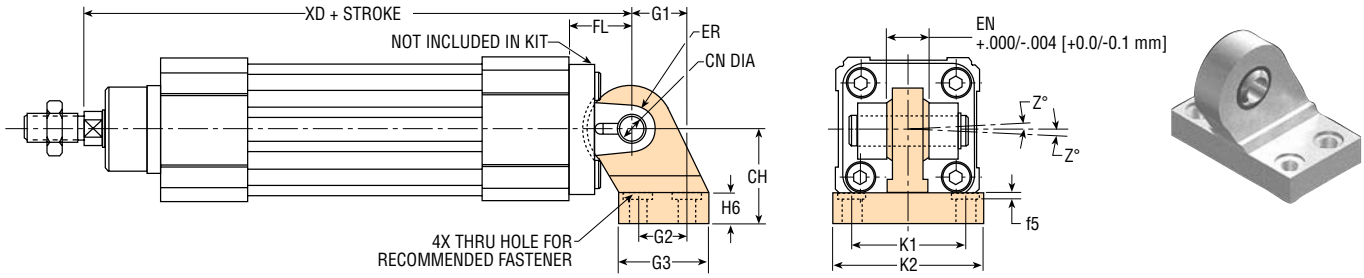
REAR MALE HINGE MOUNTING WITH SPHERICAL BEARING KIT (PHD MSB1)



LETTER DIM/ TOLERANCE	BORE SIZE											
	32 mm		40 mm		50 mm		63 mm		80 mm		100 mm	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
TG1	1.280	32.5	1.496	38.0	1.831	46.5	2.224	56.5	2.835	72.0	3.504	89.0
FL/JS15	.866	22.0	.984	25.0	1.063	27.0	1.260	32.0	1.417	36.0	1.614	41.0
D/H7	.394	10.0	.472	12.0	.630	16.0	.630	16.0	.787	20.0	.787	20.0
EN	.551	14.0	.630	16.0	.827	21.0	.827	21.0	.984	25.0	.984	25.0
ER max	.630	16.0	.748	19.0	.827	21.0	.945	24.0	1.102	28.0	1.181	30.0
L max	1.969	50.0	2.283	58.0	2.756	70.0	3.346	85.0	4.134	105.0	5.118	130.0
Z°	4°	4°	4°	4°	4°	4°	4°	4°	4°	4°	4°	4°
H	—	—	—	—	2.008	51.0	—	—	—	—	—	—
R	—	—	—	—	.748	19.0	—	—	—	—	—	—
XD	5.591	142.0	6.299	160.0	6.693	170.0	7.480	190.0	8.268	210.0	9.055	230.0
Fastener	M6 x 1 x 20		M6 x 1 x 20		M8 x 1.25 x 20		M8 x 1.25 x 20		M10 x 1.5 x 25		M10 x 1.5 x 25	
Kit No.	52488-01-1		52488-02-1		52488-03-1		52488-04-1		52488-05-1		52488-06-1	
-Z1 Kit No.	52488-01-3		52488-02-3		52488-03-3		52488-04-3		52488-05-3		52488-06-3	

NOTES:
1) Kit includes hinge and cylinder mounting fasteners.
2) Rear male hinge is compatible with MSB2 rear fork for spherical bearing.

PILLOW BLOCK MOUNTING WITH SPHERICAL BEARING KIT (PHD BSB1 PER VDMA 24562)

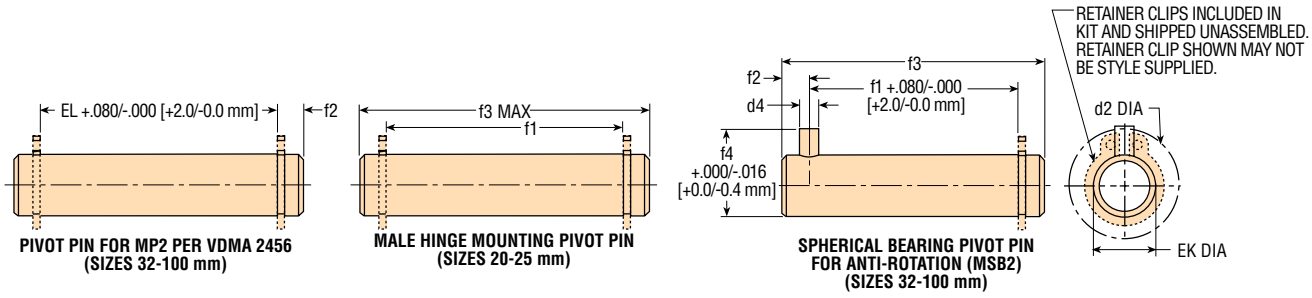


LETTER DIM/ TOLERANCE	BORE SIZE											
	32 mm		40 mm		50 mm		63 mm		80 mm		100 mm	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
CN/H7	.394	10.0	.472	12.0	.630	16.0	.630	16.0	.787	20.0	.787	20.0
K1/JS 14	1.496	38.0	1.614	41.0	1.969	50.0	2.047	52.0	2.598	66.0	2.992	76.0
K2 max	2.008	51.0	2.126	54.0	2.559	65.0	2.638	67.0	3.386	86.0	3.780	96.0
G1/JS14	.827	21.0	.945	24.0	1.299	33.0	1.457	37.0	1.850	47.0	2.165	55.0
f5 max	.063	1.6	.063	1.6	.063	1.6	.063	1.6	.098	2.5	.098	2.5
G2/JS14	.709	18.0	.866	22.0	1.181	30.0	1.378	35.0	1.575	40.0	1.969	50.0
EN	.551	14.0	.630	16.0	.827	21.0	.827	21.0	.984	25.0	.984	25.0
G3 max	1.220	31.0	1.378	35.0	1.772	45.0	1.969	50.0	2.362	60.0	2.756	70.0
CH/JS15	1.260	32.0	1.417	36.0	1.772	45.0	1.969	50.0	2.480	63.0	2.795	71.0
H6	.394	10.0	.394	10.0	.472	12.0	.472	12.0	.551	14.0	.591	15.0
ER max	.630	16.0	.709	18.0	.827	21.0	.906	23.0	1.102	28.0	1.181	30.0
FL	.866	22.0	.984	25.0	1.063	27.0	1.260	32.0	1.417	36.0	1.614	41.0
XD	5.591	142.0	6.299	160.0	6.693	170.0	7.480	190.0	8.268	210.0	9.055	230.0
Z°	4°	4°	4°	4°	4°	4°	4°	4°	4°	4°	4°	4°
Fastener	M6	M6	M6	M6	M8	M8	M8	M8	M10	M10	M10	M10
Kit No.	62822-001-00		62822-002-00		62822-003-00		62822-004-00		62822-005-00		62822-006-00	

NOTES:
1) Kit includes pillow block only. No mounting fasteners
2) Pillow block is compatible with MSB2 rear fork for spherical bearing.
3) Not available in -Z1.

All dimensions are reference only unless specifically toleranced.

PIVOT PIN KIT



PIVOT PIN FOR MP2 PER VDMA 2456 (SIZES 32-100 mm)

MALE HINGE MOUNTING PIVOT PIN (SIZES 20-25 mm)

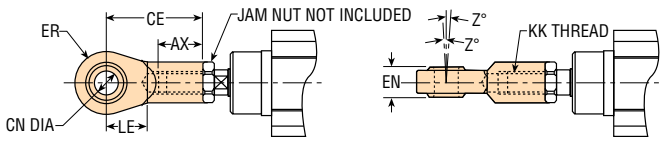
SPHERICAL BEARING PIVOT PIN FOR ANTI-ROTATION (MSB2) (SIZES 32-100 mm)

LETTER DIM/ TOLERANCE	BORE SIZE															
	20 mm		25 mm		32 mm		40 mm		50 mm		63 mm		80 mm		100 mm	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
MP2 PIVOT PIN																
d2 max	—	—	—	—	.906	23.0	.984	25.0	.984	25.0	1.260	32.0	1.260	32.0	1.575	40.0
EK/e8	—	—	—	—	.394	10.0	.472	12.0	.472	12.0	.630	16.0	.630	16.0	.787	20.0
EL	—	—	—	—	1.811	46.0	2.087	53.0	2.402	61.0	2.795	71.0	3.583	91.0	4.370	111.0
f2 max	—	—	—	—	.335	8.5	.335	8.5	.335	8.5	.433	11.0	.433	11.0	.433	11.0
Kit	—	—	—	—	52490-01-1		52490-02-1		52490-03-1		52490-04-1		52490-05-1		52490-06-1	
-Z1 Kit	—	—	—	—	52490-01-3		52490-02-3		52490-03-3		52490-04-3		52490-05-3		52490-06-3	
MALE HINGE PINS					**MSB2 PIVOT PIN**											
d2 max	—	—	—	—	.906	23.0	.984	25.0	.984	25.0	1.260	32.0	1.260	32.0	1.575	40.0
d4/H12	—	—	—	—	.118	3.0	.157	4.0	.157	4.0	.157	4.0	.157	4.0	.157	4.0
EK/h9	.315	8.0	.315	8.0	.394	10.0	.472	12.0	.630	16.0	.630	16.0	.787	20.0	.787	20.0
f1	.945	24.0	.945	24.0	1.280	32.5	1.496	38.0	1.693	43.0	1.929	49.0	2.480	63.0	2.874	73.0
f2 max	—	—	—	—	.177	4.5	.236	6.0	.236	6.0	.236	6.0	.236	6.0	.236	6.0
f3 max	1.260	32.0	1.260	32.0	1.811	46.0	2.087	53.0	2.283	58.0	2.598	66.0	3.150	80.0	3.543	90.0
f4	—	—	—	—	.551	14.0	.630	16.0	.787	20.0	.787	20.0	.945	24.0	.945	24.0
Kit No.	52491-07-1		52491-07-1		52491-01-1		52491-02-1		52491-03-1		52491-04-1		52491-05-1		52491-06-1	
-Z1 Kit No.	52491-07-3		52491-07-3		52491-01-3		52491-02-3		52491-03-3		52491-04-3		52491-05-3		52491-06-3	

ROD EYE MOUNTING WITH SPHERICAL BEARING KIT FOR METRIC ROD ENDS

(CONTACT PHD FOR IMPERIAL STYLE)

SIZES 20-100 mm (DIN 8139)

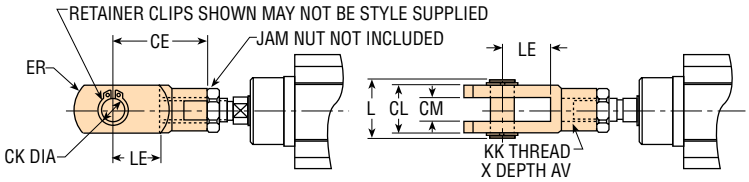


LETTER DIM/ TOLERANCE	BORE SIZE															
	20 mm		25 mm		32 mm		40 mm		50 mm		63 mm		80 mm		100 mm	
	in*	mm	in*	mm	in*	mm	in*	mm	in*	mm	in*	mm	in*	mm	in*	mm
AX min	.630	16.0	.787	20.0	.787	20.0	.866	22.0	1.102	28.0	1.102	28.0	1.299	33.0	1.299	33.0
CE	1.417	36.0	1.693	43.0	1.693	43.0	1.969	50.0	2.520	64.0	2.520	64.0	3.031	77.0	3.031	77.0
CN/H9	.315	8.0	.394	10.0	.394	10.0	.472	12.0	.630	16.0	.630	16.0	.787	20.0	.787	20.0
EN/h12	.472	12.0	.551	14.0	.551	14.0	.630	16.0	.827	21.0	.827	21.0	.984	25.0	.984	25.0
ER max	.472	12.0	.551	14.0	.551	14.0	.630	16.0	.827	21.0	.827	21.0	.984	25.0	.984	25.0
KK	—	M8 x 1.25	—	M10 x 1.25	—	M10 x 1.25	—	M12 x 1.25	—	M16 x 1.5	—	M16 x 1.5	—	M20 x 1.5	—	M20 x 1.5
LE min	.512	13.0	.591	15.0	.591	15.0	.669	17.0	.906	23.0	.906	23.0	1.063	27.0	1.063	27.0
Z°		4°		4°		4°		4°		4°		4°		4°		4°
Kit No.*	*	52493-05-1	*	52493-01-1	*	52493-01-1	*	52493-02-1	*	52493-03-1		52493-03-1	*	52493-04-1	*	52493-04-1

NOTES:

1) 32-100 mm sizes compatible with MSB2 rear fork for spherical bearing.
2) Not available in -Z1 or with imperial threads.
3) *Consult PHD for imperial rod eye mounting components and availability. Inch dimensions are given for metric conversion convenience only.

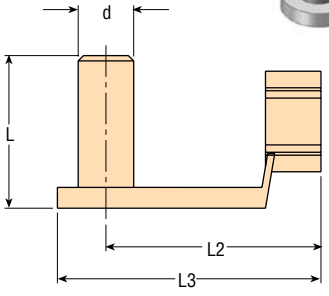
ROD CLEVIS MOUNTING KIT FOR METRIC ROD ENDS
(CONTACT PHD FOR IMPERIAL STYLE)
SIZES 20-100 mm (DIN 8140)



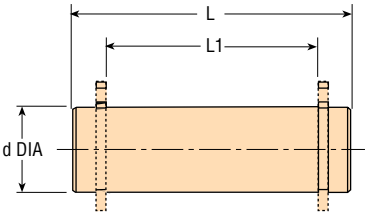
LETTER DIM/ TOLERANCE	BORE SIZE															
	20 mm		25 mm		32 mm		40 mm		50 mm		63 mm		80 mm		100 mm	
	in*	mm	in*	mm	in*	mm	in*	mm	in*	mm	in*	mm	in*	mm	in*	mm
AV min	0.630	16.0	0.787	20.0	.787	20.0	.866	22.0	1.102	28.0	1.102	28.0	1.299	33.0	1.299	33.0
CE	1.260	32.0	1.575	40.0	1.575	40.0	1.890	48.0	2.520	64.0	2.520	64.0	3.150	80.0	3.150	80.0
CK/H9	0.316	8.02	0.394	10.02	.394	10.0	.472	12.0	.630	16.0	.630	16.0	.787	20.0	.787	20.0
CL max	0.630	16.0	0.787	20.0	.787	20.0	.945	24.0	1.260	32.0	1.260	32.0	1.575	40.0	1.575	40.0
CM min	0.315	8.0	0.394	10.0	.394	10.0	.472	12.0	.630	16.0	.630	16.0	.787	20.0	.787	20.0
ER max	0.512	13.0	0.630	16.0	.630	16.0	.748	19.0	.984	25.0	.984	25.0	1.260	32.0	1.260	32.0
KK	—	M8 x 1.25	—	M10 x 1.25	—	M10 x 1.25	—	M12 x 1.25	—	M16 x 1.5	—	M16 x 1.5	—	M20 x 1.5	—	M20 x 1.5
L	0.827	21.0	0.984	25.0	.984	25.0	1.181	30.0	1.535	39.0	1.535	39.0	1.890	48.0	1.890	48.0
LE min	0.630	16.0	0.787	20.0	.787	20.0	.945	24.0	1.260	32.0	1.260	32.0	1.575	40.0	1.575	40.0
Metric Kit No.*	*	52492-05-1	*	52492-01-1	*	52492-01-1	*	52492-02-1	*	52492-03-1	*	52492-03-1	*	52492-04-1	*	52492-04-1
Metric -Z1 Kit No.*	*	52492-05-3	*	52492-01-3	*	52492-01-3	*	52492-02-3	*	52492-03-3	*	52492-03-3	*	52492-04-3	*	52492-04-3

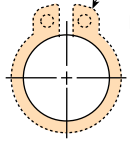
NOTES:
1) Kit includes clevis, pivot pin, and retainer rings (jam nut not included).
2) *Consult PHD for imperial rod eye mounting components and availability. Inch dimensions are given for metric conversion convenience only.

ROD CLEVIS PIVOT PIN KIT
SIZES 20-100 mm



SIZE 20 mm





SIZES 25-100 mm (DIN 8140)

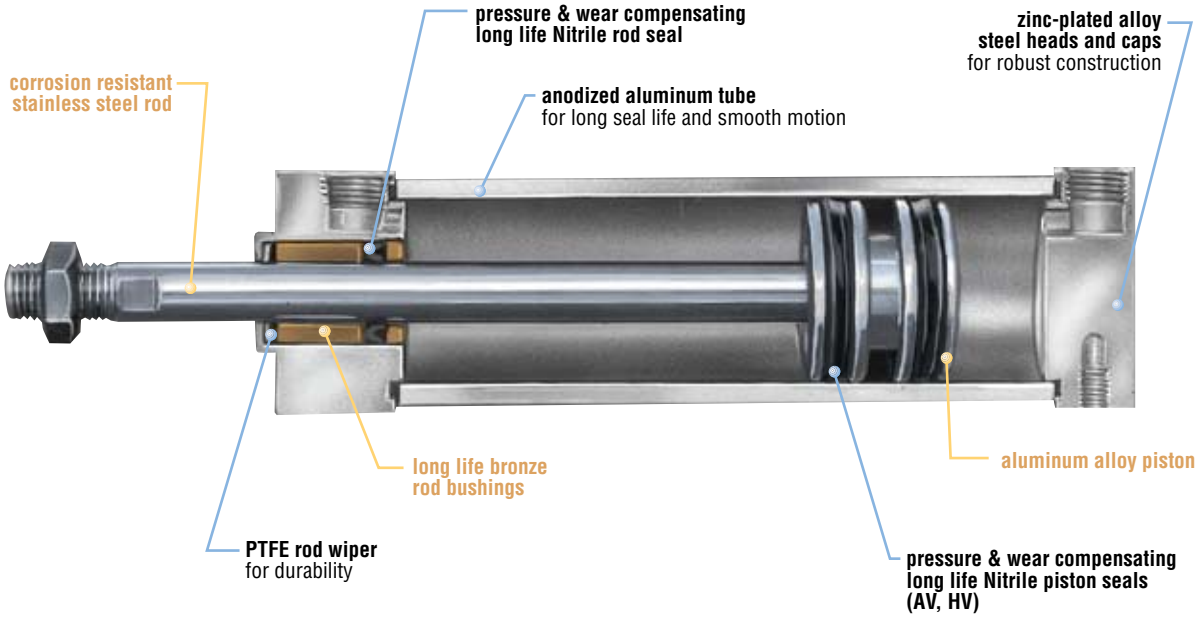
LETTER DIM	BORE SIZE															
	20 mm		25 mm		32 mm		40 mm		50 mm		63 mm		80 mm		100 mm	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
d	.315	8.0	.394	10.0	.394	10.0	.472	12.0	.630	16.0	.630	16.0	.787	20.0	.787	20.0
L	.827	21.0	.984	25.0	.984	25.0	1.181	30.0	1.535	39.0	1.535	39.0	1.890	48.0	1.890	48.0
L1	—	—	.791	20.1	.791	20.1	.949	24.1	1.264	32.1	1.264	32.1	1.579	40.1	1.579	40.1
L2	1.220	31.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—
L3	1.457	37.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Kit No.	63463-05-1		63463-01-1		63463-01-1		63463-02-1		63463-03-1		63463-03-1		63463-04-1		63463-04-1	
-Z1 Kit No.	63463-05-3		63463-01-3		63463-01-3		63463-02-3		63463-03-3		63463-03-3		63463-04-3		63463-04-3	

All dimensions are reference only unless specifically toleranced.

AV, HV, A

tom thumb®

TIE ROD CYLINDERS 3/4", 1", AND 1-1/8" BORE WITH A WIDE VARIETY OF STYLES AND OPTIONS



SERIES AV

SERIES HV
Hydraulic Service

SERIES A
Shortest Length

Major Benefits

- Long life design for low maintenance
- NFPA repairable for extended life providing long term savings
- Wide range of options for easy application and reduced design time
- Two working day delivery
- Wide range of mounting styles for easy installation

Industry Uses

- Packaging
- Assembly machines
- Machine loading/unloading
- General industrial automation

ORDERING DATA: SERIES A, AV, HV; 3/4", 1", 1-1/8" BORE

TO ORDER SPECIFY:

Spring Return/Double Rod End, Series, Mounting Style, Bore Size, Stroke, Port Control®, and any Options. Also specify rod diameter if non-standard. Rod couplings and mounting attachments must be ordered separately.

SERIES
AV - 150 psi Air
HV - 1500 psi Hyd.
A - 150 psi Air

BORE SIZE
3/4" BORE
1/4" Std. Rod Dia.
1/4-28 Thread

1" BORE
5/16" Std. Rod Dia.
5/16-24 Thread

1-1/8" BORE
3/8" Std. Rod Dia.
3/8-24 Thread

STANDARD STROKE LENGTHS
3/4" BORE
1/4" to 12"

1" BORE
1/4" to 18"

1-1/8" BORE
1/4" to 18"
All in 1/4" increments
Consult PHD for longer lengths.

CUSHION OR SHOCK PAD
D - Cushions on both ends
DR - Cushion on rod end
DC - Cushion on cap end
B - Shock Pads on both ends
BR - Shock Pad on rod end
BC - Shock Pad on cap end
(Cushions, Shock Pads, and Spring Return are not available on the same end of cylinder. Shock Pads and 3/4", 1", and 1-1/8" Cushions not available on Series HV.)

OVERSIZE ROD
To be specified only when using a non-standard diameter. Rod diameters available are shown on page 1-65

Options may affect unit length. See unit dimension and options pages for adders.

SC AV F 1 x 2 - P - D - 3/8 ROD - G-M-V

SPRING RETURN
SC - Spring on cap end
SR - Spring on rod end (Strokes available in 1/4" increments up to 6 ".) ⊕ See option pages.

and/or

DOUBLE ROD END
D - Double Rod End Cylinders
Leave blank if not needed.

MOUNTING STYLE
F - Foot Mount, C'bored thru holes
B - Bottom Mount, Tapped holes in head and cap
R - Rod Mount, Tapped holes on front face of head
T - Thread Mount, Threaded snout on head (shipped with mounting nut)
RF - Rod End Flange
CF - Cap End Flange
L - Pilot Mount, Threaded snout and pilot diameter on head (shipped with mounting nut)
P - Pivot Mount, Pivot on cap
RR - Tierod Mount, Tierods extend out rod end
RC - Tierod Mount, Tierods extend out cap end
RRC - Tierod Mount, Tierods extend out both ends

PORT CONTROL®

BUILT-IN METER OUT FLOW CONTROL VALVE
P - Flow control both ends
PR - Flow control on head end
PC - Flow control on cap end

OPTIONS
A - Stroke Adjustment, 1/2" of adjustment standard (not available on Series HV)
E - Magnetic Piston for PHD Hall Effect Switches (not available on Series A)
G - #2 Rod End, (See page 1-65 for dimensions) (See Note 1)
I - #4 Rod End, Female thread on rod (See page 1-65 for dimensions) (See Note 1)
H47 - Rodlok (Rod clamping device installed. Not available with Z1 or on HV. See option page.) ⊕
J - #2X Rod End, Twice as long as standard thread (See page 1-65 for dimensions)
_K - Extra Rod Extension, in 1/8" increments (See page 1-63) (See Note 2)
L - Coarse Thread Rod End (See page 1-65 for dimensions) (See Note 1)
M - Magnetic Piston for PHD Reed Switches (not applicable on Series A)
N - Plain Rod End (See page 1-65 for dimensions) (See Note 1)
Q - Port in Position #1, must be specified if required with mounting style "F" ("F" mounting tab on cap end)
R - Ports in Position #2
T - Ports in Position #3 ("F" mounting tab on cap end)
U - Ports in Position #4
V - Fluoro-Elastomer Seals
W - Close Tolerance Stroke, ± .005" stroke length
Y - SAE Ports (Series HV Only) 3/4, 1, 1-1/8" Bore
Z1 - Electroless Nickel Plate all ferrous parts excluding Rod Ends

⊕ Marked options provide additional cylinder flexibility, but may alter the dimensions.

PROXIMITY SWITCH MOUNTING BRACKETS

SERIES	BORE	SIZE NO.
AV, HV	3/4"	-31
	1"	-32
	1-1/8"	-33

See Switches and Sensors section for complete ordering information.

Notes:
1) For double rod cylinders, rod end options will be applied to both ends of cylinder.
2) For double rod cylinders, -_K extension will be applied to one end only (head end/primary mounting end).

SPECIFICATIONS	SERIES AV	SERIES HV	SERIES A
OPERATING PRESSURE			
STANDARD CYLINDER (NO RODLOK®)	20 to 150 psi air	40 to 1500 psi hyd*	20 to 150 psi air
CYLINDER WITH RODLOK®	30 to 150 psi air	–	30 to 150 psi air
OPERATING TEMPERATURE	-20° to 180°F [-29° to 82°C]	-20° to 180°F [-29° to 82°C]	-20° to 180°F [-29° to 82°C]
STROKE TOLERANCE	± .032	± .032	± .032
LUBRICATION	Permanently lubricated	–	Permanently lubricated
MAINTENANCE	Field repairable	Field repairable	Field repairable

*Hydraulic rating is based on non-shock hydraulic service.

CYLINDER FORCE TABLE

SERIES	CYLINDER BORE	ROD DIAMETER	ROD DIRECTION	EFFECTIVE AREA FORCE lb/psi	FREE AIR CONSUMPTION 80 lbs CUBIC ft/in OF STROKE	DISPLACEMENT gal./in OF STROKE
AV, HV, A	3/4	1/4	EXTEND	.442	.0016	.0019
			RETRACT	.393	.0014	.0017
	3/4	5/16	EXTEND	.442	.0016	.0019
			RETRACT	.365	.0013	.0016
	1	5/16	EXTEND	.785	.0029	.0034
			RETRACT	.709	.0026	.0031
	1	3/8	EXTEND	.785	.0029	.0034
			RETRACT	.676	.0025	.0029
	1-1/8	3/8	EXTEND	.994	.0037	.0043
			RETRACT	.883	.0032	.0038
	1-1/8	1/2	EXTEND	.994	.0037	.0043
			RETRACT	.799	.0029	.0034
	1-3/8	1/2	EXTEND	1.485	.0055	.0064
			RETRACT	1.289	.0048	.0056
	1-3/8	5/8	EXTEND	1.485	.0055	.0064
			RETRACT	1.178	.0044	.0051

NOTE: Use the RETRACT figures for calculating double rod cylinder forces in both directions.

MAXIMUM ALLOWABLE EXTEND STROKE

SERIES	ROD DIAMETER	CYLINDER FORCE (lb) 100	200	500	1000	1500	2000	3000	5000
3/4",1", 1-1/8" AV, HV, A	1/4	12"	9"	6"	4"	3"	—	—	—
	5/16	18"	13"	8"	6"	5"	—	—	—
	3/8	26"	18"	12"	9"	7"	—	—	—
	1/2	46"	32"	21"	15"	12"	—	—	—

SERIES	CYLINDER BORE	UNIT WEIGHTS (lb) ZERO STROKE	ADDER PER INCH OF STROKE
PLAIN UNIT	3/4	.42	.04
	1	.87	.07
	1-1/8	.95	.10

CYLINDER FORCE CALCULATIONS

IMPERIAL

$F = P \times A$

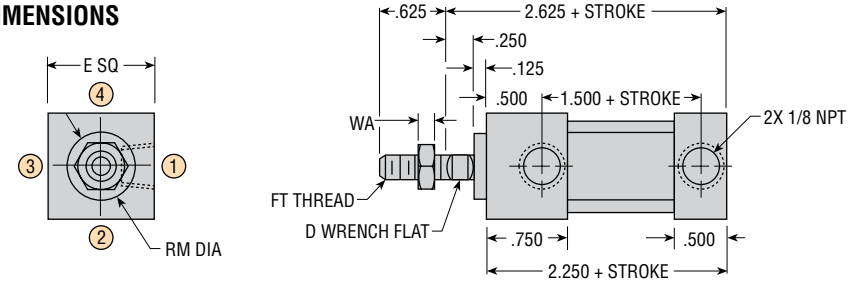
F	= Cylinder Force	lbs
P	= Operating Pressure	psi
A	= Effective Area (Extend or Retract)	in^2

SIZING AND APPLICATION ASSISTANCE

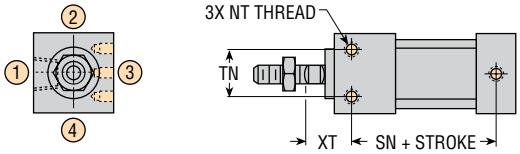
See PHD Product Sizing Catalog for specific and complete sizing information.
Online sizing assistance is available at: ***www.phdinc.com/apps/sizing***

DIMENSIONS: SERIES AV; 3/4", 1", 1-1/8" BORE

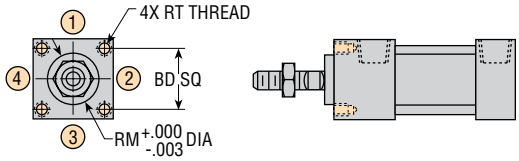
BASIC CYLINDER DIMENSIONS



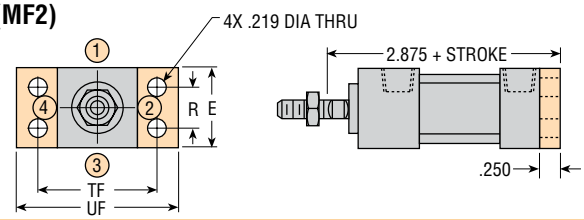
B (MS9)



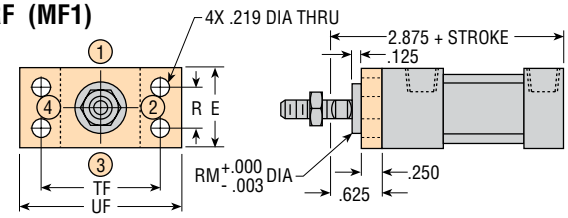
R (MR1)



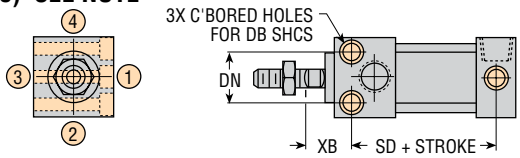
CF (MF2)



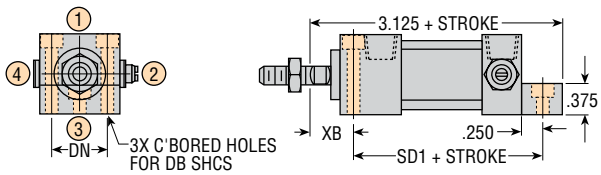
RF (MF1)



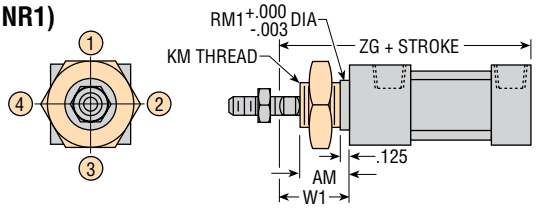
F (MS8) SEE NOTE



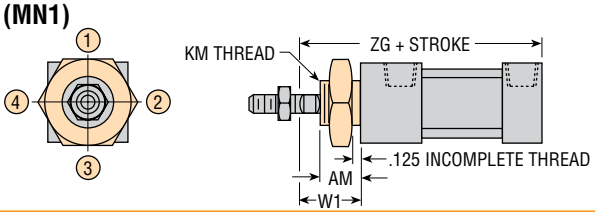
F (MS8) - WITH PORT CONTROL® ON CAP END (-Q or -T without Port Control)



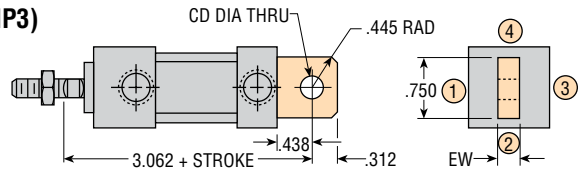
L (MNR1)



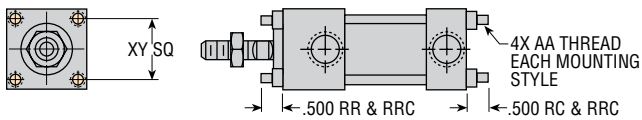
T (MN1)



P (MP3)



RC, RR, RRC (Includes RR & RC)



All standard rod ends have four wrench flats (two wrench flats with "I" option).

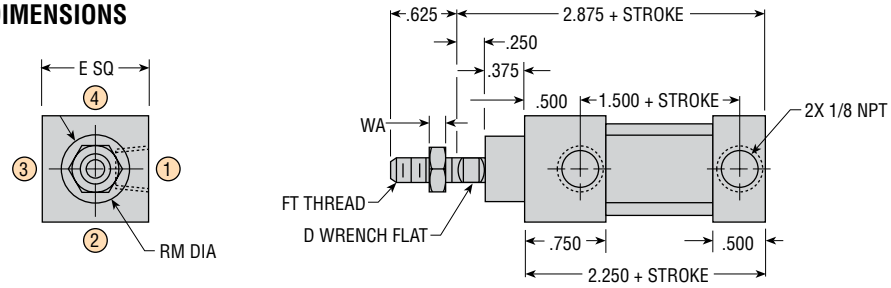
BORE	LETTER DIMENSION																										
SIZE	AA	AM	BD	CD	D	DB	DN	E	EW	FT	KM	NT	R	RM	RM1	RT	SD	SD1	SN	TF	TN	UF	WA	W1	XB	XT	ZG	XY
3/4	#6-32	.625	.750	.250	3/16	#8	.625	1.000	.250	1/4-28	5/8-18	8-32 x .18 DP	.500	.625	.687	8-32 x .25 DP	1.812	2.312	1.812	1.500	.625	2.000	.156	.875	.562	.562	3.125	.750
1	#8-32	.625	1.000	.375	1/4	#10	.875	1.375	.375	5/16-24	3/4-16	10-32 x .25 DP	.875	.750	.812	8-32 x .25 DP	1.750	2.250	1.750	1.875	.875	2.375	.188	.875	.625	.625	3.125	1.030
1-1/8	#10-32	.875	1.125	.375	5/16	#10	1.000	1.500	.375	3/8-24	1-14	10-32 x .25 DP	1.000	.750	1.062	10-32 x .25 DP	1.750	2.250	1.750	2.000	1.000	2.500	.219	1.125	.625	.625	3.375	1.125

PORT POSITIONS: INDICATED BY CIRCLED NUMBERS
CUSHIONS: ADD 1/2" TO ALL (+ STROKE) DIMENSIONS FOR EACH CUSHION
SHOCK PADS: ADD 1/4" TO ALL (+ STROKE) DIMENSIONS FOR EACH SHOCK PAD
SPRING RETURN: ADD AN ADDITIONAL STROKE LENGTH TO (+ STROKE) DIMENSIONS (2 x STROKE)
F (MS8) MTG: 3/4" BORE UNITS ORDERED WITH AN OVERSIZE PISTON ROD WILL HAVE MTG. TABS ON THE HEAD END. CONSULT PHD FOR DIMENSIONAL INFORMATION.
OVERSIZE RODS: SEE PAGE 1-65 FOR OVERSIZE ROD SPECIFICATIONS.

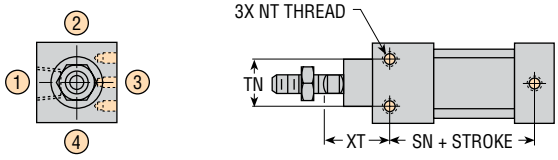
All dimensions are reference only unless specifically toleranced.

DIMENSIONS: SERIES HV; 3/4", 1", 1-1/8" BORE

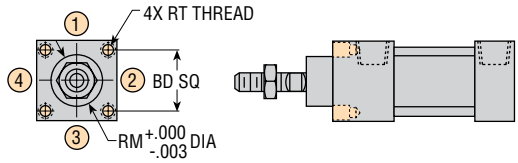
BASIC CYLINDER DIMENSIONS



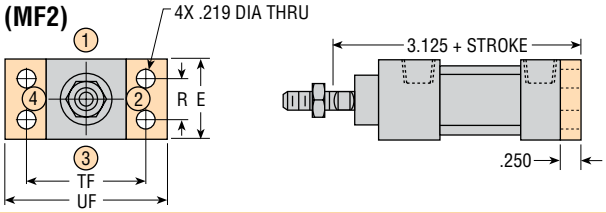
B (MS9)



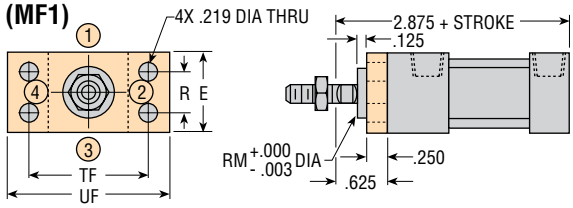
R (MR1)



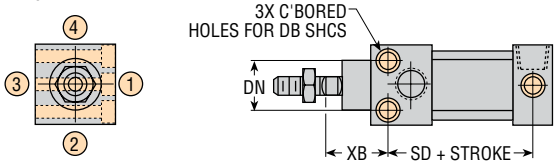
CF (MF2)



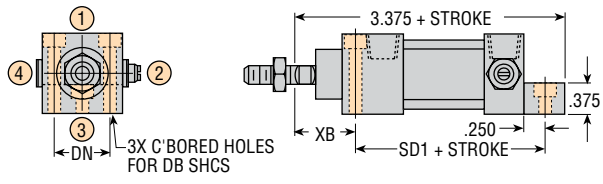
RF (MF1)



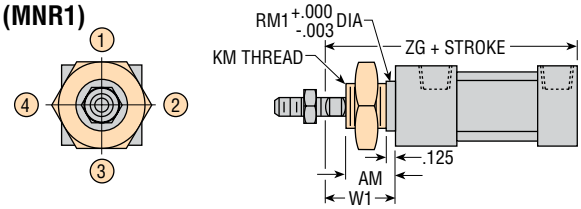
F (MS8) SEE NOTE



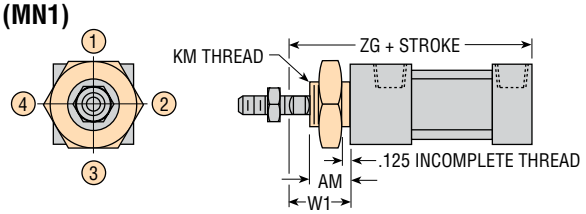
F (MS8) - WITH PORT CONTROL ON CAP END



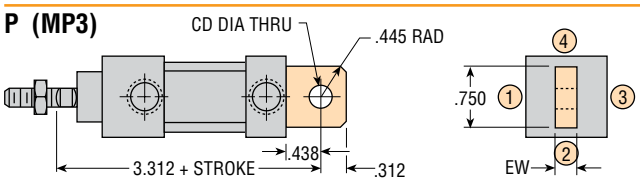
L (MNR1)



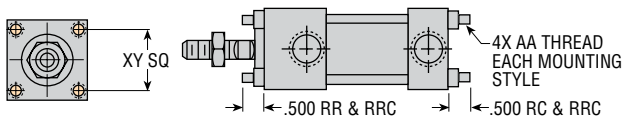
T (MN1)



P (MP3)



RC, RR, RRC (Includes RR & RC)



All standard rod ends have four wrench flats (two wrench flats with "I" option).

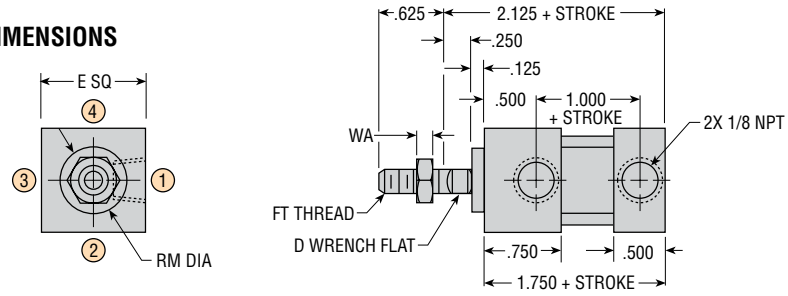
BORE SIZE	LETTER DIMENSION																											
	AA	AM	BD	CD	D	DB	DN	E	EW	FT	KM	NT	R	RM	RM1	RT	SD	SD1	SN	TF	TN	UF	WA	W1	XB	XT	XY	ZG
3/4	#6-32	.625	.750	.250	3/16	#8	.625	1.000	.250	1/4-28	5/8-18	8-32 x .18 DP	.500	.625	.687	8-32 x .25 DP	1.812	2.312	1.812	1.500	.625	2.000	.156	.875	.812	.812	.750	3.125
1	#8-32	.625	1.000	.375	1/4	#10	.875	1.375	.375	5/16-24	3/4-16	10-32 x .25 DP	.875	.750	.812	8-32 x .25 DP	1.750	2.250	1.750	1.875	.875	2.375	.188	.875	.875	.875	1.030	3.125
1-1/8	#10-32	.875	1.125	.375	5/16	#10	1.000	1.500	.375	3/8-24	1-14	10-32 x .25 DP	1.000	.750	1.062	10-32 x .25 DP	1.750	2.250	1.750	2.000	1.000	2.500	.219	1.125	.875	.875	1.125	3.375

PORT POSITIONS: INDICATED BY CIRCLED NUMBERS
CUSHIONS: ADD 1/2" TO ALL (+ STROKE) DIMENSIONS FOR EACH CUSHION
SPRING RETURN: ADD AN ADDITIONAL STROKE LENGTH TO (+ STROKE) DIMENSIONS (2 x STROKE)
F (MS8) MTG. : 3/4" BORE UNITS ORDERED WITH AN OVERSIZE PISTON ROD WILL HAVE MTG. TABS ON THE HEAD END. CONSULT PHD FOR DIMENSIONAL INFORMATION.
OVERSIZE RODS: SEE PAGE 1-65 FOR OVERSIZE ROD SPECIFICATIONS.

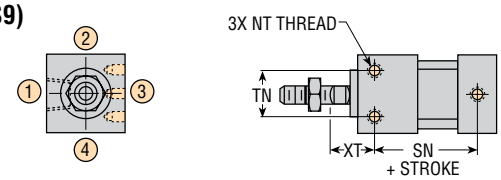
All dimensions are reference only unless specifically toleranced.

DIMENSIONS: SERIES A; 3/4", 1", 1-1/8" BORE

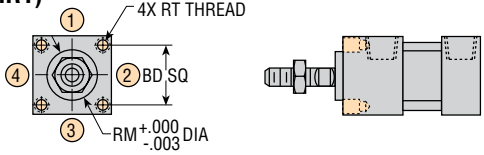
BASIC CYLINDER DIMENSIONS



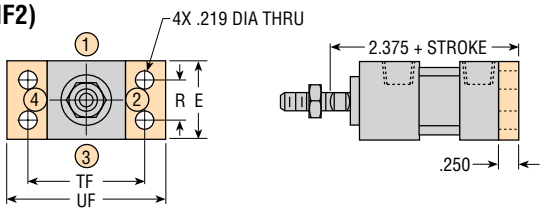
B (MS9)



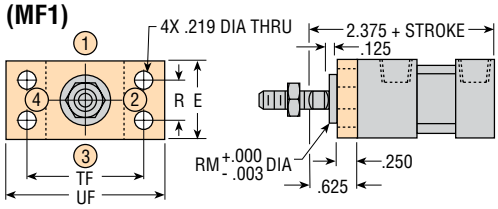
R (MR1)



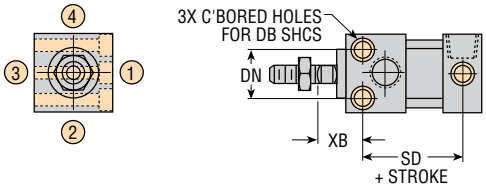
CF (MF2)



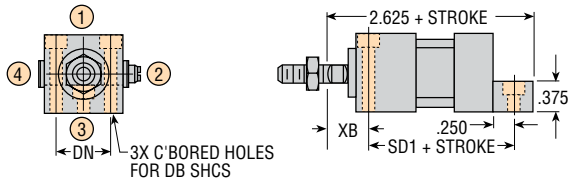
RF (MF1)



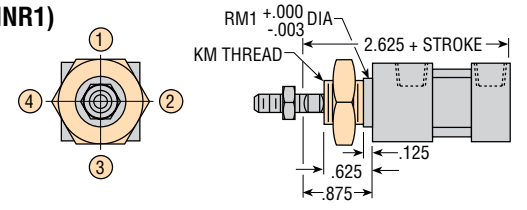
F (MS8) SEE NOTES



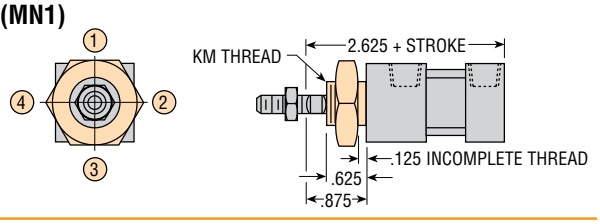
F (MS8) - WITH PORT CONTROL ON CAP END



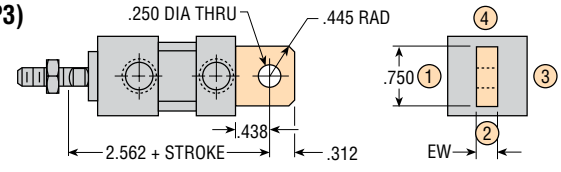
L (MNR1)



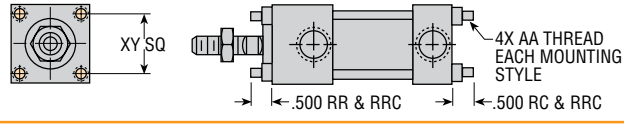
T (MN1)



P (MP3)



RC, RR, RRC (Includes RR & RC)



All standard rod ends have four wrench flats (two wrench flats with "I" option).

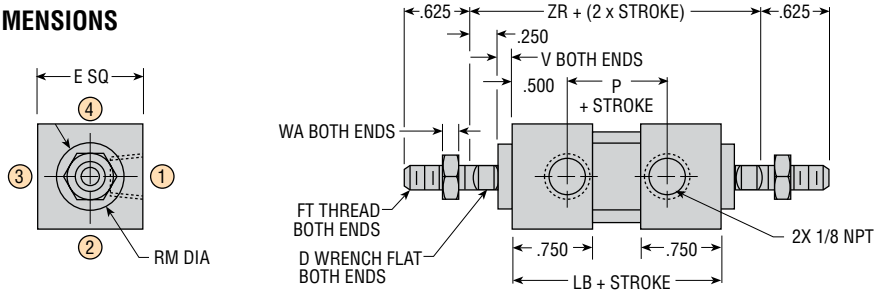
BORE SIZE	LETTER DIMENSION																							
	AA	BD	D	DB	DN	E	EW	FT	KM	NT	R	RM	RM1	RT	SD	SD1	SN	TF	TN	UF	WA	XB	XT	XY
3/4	#6-32	.750	3/16	#8	.625	1.000	.250	1/4-28	5/8-18	8-32 x .18 DP	.500	.625	.687	8-32 x .25 DP	1.312	1.812	1.312	1.500	.625	2.000	.156	.562	.562	.750
1	#8-32	1.000	1/4	#10	.875	1.375	.375	5/16-24	3/4-16	10-32 x .25 DP	.875	.750	.812	8-32 x .25 DP	1.250	1.750	1.250	1.875	.875	2.375	.188	.625	.625	1.30
1-1/8	#10-32	1.125	5/16	#10	1.000	1.500	.375	3/8-24	3/4-16	10-32 x .25 DP	1.000	.750	.812	10-32 x .25 DP	1.250	1.750	1.250	2.000	1.000	2.500	.219	.625	.625	1.125

PORT POSITIONS: INDICATED BY CIRCLED NUMBERS
CUSHIONS: ADD 1/2" TO ALL (+ STROKE) DIMENSIONS FOR EACH CUSHION
SHOCK PADS: ADD 1/4" TO ALL (+ STROKE) DIMENSIONS FOR EACH SHOCK PAD
SPRING RETURN: ADD AN ADDITIONAL STROKE LENGTH TO (+ STROKE) DIMENSIONS (2 x STROKE)
F (MS8) MTG.: 3/4" BORE UNITS ORDERED WITH AN OVERSIZE PISTON ROD WILL HAVE MTG. TABS ON THE HEAD END. CONSULT PHD FOR DIMENSIONAL INFORMATION.
OVERSIZE RODS: SEE PAGE 1-65 FOR OVERSIZE ROD SPECIFICATIONS.

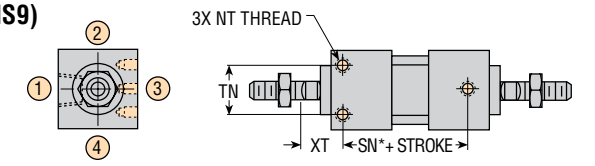
All dimensions are reference only unless specifically toleranced.

DIMENSIONS: SERIES DAV, DHV, DA DOUBLE ROD; 3/4", 1", 1-1/8" BORE

BASIC CYLINDER DIMENSIONS

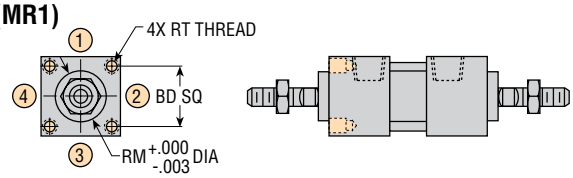


B (MS9)

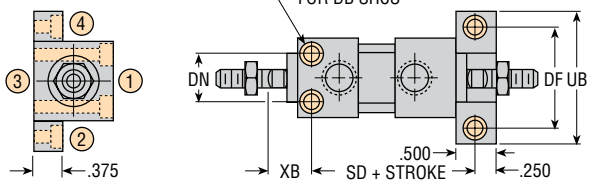


*1" AND 1-1/8" BORE: WITH PORT POSITION #3 ADD .062"
WITH PORT POSITION #2 OR #4 & PORT CONTROLS ADD .062"

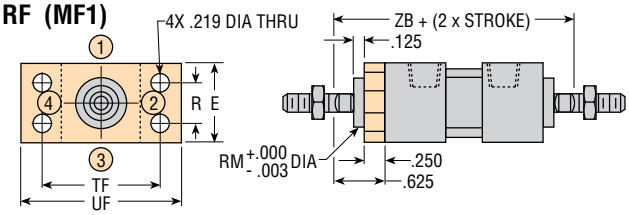
R (MR1)



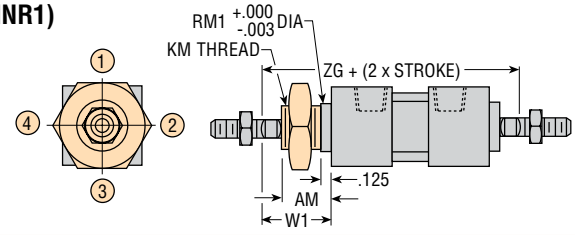
F (MS8) SEE NOTE



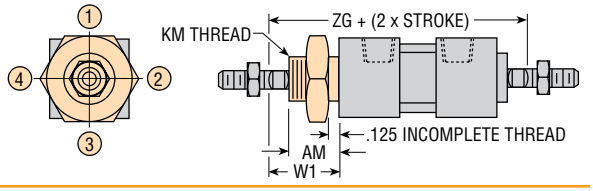
RF (MF1)



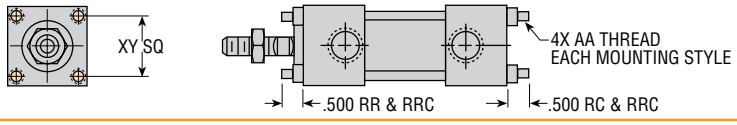
L (MNR1)



T (MN1)



RC, RR, RRC (Includes RR & RC)



All standard rod ends have four wrench flats (two wrench flats with "I" option).

DIMENSIONS COMMON TO ALL SERIES

BORE SIZE	LETTER DIMENSION																	
	AA	BD	D	DB	DF	DN	E	FT	NT	R	RM	RT	TF	TN	UB	UF	WA	XY
3/4	#6-32	.750	3/16	#8	1.375	.625	1.000	1/4-28	8-32 x .18 DP	.500	.625	8-32 x .25 DP	1.500	.625	1.750	2.000	.156	.750
1	#8-32	1.000	1/4	#10	1.750	.875	1.375	5/16-24	10-32 x .25 DP	.875	.750	8-32 x .25 DP	1.875	.875	2.125	2.375	.188	1.030
1-1/8	#10-32	1.125	5/16	#10	1.875	1.000	1.500	3/8-24	10-32 x .25 DP	1.000	.750	10-32 x .25 DP	2.000	1.000	2.250	2.500	.219	1.125

SERIES DA CYLINDERS

BORE SIZE	LETTER DIMENSION													
	AM	KM	LB	P	RM1	SD	SN	V	W1	XB	XT	ZB	ZG	ZR
3/4	.625	5/8-18	2.000	1.000	.687	2.063	1.562	.125	.875	.562	.562	3.000	3.250	2.750
1	.625	3/4-16	2.000	1.000	.812	2.000	1.500	.125	.875	.625	.625	3.000	3.250	2.750
1-1/8	.625	3/4-16	2.000	1.000	.812	2.000	1.500	.125	.875	.625	.625	3.000	3.250	2.750

SERIES DAV CYLINDERS

BORE SIZE	LETTER DIMENSION													
	AM	KM	LB	P	RM1	SD	SN	V	W1	XB	XT	ZB	ZG	ZR
3/4	.625	5/8-18	2.500	1.500	.687	2.562	2.062	.125	.875	.562	.562	3.500	3.750	3.250
1	.625	3/4-16	2.500	1.500	.812	2.500	2.000	.125	.875	.625	.625	3.500	3.750	3.250
1-1/8	.875	1-14	2.500	1.500	1.062	2.500	2.000	.125	1.125	.625	.625	3.500	4.000	3.250

SERIES DHV CYLINDERS

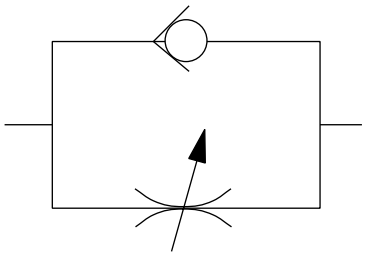
BORE SIZE	LETTER DIMENSION													
	AM	KM	LB	P	RM1	SD	SN	V	W1	XB	XT	ZB	ZG	ZR
3/4	.625	5/8-18	2.500	1.500	.687	2.562	2.062	.375	.875	.812	.812	3.750	4.000	3.750
1	.625	3/4-16	2.500	1.500	.812	2.500	2.000	.375	.875	.875	.875	3.750	4.000	3.750
1-1/8	.875	1-14	2.500	1.500	1.062	2.500	2.000	.375	1.125	.875	.875	3.750	4.250	3.750

PORT POSITIONS: INDICATED BY CIRCLED NUMBERS
CUSHIONS: ADD 1/2" TO ALL (+ STROKE) DIMENSIONS FOR EACH CUSHION
SHOCK PADS: ADD 1/4" TO ALL (+ STROKE) DIMENSIONS FOR EACH SHOCK PAD
SPRING RETURN: ADD AN ADDITIONAL STROKE LENGTH TO ALL (+ STROKE) DIMENSIONS (2 x STROKE)
F (MS8) MTG: 3/4" BORE UNITS ORDERED WITH AN OVERSIZE PISTON ROD WILL HAVE MTG. TABS ON THE HEAD END. CONSULT PHD FOR DIMENSIONAL INFORMATION.
OVERSIZE RODS: SEE PAGE 1-65 FOR OVERSIZE ROD SPECIFICATIONS.

P PC PR 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 cylinder end cap and are used to control the speed of the cylinder over its entire stroke.

The self-locking needle has micrometer threads and 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 cylinder, but opens to permit full flow of incoming fluids. The PHD Port Control® provides the optimum in speed control for small bore cylinders. It saves space and eliminates the cost of installation and fittings for external flow control valves.



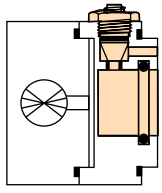
D DC DR ADJUSTABLE CUSHION

PHD Cushions are designed for smooth deceleration at the end of stroke. When the cushion is activated the remaining volume in the cylinder must exhaust past an adjustable needle which controls the amount of deceleration.

See Dimension pages for dimensional information.

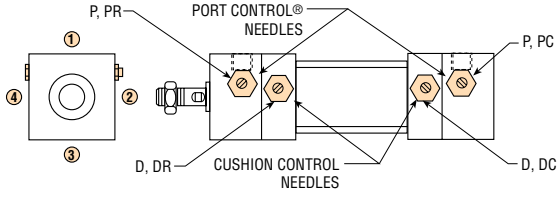
Effective cushion length 1/2"

CUSHION BLOCK



STANDARD PORT CONTROL® AND CUSHION NEEDLE POSITIONS

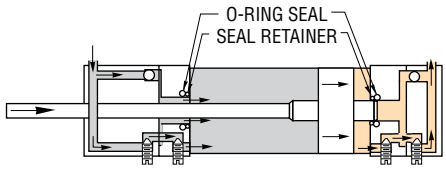
Port Control® and cushion needles are located in position 2 on standard cylinders. They may be located at position 4 when specified on all Series A, AV, and HV.



PORT CONTROL® AND ADJUSTABLE CUSHION COMBINATION

Cushion and Port Control® combination arranged in series provides a compact efficient control system for maximum space weight and cost savings. The cushion is activated when the piston extension enters a seal in the cushion block. The remaining volume in the cylinder exhausts past an adjustable needle. A check seal in the adjusting needle is closed during deceleration, but opens to permit full flow for immediate reversing. The cushion seal in the block is an O-ring for air units.

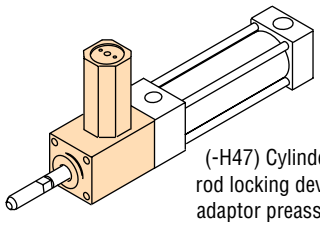
CUSHION BLOCK STYLE



H47 RODLOK® CYLINDER & RODLOK®

Available on single rod Series A and AV units only. (preassembled) ⊕

PHD's Rodlok® is ideal for locking the piston rod while in a static / stationary position. When the pressure is removed from the port of the Rodlok®, the mechanism will grip the rod and prevent it from moving. The loads are held indefinitely without power. Rodlok® performance is application and environment sensitive (cleanliness of rod or Rodlok® will also affect performance). THE RODLOK® IS NOT DESIGNED TO BE USED AS A PERSONNEL SAFETY DEVICE.



(-H47) Cylinder with rod locking device and adaptor preassembled

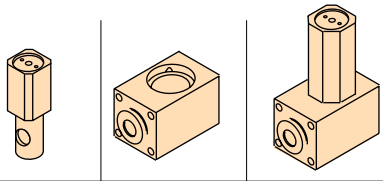
Option -H47 provides a cylinder and Rodlok® pre-assembled. The port for the Rodlok® will be assembled in the same position as the port on the extend end of the cylinder.

Replacement Rodlok® kits can be purchased separately. See chart at right. The locking device and adaptor are not available with the -Z1 corrosion resistant finish.

-H47 available on B, R, P, and RC only.

⊕ This option does not dimensionally comply with the NFPA standard specifications.

REPLACEMENT RODLOK® KITS

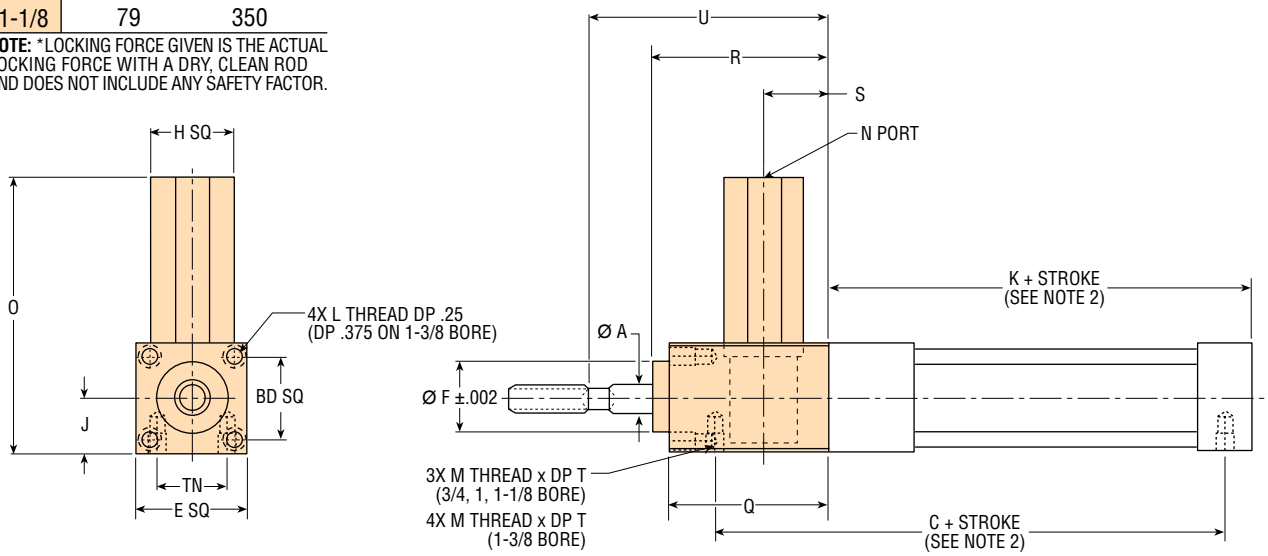


BORE in	LOCKING DEVICE KIT	ADAPTOR KIT	COMPLETE RODLOK®
3/4	63932-01	63931-01	63935-01
1	63932-02	63931-02	63935-02
1-1/8	63932-03	63931-03	63935-03

PART NUMBERS LISTED ABOVE ARE INTENDED FOR REPLACEMENT PURPOSES ONLY.

BORE in	STATIC LOCKING FORCE* lb	[N]
3/4	40	180
1	56	250
1-1/8	79	350

NOTE: *LOCKING FORCE GIVEN IS THE ACTUAL LOCKING FORCE WITH A DRY, CLEAN ROD AND DOES NOT INCLUDE ANY SAFETY FACTOR.



BORE in	LETTER DIMENSION A	C	E	F	H	J	K	L	M	N	O	Q	R	S	T	U	BD	TN
3/4	.250 [6.4]	3.063 [77.8]	1.000 [25.4]	.622 [15.8]	0.728 [18.5]	.500 [12.7]	2.250 [57.2]	8-32 UNC-2B	8-32 UNC-2B	10-32 UNF-2B	2.409 [61.2]	1.500 [38.1]	1.625 [41.3]	.625 [15.9]	.187 [4.7]	1.875 [47.6]	.750 [19.1]	.625 [15.9]
1	.312 [7.9]	3.000 [76.2]	1.375 [34.9]	.747 [19.0]	0.787 [20.0]	.688 [17.5]	2.250 [57.2]	8-32 UNC-2B	8-32 UNC-2B	10-32 UNF-2B	2.756 [70.0]	1.500 [38.1]	1.625 [41.3]	.625 [15.9]	.250 [6.4]	1.875 [47.6]	1.000 [25.4]	.875 [22.2]
1-1/8	.375 [9.5]	3.000 [76.2]	1.500 [38.1]	.747 [19.0]	0.787 [20.0]	.750 [19.1]	2.250 [57.2]	10-32 UNF-2B	10-32 UNF-2B	10-32 UNF-2B	2.819 [71.6]	1.500 [38.1]	1.625 [41.3]	.625 [15.9]	.250 [6.4]	1.875 [47.6]	1.125 [28.6]	1.000 [25.4]

NOTES:

1) Breakaway force on cylinders with Rodlok® approximately 30 psi.

2) For Series A 3/4, 1, and 1-1/8 bores, subtract .500 (K = 1.750, C : 3/4 = 2.563, 1, 1-1/8 = 2.500)

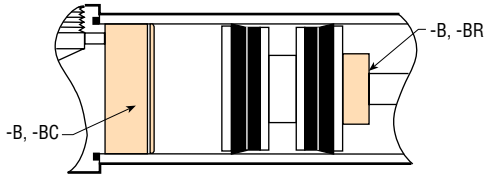
OPTIONS: SERIES A, AV, HV; 3/4", 1", 1-1/8" BORE

B BC BR SHOCK PADS

Polyurethane pads for absorption of shock and noise (not available on HV hydraulic units). Reducing shock permits higher piston velocities for shorter cycle times. Reducing noise levels provides improved environment for increased productivity. Eliminates metal to metal contact between piston and end caps.

Available with all options EXCEPT -

- **Same end as Cushion (-D, -DC, or -DR)**
- **Spring end of Spring Return cylinder (-SC or -SR)**
- **Same end as Stroke Adjustment (-A)**



SR SC SPRING RETURN

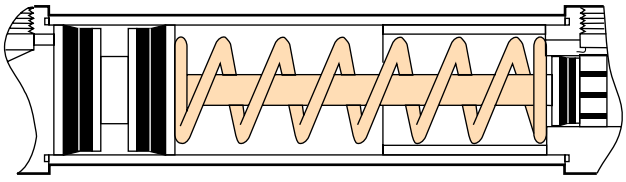
Available in 1/4" increments

All standard A, AV and HV Cylinders from 1/4" to 6" of stroke can be built with internal springs to return or extend the piston rod in single acting applications. The standard spring provides a preload and a spring rate per chart below. Other spring combinations will be quoted on request.

STROKE	PRELOAD	RATE
1/4"-3"	4 lb	7 lb/in
3-1/4" - 6"	2 lb	3-1/2 lb/in

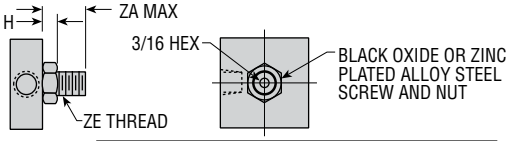
Available with all options EXCEPT -

- **Cushion on the spring end (-D, -DC, or -DR)**
- **Shock pad on the spring end (-B, -BC, or -BR)**
- **Stroke adjustment on the spring end (-A)**



A CYLINDER STROKE ADJUSTMENT

Stroke adjustment screws are available to decrease the retraction stroke of any Series AV or A cylinders. The standard adjusting range is 1/2 inch. Longer adjusting lengths are available on request.



BORE SIZE	H	ZA	ZE STANDARD	ZE WITH -P OR -PC
3/4	.370	1.031	3/8-24	5/16-24
1	.462	1.156	1/2-20	3/8-24
1-1/8	.462	1.156	1/2-20	1/2-20

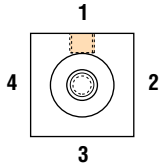
Available with all options EXCEPT -

- **Cushion on the cap end (-D or -DC)**
- **Shock pad on the cap end (-B or -BC)**
- **Spring on the cap end (-SC)**
- **Pivot Mount, Pivot on cap (P Mounting)**
- **Cap flange mount, flange on cap (CF Mounting)**
- **F Mounting on 3/4 bore with -P or -PC**

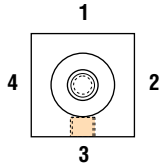
PORT POSITIONS

Port position 1 is standard on all cylinders except mounting style -F without port controls. The cap end port will be in position 4 standard. If port position 1(-Q) or 3 (-T) is desired, add -Q or -T to unit description and -F mounting tab will be added to unit to accommodate units.

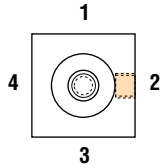
STANDARD PORT POSITION 1



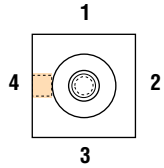
T PORT POSITION 3



R PORT POSITION 2



U PORT POSITION 4



All dimensions are reference only unless specifically toleranced.

MAGNETIC PISTON FOR USE WITH PHD PROXIMITY SWITCHES

E HALL EFFECT SWITCHES

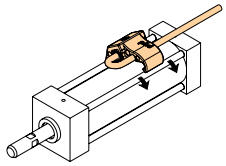
PHD Cylinders may be equipped with a magnetic band (specify -E) on the piston which activates externally mounted PHD Hall Effect Switches. These switches allow the interfacing of the Tom Thumb® air or hydraulic cylinder to various logic systems. This option is for use with the following switches.

COMPACT HALL EFFECT SWITCHES

PART NO.	DESCRIPTION
17503-2-06	NPN Type 10-30 VDC
17504-2-06	PNP Type 10-30 VDC
17523-2	NPN Type 10-30 VDC, Quick Connect
17524-2	PNP Type 10-30 VDC, Quick Connect

See Switches and Sensors section for complete switch information.

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 piston 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 10-30 VDC
17509-3-06	AC Type 110-120 VAC with Current Limit
17522-2	Sink or Source Type 10-30 VDC, Quick Connect
17529-3	AC Type 110-120 VAC, Quick Connect with Current Limit

See Switches and Sensors section for complete switch information.

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.

Z1 ELECTROLESS NICKEL PLATING

Electroless nickel plating is done on all externally exposed ferrous parts except rods and rod end, or parts made of stainless steel or aluminum. This optional plating treatment gives an alternative method of protecting the cylinder from severe environments.

W CLOSE TOLERANCE STROKE

This option may be specified when a precise stroke length is required and stroke adjustment is not acceptable. By specifying this option, a stroke length with a tolerance of ± .005 will be supplied. Standard stroke tolerance is ± .032.

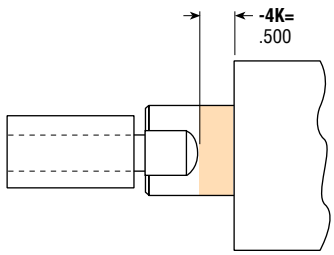
Maximum stroke for cylinders with close tolerance is 18".

NOTE: This option is not available with shock pads (-B, -BC, or -BR).

_K EXTRA ROD EXTENSION

This option may be specified when extra plain rod extension between rod flats and cylinder snout is desired. Length is specified in 1/8" increments.

Length code example (for imperial units)
-4K = 1/2" of extra rod extension
-8K = 1", etc.

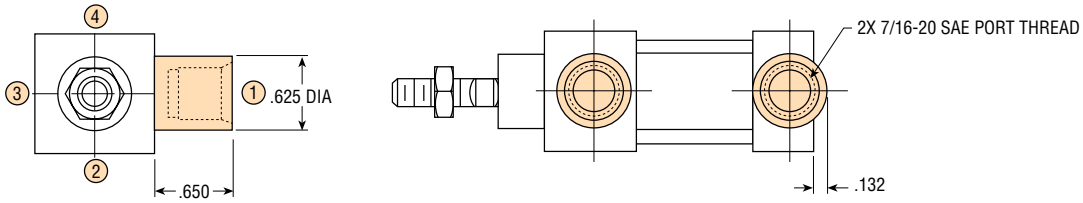


NOTE: On double rod end cylinders with -_K specified will be applied to one end of cylinder only (head end/primary mounting end).

Y SAE PORTS FOR SERIES HV

SAE Ports are available on most Tom Thumb Hydraulic Cylinders. Series HV Cylinders require a boss which is brazed to the head and cap.

Dimensions for this boss are shown below. This option is not available on cylinders with an "F" mounting style. Consult PHD for optional port position or **units with Port Controls®**. Oversize rods are available except on T & L mounting styles on 3/4" bore cylinders.



SELF-ALIGNING PISTON ROD COUPLERS

To order, specify the model number.

MODEL NO.	LETTER DIMENSION						
	A	B	C	D	E	F	G
250	1/4-28	1.000	.625	1.875	.500	.875	.156
312	5/16-24	1.000	.625	1.875	.500	.875	.187
375	3/8-24	1.000	.625	1.875	.500	.875	.219
437	7/16-20	1.125	.650	2.187	.500	1.000	.250
500	1/2-20	1.125	.650	2.187	.500	1.000	.312
625	5/8-18	1.750	1.125	3.312	.812	1.562	.375
750	3/4-16	1.750	1.125	3.312	.812	1.562	.421

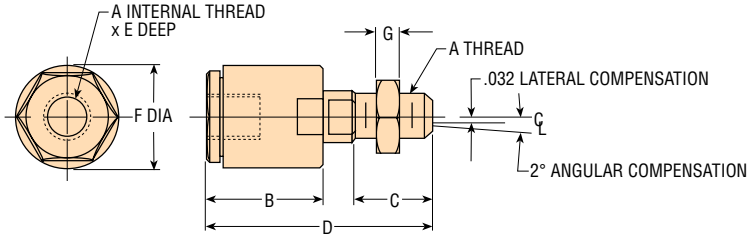
Rod Couplers eliminate expensive precision machining for mounting fixed or rigid cylinder on guide or slide applications.

Cylinder efficiency is increased by eliminating friction caused by misalignment. Couplers compensate for 2° angular error and 1/32" lateral misalignment on push and pull stroke.

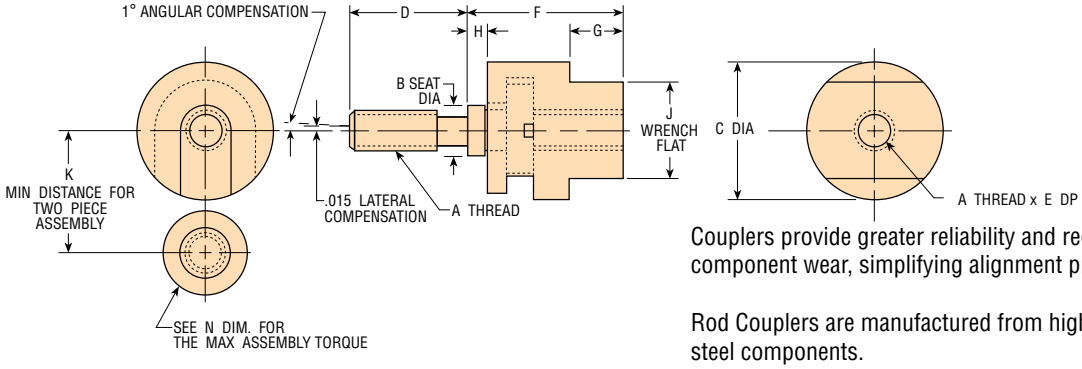
Couplers provide greater reliability and reduce cylinder and component wear, simplifying alignment problems in the field.

Rod Couplers are manufactured from high tensile and hardened steel components.

For metric piston rod couplers, see page 1-44.



MINIATURE COUPLERS



Couplers provide greater reliability and reduce cylinder and component wear, simplifying alignment problems in the field.

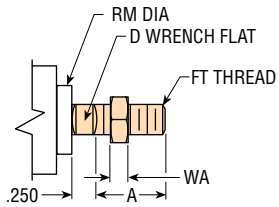
Rod Couplers are manufactured from high tensile and hardened steel components.

MODEL NO.	LETTER DIMENSION										
	A	B	C	D	E	F	G	H	J	K	N
19300-01	5-40	.160	.440	.375	.250	.500	.170	.066	5/16	.390	20 in-lbs
19300-02	10-32	.250	.560	.500	.281	.558	.200	.058	3/8	.490	70 in-lbs

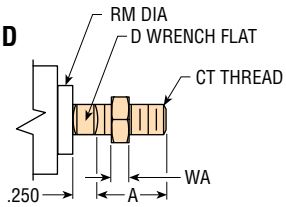
All dimensions are reference only unless specifically toleranced.

OPTIONS: SERIES A, AV, HV; 3/4", 1", 1-1/8" BORE

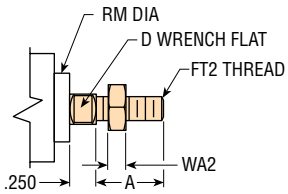
STANDARD (#1 ROD END)



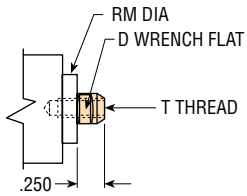
L
COARSE THREAD ROD END



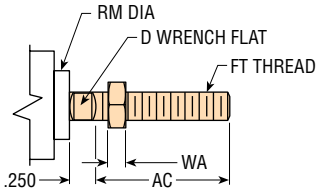
G
ROD END STYLE #2



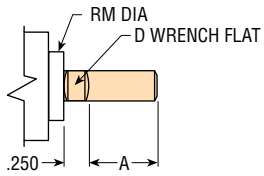
I
ROD END STYLE #4



J
ROD END STYLE #2X



N
PLAIN ROD END



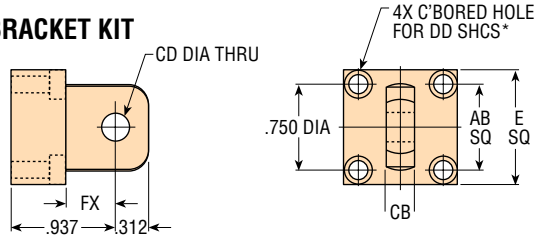
All standard rod ends have four wrench flats (two wrench flats with "I" option).

BORE SIZE	ROD TYPE	ROD DIA.	LETTER DIMENSION									
			A	AC	CT	D	FT	FT2	RM	T	WA	WA2
3/4	STANDARD	.250	.625	1.250	1/4-20	7/32	1/4-28	10-32	.625	6-32 x .437 DP	.156	.130
	OVERSIZE	.312	.625	1.250	5/16-18	1/4	5/16-24	1/4-28	.625	10-32 x .625 DP	.187	.156
1	STANDARD	.312	.625	1.250	5/16-18	1/4	5/16-24	1/4-28	.750	10-32 x .625 DP	.187	.156
	OVERSIZE	.375	.625	1.250	3/8-16	5/16	3/8-24	5/16-24	.750	1/4-28 x .625 DP	.219	.187
1-1/8	STANDARD	.375	.625	1.250	3/8-16	5/16	3/8-24	5/16-24	.750	1/4-28 x .625 DP	.219	.187
	OVERSIZE	.500	.750	1.500	1/2-13	7/16	1/2-20	7/16-20	A-.750 AV-HV 1.000	3/8-24 x .625 DP	.312	.250

NOTE: On double rod cylinders, both rod ends will be the same on both ends of the cylinder.

ACCESSORIES: SERIES A, AV, HV; 3/4", 1", 1-1/8" BORE

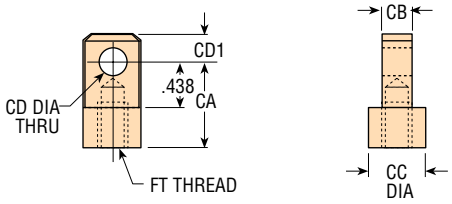
EYE BRACKET KIT



BORE SIZE	CYL SERIES	PART NO.	LETTER DIMENSION AB	CB	CD	DD*	E	FX
3/4	A,AV,HV	1077-01	.750	.248	.250	#6	1.000	.577
1 &	A	1077-02	1.000	.373	.250	#10	1.375	.437
1-1/8	AV,HV	1077-03	1.000	.373	.375	#10	1.375	.437

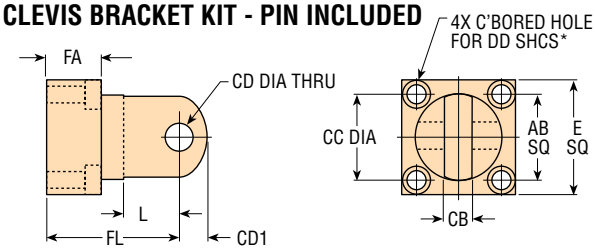
*For 3/4 bore thru hole only.

ROD EYE KIT



BORE SIZE	CYL SERIES	PART NO.	LETTER DIMENSION CA	CB	CC	CD	CD1	FT
3/4	A,AV,HV	1075-01	.750	.248	.500	.250	.250	1/4-28 x .375 DP
1	A	1075-02	.875	.373	.750	.250	.375	5/16-24 x .375 DP
	AV,HV	1075-04	.875	.373	.750	.375	.375	5/16-24 x .375 DP
1-1/8	A	1075-03	.875	.373	.750	.250	.375	3/8-24 x .312 DP
	AV,HV	1075-05	.875	.373	.750	.375	.375	3/8-24 x .312 DP

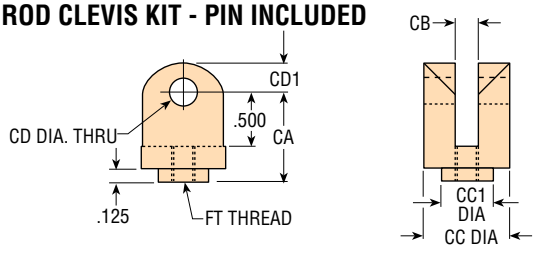
CLEVIS BRACKET KIT - PIN INCLUDED



BORE SIZE	CYL SERIES	KIT NO.	LETTER DIMENSION AB	CB	CC	CD	CD1	DD*	E	FA	FL	L
3/4	A,AV,HV	12901	.750	.254	.750	.250	.250	#6	1.000	.360	1.187	.500
1 &	A	12902	1.000	.379	.875	.250	.375	#10	1.375	.500	1.250	.531
1-1/8	AV,HV	12903	1.000	.379	.875	.375	.375	#10	1.375	.500	1.250	.531

*For 3/4 bore thru hole only.

ROD CLEVIS KIT - PIN INCLUDED



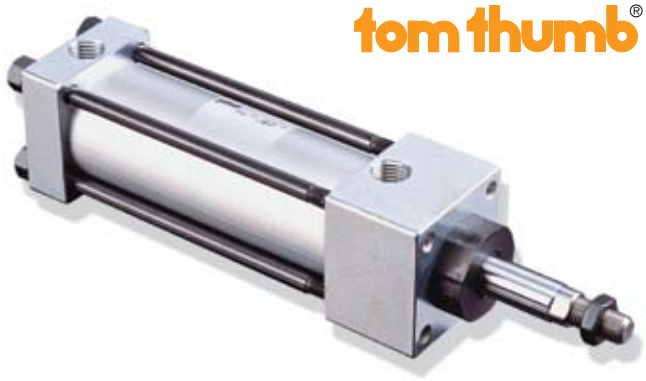
BORE SIZE	CYL SERIES	KIT NO.	LETTER DIMENSION CA	CB	CC	CC1	CD	CD1	FT
3/4	A,AV,HV	12904	.812	.254	.750	.437	.250	.250	1/4-28 TO SLOT
1	A	12905	.875	.379	.875	.562	.250	.375	5/16-24 TO SLOT
	AV,HV	12906	.875	.379	.875	.562	.375	.375	5/16-24 TO SLOT
1-1/8	A	12907	.875	.379	.875	.562	.250	.375	3/8-24 TO SLOT
	AV,HV	12908	.875	.379	.875	.562	.375	.375	3/8-24 TO SLOT

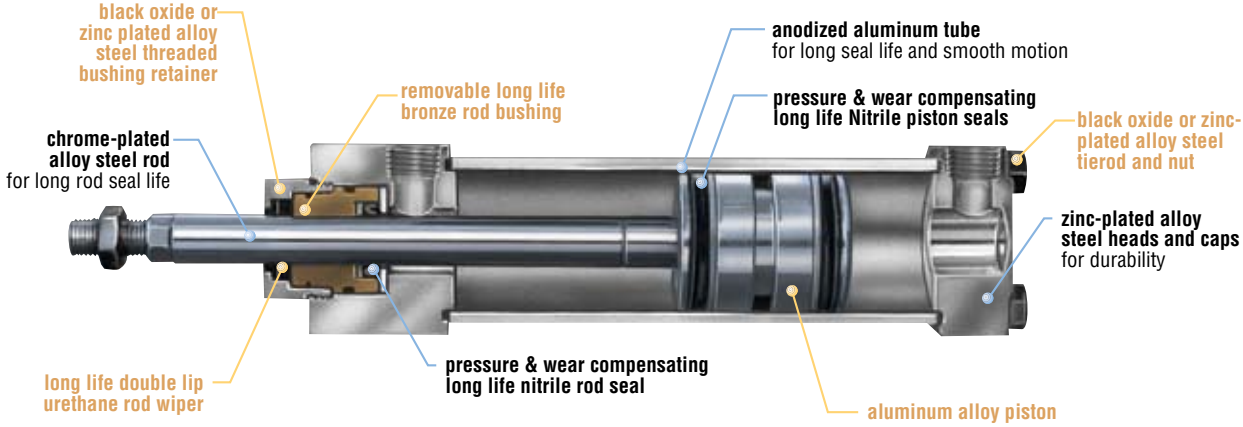
All dimensions are reference only unless specifically toleranced.

AV, HV

TIE ROD CYLINDERS 1-3/8" BORE WITH A WIDE VARIETY OF STYLES AND OPTIONS

tom thumb®





Major Benefits

- Long life design for low maintenance
- NFPA repairable for extended life providing long term savings
- Wide range of options for easy application and reduced design time
- Two working day delivery
- Wide range of mounting styles for easy installation

Industry Uses

- Packaging
- Assembly machines
- Machine loading/unloading
- General industrial automation

ORDERING DATA: SERIES AV, HV; 1-3/8" BORE

TO ORDER SPECIFY:

Series, Mounting Style, Bore Size, Stroke, Port Control®, and any Options. Also specify rod diameter if non-standard. Rod couplings and mounting attachments must be ordered separately.

SERIES
AV - 150 psi Air
HV - 1500 psi Hyd.

BORE SIZE
1-3/8" BORE
1/2" Std. Rod Dia.
3/8-24 Thread

STANDARD STROKE LENGTHS
1-3/8" BORE SIZE
1/2" to 24"
in 1/2" increments
For Longer Lengths, Consult PHD

CUSHION OR SHOCK PAD
D - Cushions on both ends
DR - Cushion on rod end
DC - Cushion on cap end
B - Shock Pads on both ends
BR - Shock Pad on rod end
BC - Shock Pad on cap end
(Cushions, Shock Pads, and Spring Return are not available on the same end of cylinder.)

OVERSIZE ROD
To be specified only when using a non-standard diameter. Rod diameters available are shown on page 1-77.

SC AV F 1-3/8 x 2 - P - D - 5/8 ROD - G-M-V

SPRING RETURN
SC - Spring on cap end
SR - Spring on rod end (Strokes available in 1/4" increments up to 6 ".) ⊕ See option pages.

and/or

DOUBLE ROD END
D - Double Rod End Cylinders
Leave blank if not needed.

MOUNTING STYLE
F - Foot Mount
B - Bottom Mount, Tapped holes in head and cap
R - Rod Mount, Tapped holes on front face of head
T - Thread Mount, Threaded snout on head (shipped with mounting nut)
RF - Rod End Flange
CF - Cap End Flange
K - Clevis Mount, Clevis on cap
TR - Trunnion Mount
RR - Tierod Mount, Tierods extend out rod end
RC - Tierod Mount, Tierods extend out cap end
RRC - Tierod Mount, Tierods extend out both ends

PORT CONTROL®

BUILT-IN METER OUT FLOW CONTROL VALVE
P - Flow control both ends
PR - Flow control on head end
PC - Flow control on cap end

OPTIONS
A - Stroke Adjustment, 1/2" of adjustment standard (not available on Series HV)
E - Magnetic Piston for PHD Hall Effect Switches
F - #1 Rod End (See page 1-77 for dimensions) (See Note 1)
I - #4 Rod End, Female thread on rod (See page 1-77 for dimensions) (See Note 1)
H47 - Rodlok (Rod clamping device installed. Not available with Z1 or on HV. See option page.) ⊕
J - #2X Rod End, Twice as long as standard thread (See page 1-77 for dimensions)
_K - Extra Rod Extension, in 1/8" increments (See page 1-75) (See Note 2)
L - Coarse Thread Rod End (See page 1-77 for dimensions) (See Note 1)
M - Magnetic Piston for PHD Reed Switches
N - Plain Rod End (See page 1-77 for dimensions) (See Note 1)
R - Ports in Position #2
T - Ports in Position #3
U - Ports in Position #4
V - Fluoro-Elastomer Seals
W - Close Tolerance Stroke, ± .005" stroke length
Z1 - Electroless Nickel Plate all ferrous parts excluding Rod Ends

PROXIMITY SWITCH MOUNTING BRACKETS

SERIES	BORE	SIZE NO.
AV, HV	1-3/8"	-34

See Switches and Sensors section for complete ordering information.

Notes:
1) For double rod cylinders, rod end options will be applied to both ends of cylinder.
2) For double rod cylinders, -_K extension will be applied to one end only (head end/primary mounting end).

⊕ Marked options provide additional cylinder flexibility, but may alter the dimensions.

SPECIFICATIONS	SERIES AV	SERIES HV
OPERATING PRESSURE		
STANDARD CYLINDER (NO RODLOK®)	20 to 150 psi air	40 to 1500 psi hyd*
CYLINDER WITH RODLOK®	30 to 150 psi air	—
OPERATING TEMPERATURE	-20° to 180°F [-29° to 82°C]	-20° to 180°F [-29° to 82°C]
STROKE TOLERANCE	± .032	± .032
LUBRICATION	Permanently lubricated	—
MAINTENANCE	Field repairable	Field repairable

*Hydraulic rating is based on non-shock hydraulic service.

CYLINDER FORCE TABLE

SERIES	CYLINDER BORE	ROD DIAMETER	ROD DIRECTION	EFFECTIVE AREA FORCE lb/psi	FREE AIR CONSUMPTION 80 lbs CUBIC ft/in OF STROKE	DISPLACEMENT gal./in OF STROKE
AV, HV	1-3/8	1/2	EXTEND	1.485	.0055	.0064
			RETRACT	1.289	.0048	.0056
	1-3/8	5/8	EXTEND	1.485	.0055	.0064
			RETRACT	1.178	.0044	.0051

NOTE: Use the RETRACT figures for calculating double rod cylinder forces in both directions.

MAXIMUM ALLOWABLE EXTEND STROKE

SERIES	ROD DIAMETER	CYLINDER FORCE (lb) 100	200	500	1000	1500	2000	3000	5000
1-3/8" AV, HV	1/2	48"	34"	21"	15"	12"	11"	—	—
	5/8	74"	53"	33"	24"	19"	17"	—	—

SERIES	UNIT WEIGHTS (lb) ZERO STROKE	ADDER PER INCH OF STROKE
PLAIN UNIT	2.56	.12

CYLINDER FORCE CALCULATIONS

IMPERIAL

$F = P \times A$

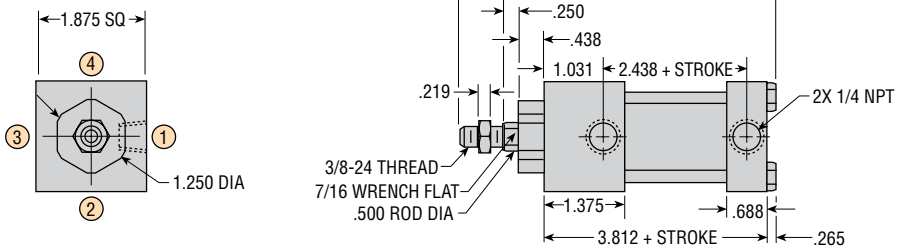
F	= Cylinder Force	lbs
P	= Operating Pressure	psi
A	= Effective Area (Extend or Retract)	in^2

SIZING AND APPLICATION ASSISTANCE

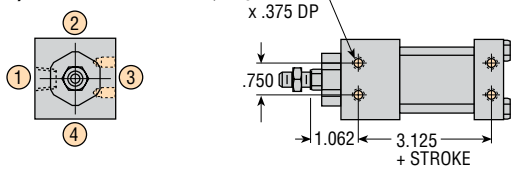
See PHD Product Sizing Catalog for specific and complete sizing information. Online sizing assistance is available at: ***www.phdinc.com/apps/sizing***

DIMENSIONS: SERIES AV, HV; 1-3/8" BORE

BASIC CYLINDER DIMENSIONS



B (MS4)



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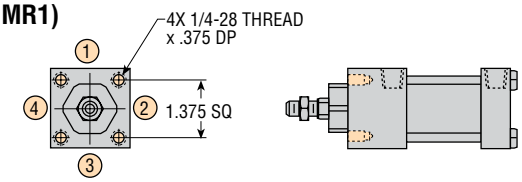

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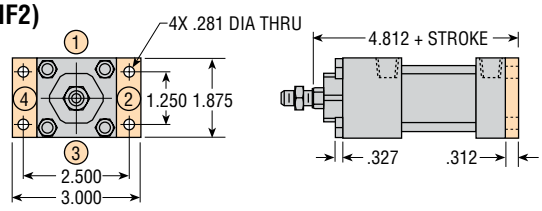

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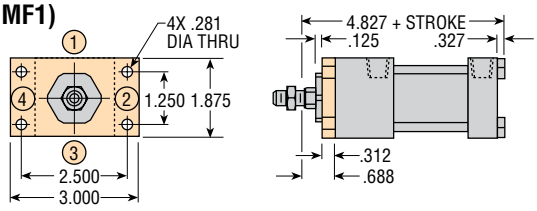

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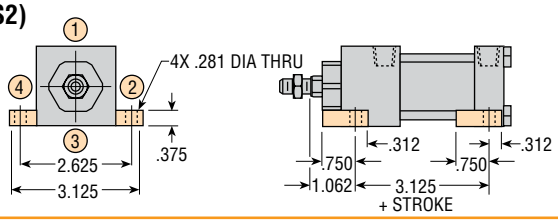
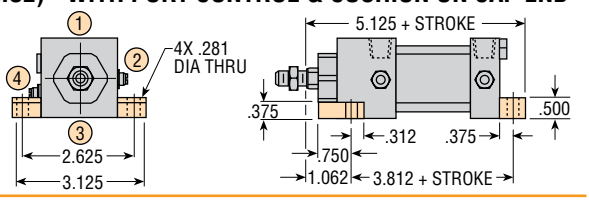


F (MS2) - WITH PORT CONTROL & CUSHION ON CAP END



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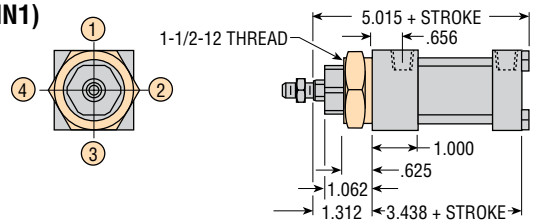
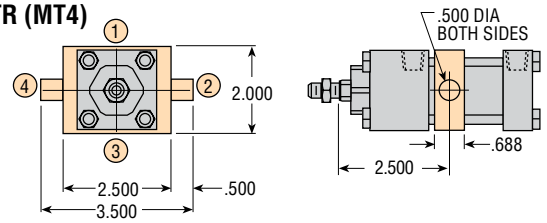


TR (MT4)



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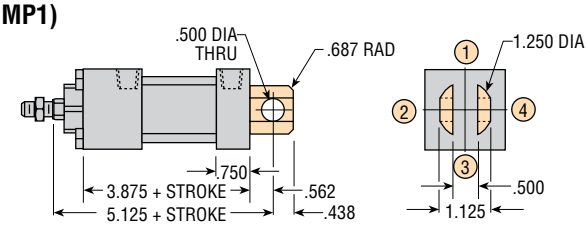
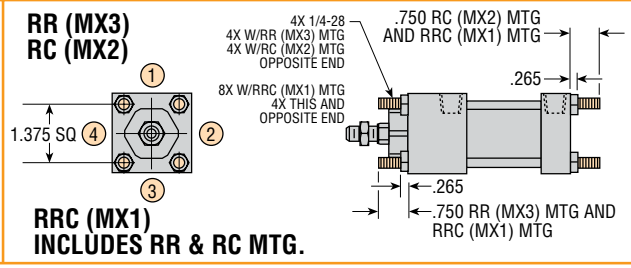


RR (MX3) RC (MX2)



RRC (MX1) INCLUDES RR & RC MTG.

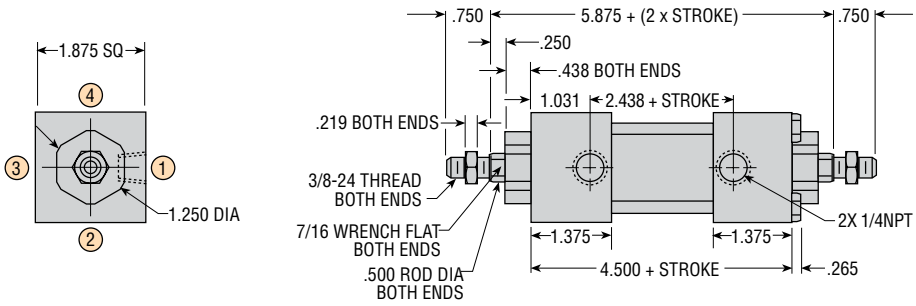
All standard rod ends have four wrench flats (two wrench flats with "I" option).

PORT POSITIONS: INDICATED BY CIRCLED NUMBERS
CUSHIONS: CYLINDER LENGTH IS NOT AFFECTED BY ADDITION OF CUSHIONS
SHOCK PADS: ADD 1/4" TO ALL (+ STROKE) DIMENSIONS FOR EACH SHOCK PAD
SPRING RETURN: ADD AN ADDITIONAL STROKE LENGTH TO (+ STROKE) DIMENSIONS (2 x STROKE)
OVERSIZE RODS: SEE PAGE 1-77 FOR OVERSIZE ROD SPECIFICATIONS.

All dimensions are reference only unless specifically toleranced.

DIMENSIONS: SERIES DAV, DHV DOUBLE ROD END;1-3/8" BORE

BASIC CYLINDER DIMENSIONS



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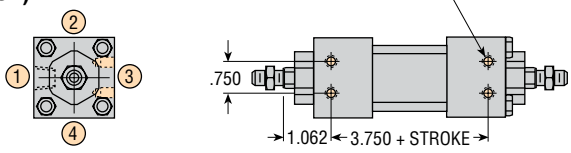

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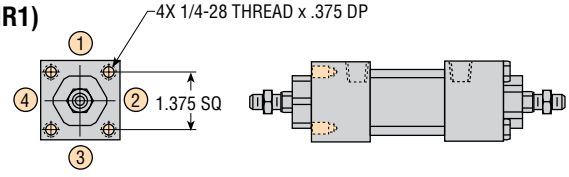
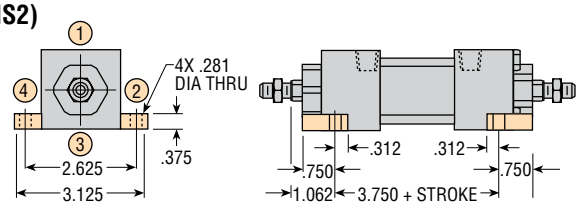


F (MS2)



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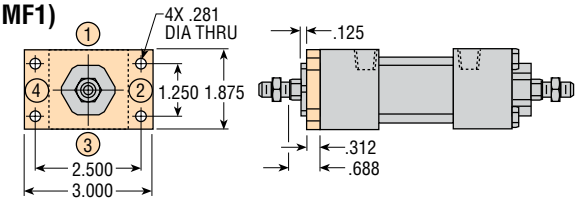

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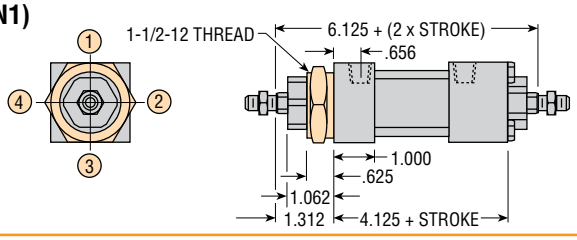

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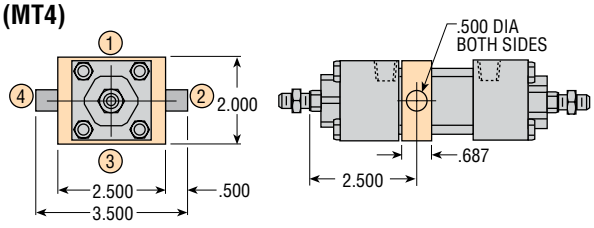
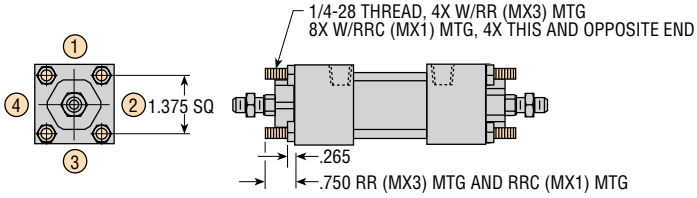


RR (MX3)



RRC (MX1)
THREADED TIEROD ON BOTH ENDS

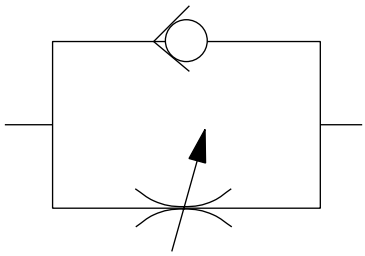
All standard rod ends have four wrench flats (two wrench flats with "I" option).

PORT POSITIONS: INDICATED BY CIRCLED NUMBERS
CUSHIONS: CYLINDER LENGTH IS NOT AFFECTED BY ADDITION OF CUSHIONS
SHOCK PADS: ADD 1/4" TO ALL (+ STROKE) DIMENSIONS FOR EACH SHOCK PAD
SPRING RETURN: ADD AN ADDITIONAL STROKE LENGTH TO ALL (+ STROKE) DIMENSIONS (2 x STROKE)
OVERSIZE RODS: SEE PAGE 1-77 FOR OVERSIZE ROD SPECIFICATIONS.

P PC PR 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 cylinder end cap and are used to control the speed of the cylinder over its entire stroke.

The self-locking needle has micrometer threads and 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 cylinder, but opens to permit full flow of incoming fluids. The PHD Port Control® provides the optimum in speed control for small bore cylinders. It saves space and eliminates the cost of installation and fittings for external flow control valves.

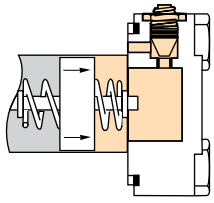


D DC DR ADJUSTABLE CUSHION

PHD Cushions are designed for smooth deceleration at the end of stroke. When the cushion is activated the remaining volume in the cylinder must exhaust past an adjustable needle which controls the amount of deceleration.

Effective cushion length 1/2"

POPPET STYLE

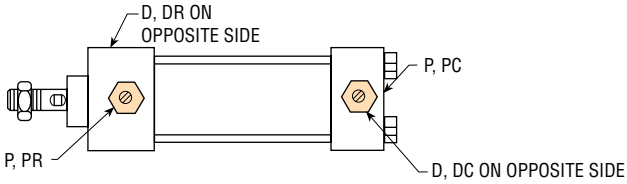


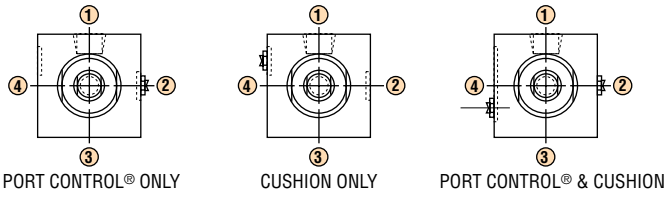
1-3/8" BORE

STANDARD PORT CONTROL® AND CUSHION NEEDLE POSITIONS

Port Control® and cushion needles are located on opposite sides adjacent to port. Please consult distributor or PHD to check availability of special Port Control® or cushion needle positions.

Location may vary depending on mounting and option combinations.

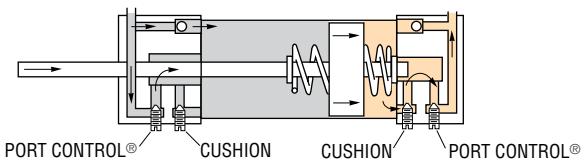




PORT CONTROL® AND ADJUSTABLE CUSHION COMBINATION

The cushion and Port Control® combination is available on the 1-3/8" Bore. This cushion is activated when a seal, which is traveling with the piston, seals against the cylinder end cap. This causes the remaining volume in the cylinder to exhaust past an adjustable needle which controls the amount of deceleration. The spring, which extends the seal from the piston, permits the seal to act as a check valve to allow full flow back into the cylinder for immediate reversing. The cushion seal for air units is made of urethane while seals for oil units are close tolerance metal.

POPPET STYLE



H47 RODLOK® CYLINDER & RODLOK®

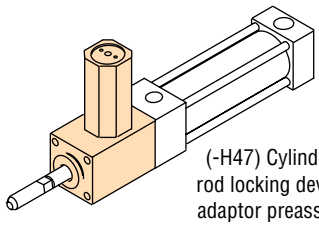
Available on single rod Series AV units only.

PHD's Rodlok® is ideal for locking the piston rod while in a static / stationary position. When the pressure is removed from the port of the Rodlok®, the mechanism will grip the rod and prevent it from moving. The loads are held indefinitely without power. Rodlok® performance is application and environment sensitive (cleanliness of rod or Rodlok® will also affect performance). THE RODLOK® IS NOT DESIGNED TO BE USED AS A PERSONNEL SAFETY DEVICE.

Option H47 provides a cylinder and Rodlok® pre-assembled. The port for the Rodlok® will be assembled in the same position as the port on the extend end of the cylinder.

Replacement Rodlok® kits can be purchased separately. See chart at right. The locking device and adaptor are not available with the -Z1 corrosion resistant finish.

-H47 available on B, R, and RC mounting only.

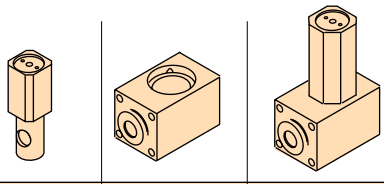


(-H47) Cylinder with rod locking device and adaptor preassembled

BORE	STATIC LOCKING FORCE*	
in	lb	[N]
1-3/8	135	600

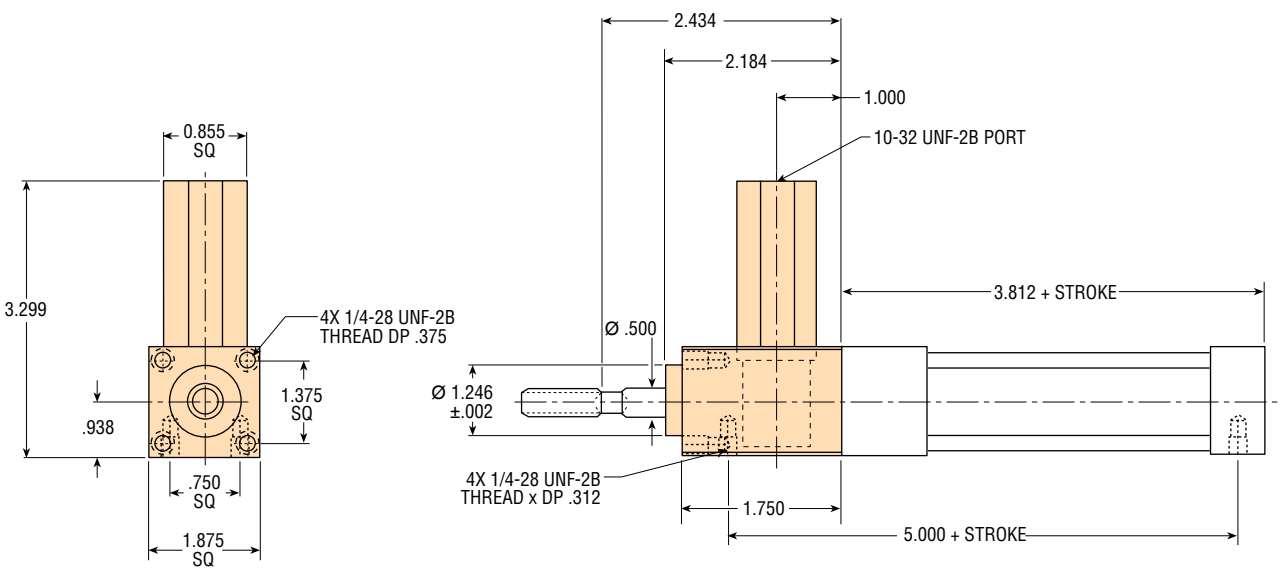
NOTE: *LOCKING FORCE GIVEN IS THE ACTUAL LOCKING FORCE WITH A DRY, CLEAN ROD AND DOES NOT INCLUDE ANY SAFETY FACTOR.

REPLACEMENT RODLOK® KITS



BORE in	LOCKING DEVICE KIT	ADAPTOR KIT	COMPLETE RODLOK®
1-3/8	63932-04	63931-04	63935-04

PART NUMBERS LISTED ABOVE ARE INTENDED FOR REPLACEMENT PURPOSES ONLY.



NOTE:
Breakaway force on cylinders with Rodlok® approximately 30 psi.

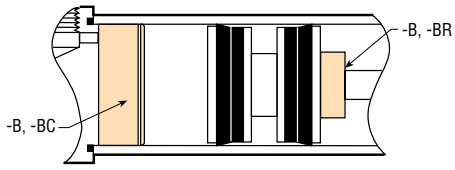
OPTIONS: SERIES AV, HV; 1-3/8" BORE

B BC BR SHOCK PADS

Polyurethane pads for absorption of shock and noise (not available on hydraulic units). Reducing shock permits higher piston velocities for shorter cycle times. Reducing noise levels provides improved environment for increased productivity. Eliminates metal to metal contact between piston and end caps.

Available together with all options EXCEPT -

- **Same end as Cushion (-D, -DC, or -DR)**
- **Spring end of Spring Return cylinder (SR or SC)**
- **Same end as Stroke Adjustment (-A)**



SR SC SPRING RETURN

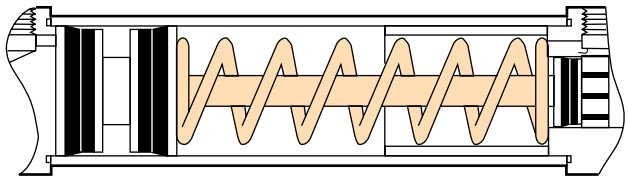
Available in 1/4" increments

All standard AV and HV Cylinders from 1/4" to 6" of stroke can be built with internal springs to return or extend the piston rod in single acting applications. The standard spring provides a preload and a spring rate per chart below. Other spring combinations will be quoted on request.

STROKE	PRELOAD	RATE
1/4"-3"	4 lb	7 lb/in
3-1/4" - 6"	2 lb	3-1/2 lb/in

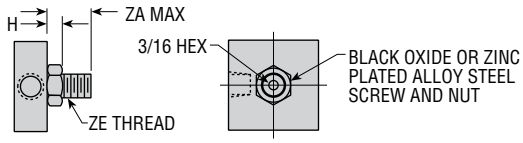
Available with all options EXCEPT -

- **Cushion on the spring end (-D, -DC, or -DR)**
- **Shock pad on the spring end (-B, -BC, or -BR)**
- **Stroke adjustment on the spring end (-A)**



A CYLINDER STROKE ADJUSTMENT (AV SERIES)

Stroke adjustment screws are available to decrease the retraction stroke of any Series AV. The standard adjusting range is 1/2 inch. Longer adjusting lengths are available on request.



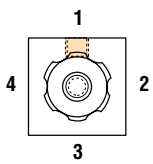
BORE SIZE	H	ZA	ZE
1-3/8	.462	1.000	1/2-20

Available with all options EXCEPT -

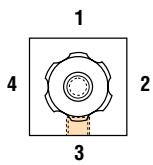
- **Cushion on the cap end (-D or -DC)**
- **Shock pad on the cap end (-B or -BC)**
- **Spring on the cap end (SC)**
- **Cap flange mounting (CF)**
- **Clevis mount on cap (K)**

PORT POSITIONS

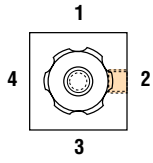
STANDARD PORT POSITION 1



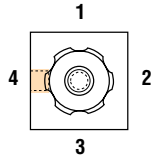
T PORT POSITION 3



R PORT POSITION 2



U PORT POSITION 4



All dimensions are reference only unless specifically toleranced.

MAGNETIC PISTON FOR USE WITH PHD PROXIMITY SWITCHES

E HALL EFFECT SWITCHES

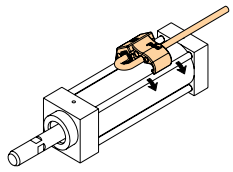
PHD Cylinders may be equipped with a magnetic band (specify -E) on the piston which activates externally mounted PHD Hall Effect Switches. These switches allow the interfacing of the Tom Thumb® air or hydraulic cylinder to various logic systems. This option is for use with the following switches.

COMPACT HALL EFFECT SWITCHES

PART NO.	DESCRIPTION
17503-2-06	NPN Type 10-30 VDC
17504-2-06	PNP Type 10-30 VDC
17523-2	NPN Type 10-30 VDC, Quick Connect
17524-2	PNP Type 10-30 VDC, Quick Connect

See Switches and Sensors section for complete switch information.

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 piston 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 10-30 VDC
17509-3-06	AC Type 110-120 VAC with Current Limit
17522-2	Sink or Source Type 10-30 VDC, Quick Connect
17529-3	AC Type 110-120 VAC, Quick Connect with Current Limit

See Switches and Sensors section for complete switch information.

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.

Z1 ELECTROLESS NICKEL PLATING

Electroless nickel plating is done on all externally exposed ferrous parts except rods and rod end, or parts made of stainless steel or aluminum. This optional plating treatment gives an alternative method of protecting the cylinder from severe environments.

NOTE: Standard plating is Brite Zinc.

W CLOSE TOLERANCE STROKE

This option may be specified when a precise stroke length is required and stroke adjustment is not acceptable. By specifying this option, a stroke length with a tolerance of ± .005 will be supplied. Standard stroke tolerance is ± .032.

Maximum stroke for cylinders with close tolerance is 18".

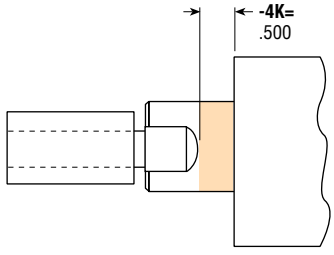
NOTE: This option is not available with shock pads (-B, -BC, or -BR).

_K EXTRA ROD EXTENSION

This option may be specified when extra plain rod extension between rod flats and cylinder snout is desired. Length is specified in 1/8" [1 mm] increments.

Length code example (for imperial units)
-4K = 1/2 of extra rod extension
-8K = 1, etc.

Length code example (for metric units)
-4K = 4 mm of extra rod extension
-12K = 12 mm, etc.



NOTE: On double rod end cylinders and -_K specified will be applied to one end of cylinder only (head end/primary mounting end).

SELF-ALIGNING PISTON ROD COUPLERS

To order, specify the model number.

MODEL NO.	LETTER DIMENSION						
	A	B	C	D	E	F	G
375	3/8-24	1.000	.625	1.875	.500	.875	.219
437	7/16-20	1.125	.650	2.187	.500	1.000	.250
500	1/2-20	1.125	.650	2.187	.500	1.000	.312

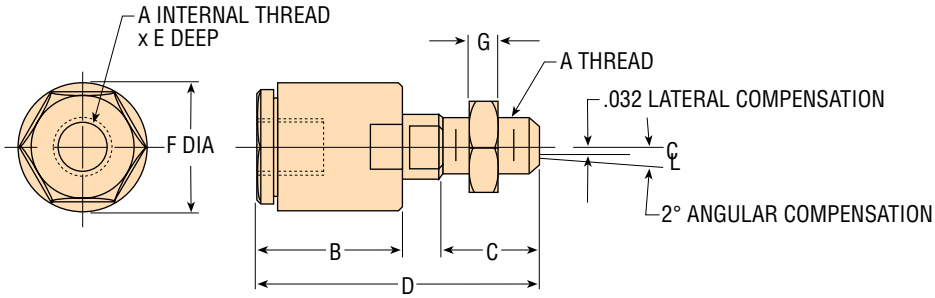
Rod Couplers eliminate expensive precision machining for mounting fixed or rigid cylinder on guide or slide applications.

Cylinder efficiency is increased by eliminating friction caused by misalignment. Couplers compensate for 2° angular error and 1/32" lateral misalignment on push and pull stroke.

Couplers provide greater reliability and reduce cylinder and component wear, simplifying alignment problems in the field.

Rod Couplers are manufactured from high tensile and hardened steel components.

For metric piston rod couplers, see page 1-44.

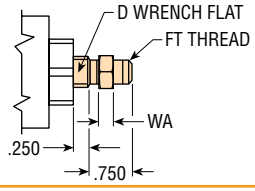


All dimensions are reference only unless specifically toleranced.

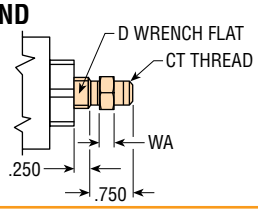
OPTIONS: SERIES AV, HV; 1-3/8" BORE

1-3/8" BORE CYLINDERS

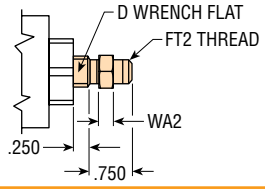
G
ROD END STYLE #2
STANDARD ON:
(1-3/8" BORE)



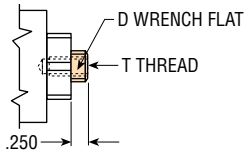
L
COARSE THREAD ROD END



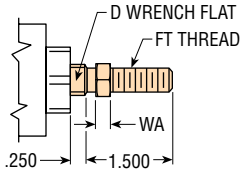
F
ROD END STYLE #1



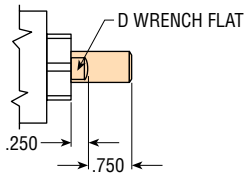
I
ROD END STYLE #4



J
ROD END STYLE #2X



N
PLAIN ROD END

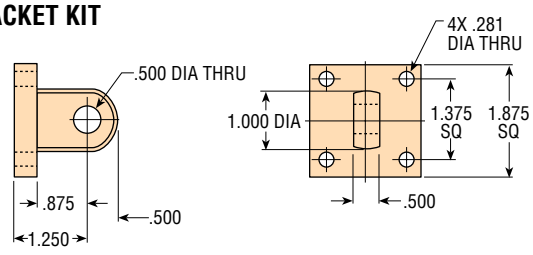


All standard rod ends have four wrench flats (two wrench flats with "I" option).

BORE SIZE	ROD TYPE	ROD DIA.	LETTER DIMENSION CT	D	FT	FT2	T	WA	WA2
1-3/8	STANDARD	.500	3/8-16	7/16	3/8-24	7/16-20	3/8-24 x .625 DP	.219	.250
	OVERSIZE	.625	7/16-14	9/16	7/16-20	1/2-20	7/16-20 x .625 DP	.250	.312

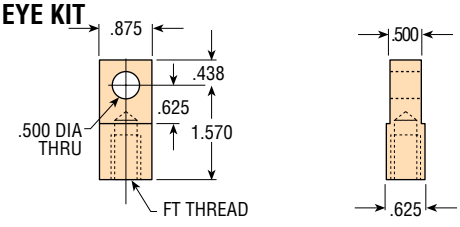
NOTE: On double rod cylinders, both rod ends will be the same on both ends of the cylinder.

EYE BRACKET KIT



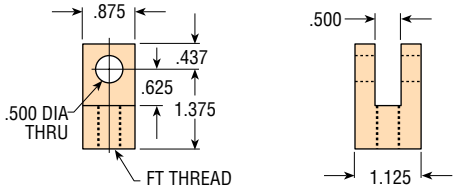
BORE SIZE	PART NO.
1-3/8	1330

ROD EYE KIT



BORE SIZE	PART NO.	LETTER DIMENSION FT
1-3/8	1375-01	3/8-24 x .750 DP
1-3/8	1375-02	7/16-20 x .750 DP
1-3/8	1375-03	1/2-20 x .750 DP

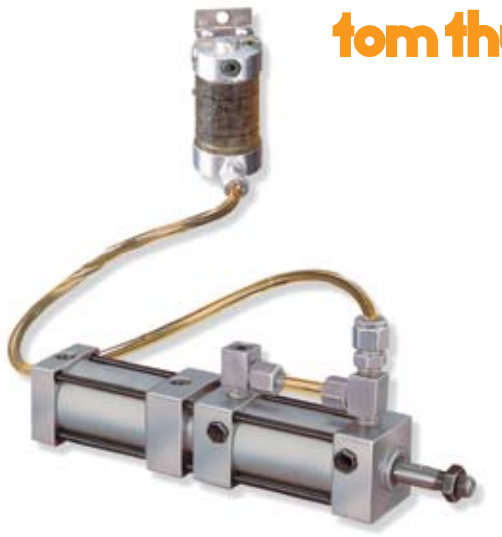
ROD CLEVIS KIT - PIN INCLUDED



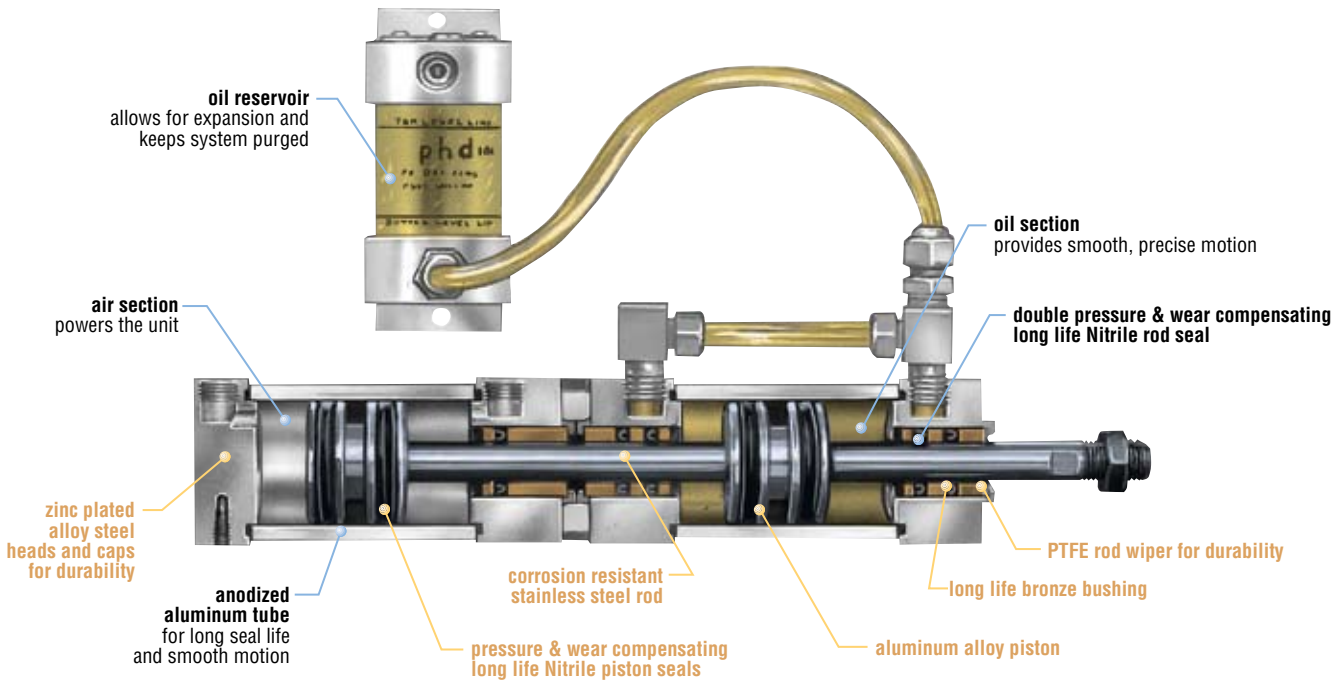
BORE SIZE	KIT NO.	LETTER DIMENSION FT
1-3/8	12909	3/8-24 TO SLOT
1-3/8	12910	7/16-20 TO SLOT
1-3/8	12911	1/2-20 TO SLOT

TANDEM CYLINDERS 3/4", 1", 1-1/8", AND 1-3/8" BORE FOR DUAL POWER WITHOUT -Z OR -X OPTIONS

tom thumb®



SERIES TD
Cutaway depicts a 1-1/8" bore with -C option.



Major Benefits

- Precise speed control and smooth operation at low velocities with -C option
- Long life design for low maintenance
- NFPA repairable for extended life providing long term savings
- Wide range of options for easy application and reduced design time
- Two working day delivery
- Wide range of mounting styles for easy installation

Industry Uses

- Packaging
- Assembly machines
- Machine loading/unloading
- Slow speed/precision applications
- General industrial automation

ORDERING DATA: SERIES TD AIR/OIL TANDEM 3/4", 1", 1-1/8", 1-3/8" BORE

TO ORDER SPECIFY:
Series, Mounting Style, Bore Size, Stroke, and Options.

BORE SIZE

3/4" BORE
1/4" Rod Dia.
1/4-28 Thread

1" BORE
5/16" Rod Dia.
5/16-24 Thread

1-1/8" BORE
3/8" Rod Dia.
3/8-24 Thread

1-3/8" BORE
1/2" Rod Dia.
3/8-24 Thread

OPTIONS

E - Magnetic Piston for PHD Hall Effect Switches
M - Magnetic Piston for PHD Reed Switches
V - Fluoro-Elastomer Seals

CYLINDER SERIES

TD - 150 psi Air

TD F 1-1/8 x 3 - X-M

MOUNTING STYLE

F - Foot Mount, C'bored thru holes
B - Bottom Mount, Tapped holes in head and cap
R - Rod Mount, Tapped holes on front face of head
T - Thread Mount, Threaded snout on head (shipped with mounting nut)
RF - Rod End Flange
CF - Cap End Flange
*L - Mount, Threaded snout and pilot diameter on head (shipped with mounting nut)
*P - Pivot Mount, Pivot on cap
**K - Clevis Mount, Clevis on cap

* Available on 3/4", 1", and 1-1/8" Bore only
** Available on 1-3/8" Bore only

STANDARD STROKE LENGTHS

3/4" BORE SIZE
1/4" to 6"
1" and 1-1/8" BORE SIZES
1/4" to 9"
in 1/4" increments

1-3/8" BORE SIZE
1/2" to 12"
in 1/2" increments

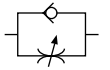
For Longer Strokes, Consult PHD.

TANDEM OPTION

X - Crossover Tube must be specified to receive the unit with Crossover Tube and Fittings filled with oil for use as Air/Oil Tandem (crossover tube only)
C - Includes -X above with the reservoir plumbed to the head end. Foruse as Air/Oil crossover with reservoir

Standard Feature

PORT CONTROL®



BUILT-IN METER OUT FLOW CONTROL VALVE

PROXIMITY SWITCH MOUNTING BRACKETS

SERIES	BORE	SIZE NO.
TD	3/4"	-31
	1"	-32
	1-1/8"	-33
	1-3/8"	-34

See Switches and Sensors section for complete ordering information.

Consult PHD for Maintenance Videos.

SPECIFICATIONS	SERIES TD
OPERATING PRESSURE	
STANDARD	20 psi min to 150 psi max air
WITH -X OR -C	30 psi min to 150 psi max air
RESERVOIR PRESSURE	20 psi recommended
OPERATING TEMPERATURE	-20° to +180°F [-28° to +82°C]
STROKE TOLERANCE	± .032
LUBRICATION	Permanently lubricated
TANDEM FLUID	SAE 32 weight oil (viscosity at 100°F is 158. SSU at 250° is 45.1)
MAINTENANCE	Field repairable

CYLINDER FORCE TABLE

SERIES	CYLINDER BORE	ROD DIAMETER	ROD DIRECTION	EFFECTIVE AREA FORCE WITH -C OR -X lb/psi	EFFECTIVE AREA FORCE W/OUT -C OR -X lb/psi	FREE AIR CONSUMPTION 80 lbs CUBIC ft/in OF STROKE	DISPLACEMENT gal./in OF STROKE
TD	3/4	1/4	EXTEND	.442	.835	.0016	.0019
			RETRACT	.393	.786	.0014	.0017
	1	5/16	EXTEND	.785	1.494	.0029	.0034
			RETRACT	.709	1.418	.0026	.0031
	1-1/8	3/8	EXTEND	.994	1.877	.0037	.0043
			RETRACT	.883	1.766	.0032	.0038
	1-3/8	1/2	EXTEND	1.485	2.774	.0055	.0064
			RETRACT	1.289	2.578	.0048	.0056

MAXIMUM ALLOWABLE EXTEND STROKE

SERIES	ROD DIAMETER	CYLINDER FORCE (lb) 100	200	500	1000	1500	2000	3000	5000
3/4",1", 1-1/8" TD	1/4	12"	9"	6"	—	—	—	—	—
	5/16	18"	13"	8"	—	—	—	—	—
	3/8	26"	18"	12"	—	—	—	—	—
1-3/8" TD	1/2	48"	34"	21"	—	—	—	—	—

Field Maintenance Videos on filling and bleeding Air/Oil Tandem Actuators are available. Contact your local PHD distributor or call our toll free number: 1-800-624-8511. Or go online to www.phdinc.com to view working cutaways and applications.

MAXIMUM AIR/OIL TANDEM CYLINDER VELOCITY in/sec

PRESSURE psi		BORE 3/4"	1"	1-1/8"	1-3/8"
40	Extend	0.68	2.26	2.66	3.07
	Retract	1.00	2.26	2.30	2.60
60	Extend	1.26	3.07	3.33	4.13
	Retract	1.50	3.00	3.24	3.52
80	Extend	1.71	3.42	4.28	4.80
	Retract	2.00	3.42	3.87	4.44
100	Extend	2.06	4.28	5.00	5.21
	Retract	2.44	4.44	4.61	4.80

Minimum recommended velocity for all bore sizes at pressures from 40 to 150 psi is .133 in/sec.

CYLINDER FORCE CALCULATIONS

IMPERIAL

$F = P \times A$

F =	Cylinder Force	lbs
P =	Operating Pressure	psi
A =	Effective Area (Extend or Retract)	in^2

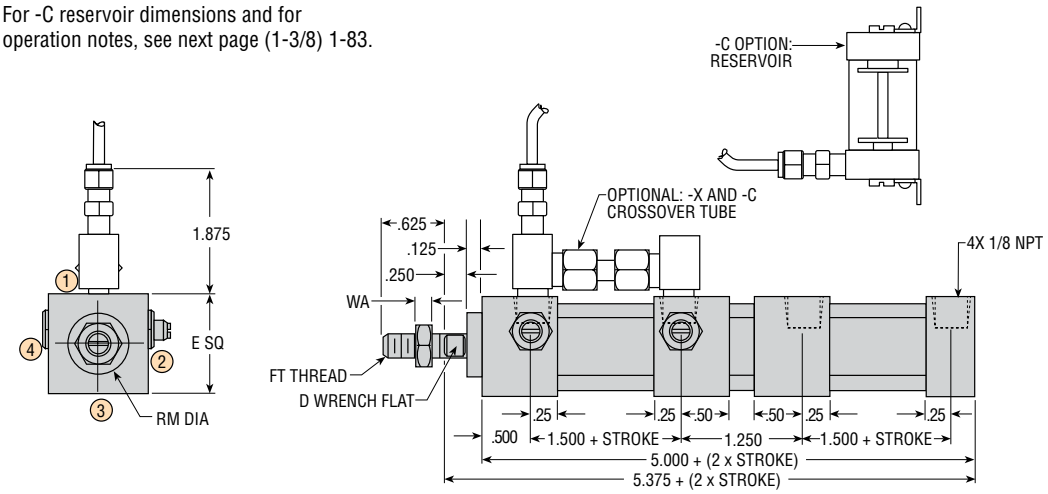
SIZING AND APPLICATION ASSISTANCE

See PHD Product Sizing Catalog for specific and complete sizing information.
Online sizing assistance is available at: ***www.phdinc.com/apps/sizing***

DIMENSIONS: SERIES TD AIR/OIL TANDEM 3/4", 1", 1-1/8", BORE

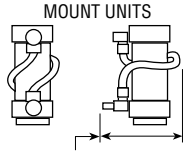
BASIC CYLINDER DIMENSIONS

For -C reservoir dimensions and for operation notes, see next page (1-3/8) 1-83.



TUBE CROSSOVER VIEW

FOR NON F OR B MOUNT UNITS

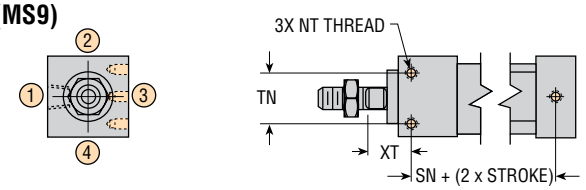


TUBE COIL DIAMETER APPROXIMATELY 9" SEE NOTE 1*

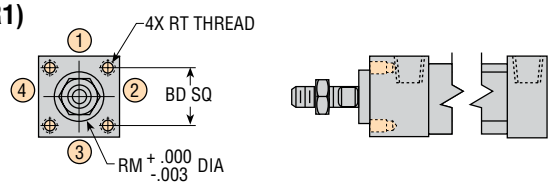
F & B MOUNT UNITS

TUBE COIL DIAMETER APPROXIMATELY 9" SEE NOTE 1*

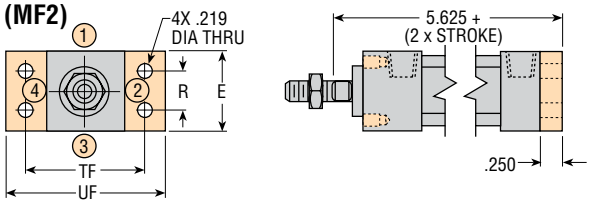
B (MS9)



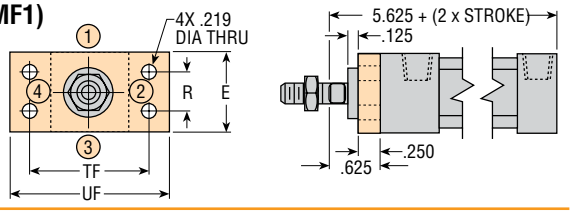
R (MR1)



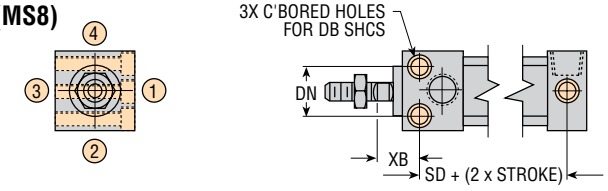
CF (MF2)



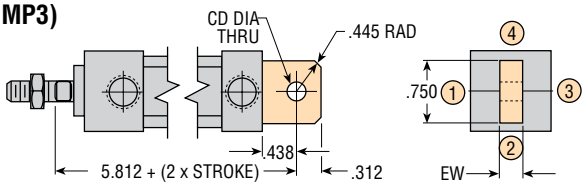
RF (MF1)



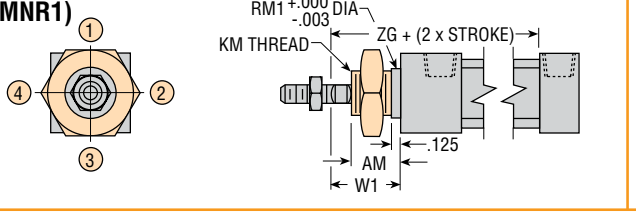
F (MS8)



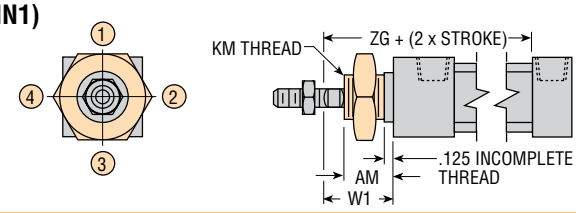
P (MP3)



L (MNR1)



T (MN1)



All standard rod ends have four wrench flats (two wrench flats with "I" option).

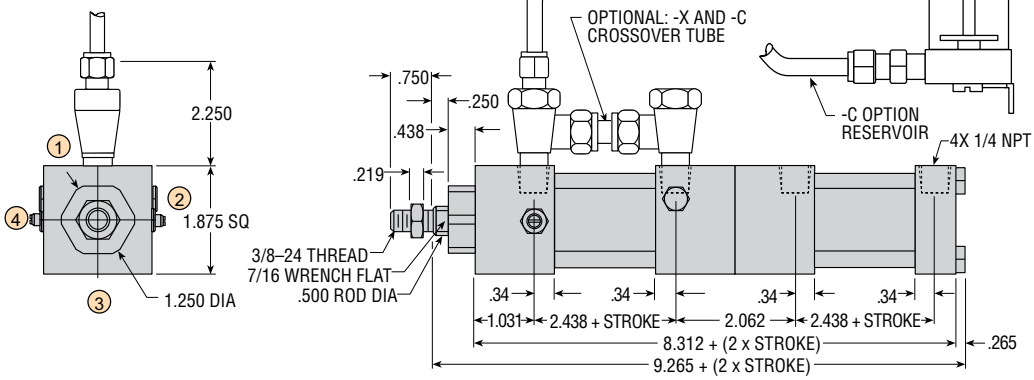
BORE	LETTER DIMENSION																								
SIZE	AM	BD	CD	D	DB	DN	E	EW	FT	KM	NT	R	RM	RM1	RT	SD	SN	TF	TN	UF	WA	W1	XB	XT	ZG
3/4	.625	.750	.250	3/16	#8	.625	1.000	.250	1/4-28	5/8-18	8-32 x .18 DP	.500	.625	.687	8-32 x .25 DP	4.593	4.593	1.500	.625	2.000	.156	.875	.562	.562	5.875
1	.625	1.000	.375	1/4	#10	.875	1.375	.375	5/16-24	3/4-16	10-32 x .25 DP	.875	.750	.812	8-32 x .25 DP	4.531	4.531	1.875	.875	2.375	.188	.875	.625	.625	5.875
1-1/8	.875	1.125	.375	5/16	#10	1.000	1.500	.375	3/8-24	1-14	10-32 x .25 DP	1.000	.750	1.062	10-32 x .25 DP	4.531	4.531	2.000	1.000	2.500	.219	1.125	.625	.625	6.125

PORT POSITIONS: INDICATED BY CIRCLED NUMBERS
NOTE: *FOR -X AND -C OPTIONS WITH STROKES OF 1/2" OR LESS, THE CROSSOVER TUBE WILL BE COILED AROUND CYLINDERS FOR ALL NON B OR F MOUNTING UNITS. F & B MOUNTING UNITS WILL HAVE TUBE COILED ABOVE CYLINDER DUE TO DISTANCE BETWEEN FITTINGS. SEE DETAIL ABOVE.

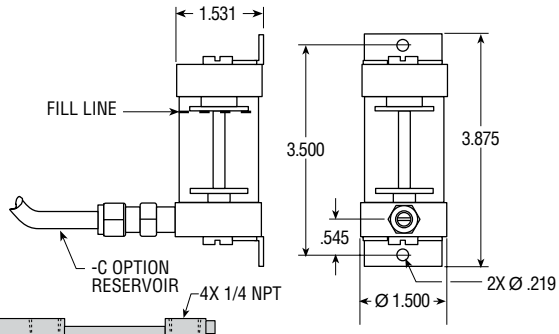
All dimensions are reference only unless specifically toleranced.

DIMENSIONS: SERIES TD AIR/OIL TANDEM 1-3/8" BORE

BASIC CYLINDER DIMENSIONS



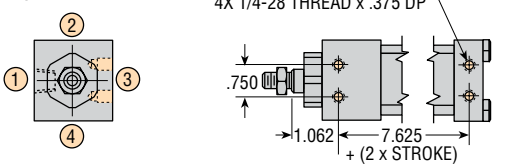
TANK DIMENSIONS



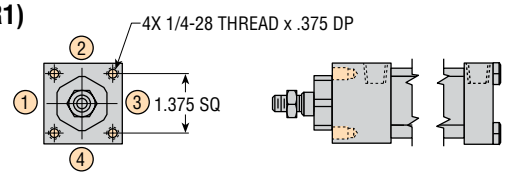
-C Option Air/Oil Tandem Mounting and Operation Notes:

1. Mount reservoir vertically above hydraulic section. Excess tubing may be coiled or cut off. Shortening of tubing should be done in a fashion as to keep oil loss to a minimum. Tubing and crossover below cut must be kept full of oil at all times.
2. A constant air supply of 20 psi to be on inlet port of reservoir during operation. Use of E-stop or other applications with pressure lost to reservoir may cause rod seal seepage. PHD recommends use of check valve in circuit on reservoir port.
3. Oil level in reservoir should be kept at level indicated on label of tube.

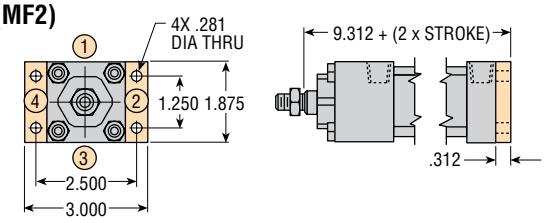
B (MS4)



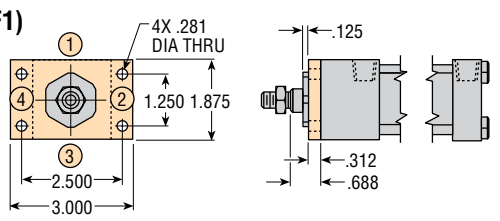
R (MR1)



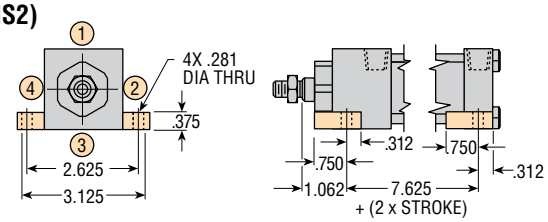
CF (MF2)



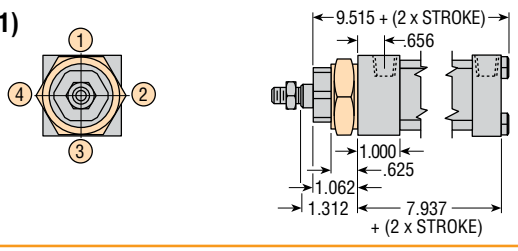
RF (MF1)



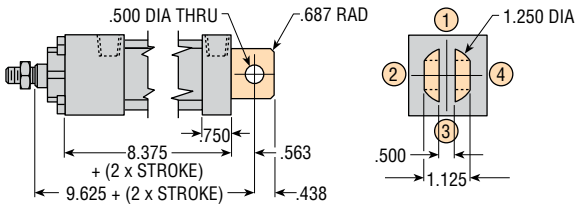
F (MS2)



T (MN1)



K (MP1)



All standard rod ends have four wrench flats (two wrench flats with "I" option).

PORT POSITIONS: INDICATED BY CIRCLED NUMBERS

MAGNETIC PISTON FOR USE WITH PHD PROXIMITY SWITCHES

E HALL EFFECT SWITCHES

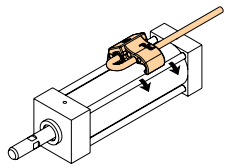
PHD Cylinders may be equipped with a magnetic band (specify -E) on the piston which activates externally mounted PHD Hall Effect Switches. These switches allow the interfacing of the Tom Thumb® air or hydraulic cylinder to various logic systems. This option is for use with the following switches.

COMPACT HALL EFFECT SWITCHES

PART NO.	DESCRIPTION
17503-2-06	NPN Type 10-30 VDC
17504-2-06	PNP Type 10-30 VDC
17523-2	NPN Type 10-30 VDC, Quick Connect
17524-2	PNP Type 10-30 VDC, Quick Connect

See Switches and Sensors section for complete switch information.

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 piston 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 10-30 VDC
17509-3-06	AC Type 110-120 VAC with Current Limit
17522-2	Sink or Source Type 10-30 VDC, Quick Connect
17529-3	AC Type 110-120 VAC, Quick Connect with Current Limit

See Switches and Sensors section for complete switch information.

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.

X CROSSOVER TUBE

AIR/OIL TANDEM MODELS ONLY (SERIES TD)

Available on Series TD tandem models only. These tandem models provide the smooth control of hydraulics with the simplicity of pneumatics. The -X option must be specified to receive the air/oil tandem units filled with oil and bled of air. (It is recommended that these units be used with reservoir and 20 psi oil pressure.)

C RESERVOIR ASSEMBLY PLUMBED

AIR/OIL TANDEM MODELS ONLY (SERIES TD)

See previous page for dimensions.

Available on Series TD tandem models only. The reservoir assembly is plumbed to the unit and is bled of air for easy installation. (Includes -X option).

1) Mount reservoir vertically above hydraulic section. Extra tubing may be coiled or cut off. Shorten tubing in a manner that minimizes oil loss. Tubing and crossover should be kept full at all times.

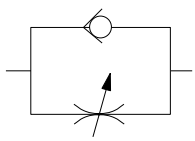
2) Keep a constant 20 psi on inlet port of reservoir during operation.

3) Oil level in reservoir should be kept at levels indicated on tube label.

STANDARD 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 cylinder end cap and are used to control the speed of the cylinder over its entire stroke.

The self-locking needle has micrometer threads and 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 cylinder, but opens to permit full flow of incoming fluids. The PHD Port Control® provides the optimum in speed control for small bore cylinders. It saves space and eliminates the cost of installation and fittings for external flow control valves.



All dimensions are reference only unless specifically toleranced.

SELF-ALIGNING PISTON ROD COUPLERS

To order, specify the model number.

MODEL NO.	LETTER DIMENSION						
	A	B	C	D	E	F	G
250	1/4-28	1.000	.625	1.875	.500	.875	.156
312	5/16-24	1.000	.625	1.875	.500	.875	.187
375	3/8-24	1.000	.625	1.875	.500	.875	.219
437	7/16-28	1.125	.650	2.187	.500	1.000	.250
500	1/2-20	1.125	.650	2.187	.500	1.000	.312

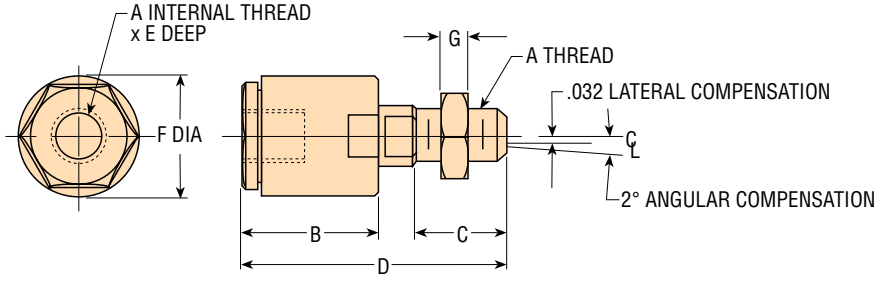
Rod Couplers eliminate expensive precision machining for mounting fixed or rigid cylinder on guide or slide applications.

Cylinder efficiency is increased by eliminating friction caused by misalignment. Couplers compensate for 2° angular error and 1/32" lateral misalignment on push and pull stroke.

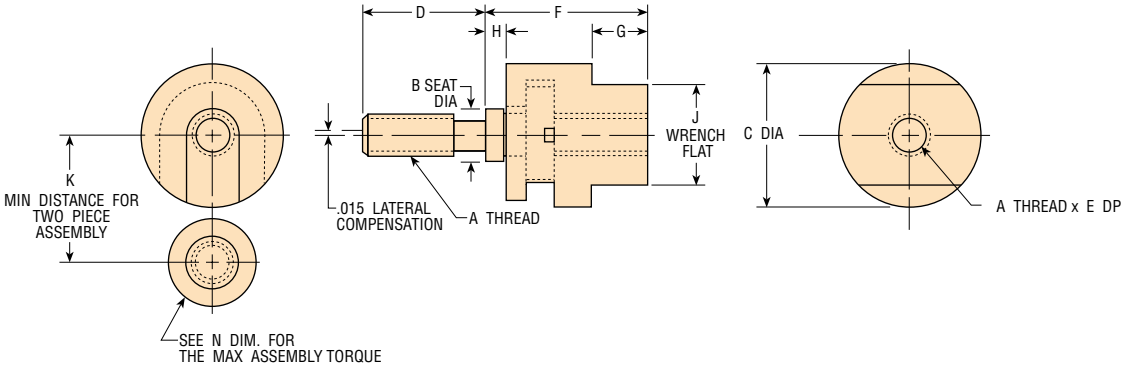
Couplers provide greater reliability and reduce cylinder and component wear, simplifying alignment problems in the field.

Rod Couplers are manufactured from high tensile and hardened steel components.

For metric piston rod couplers, see page 1-44.



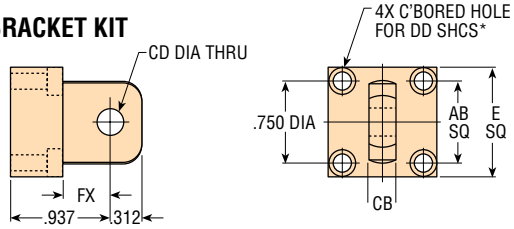
MINIATURE COUPLERS



MODEL NO.	LETTER DIMENSION										
	A	B	C	D	E	F	G	H	J	K	N
19300-01	5-40	.160	.440	.375	.250	.500	.170	.066	5/16	.390	20 in-lbs
19300-02	10/32	.250	.560	.500	.281	.558	.200	.058	3/8	.490	70 in-lbs

ACCESSORIES: SERIES TD AIR/OIL TANDEM 3/4", 1", 1-1/8", 1-3/8" BORE

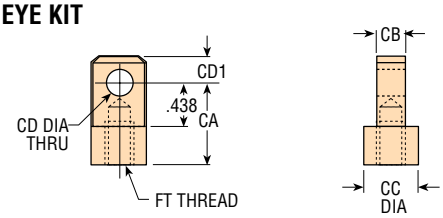
EYE BRACKET KIT



BORE SIZE	PART NO.	LETTER DIMENSION AB	CB	CD	DD*	E	FX
3/4	1077-01	.750	.248	.250	#6	1.000	.577
1 & 1-1/8	1077-03	1.000	.373	.375	#10	1.375	.437

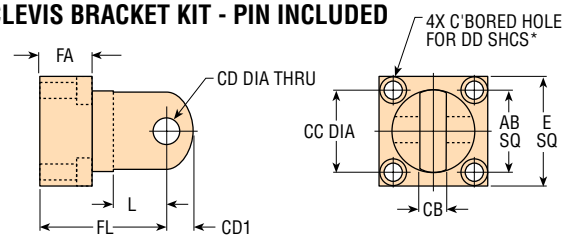
*For 3/4 bore thru hole only.

ROD EYE KIT



BORE SIZE	PART NO.	LETTER DIMENSION CA	CB	CC	CD	CD1	FT
3/4	1075-01	.750	.248	.500	.250	.250	1/4-28 x .375 DP
1	1075-04	.875	.373	.750	.375	.375	5/16-24 x .375 DP
1-1/8	1075-05	.875	.373	.750	.375	.375	3/8-24 x .312 DP

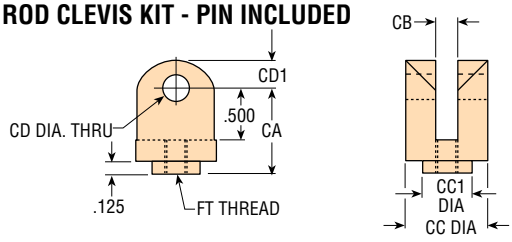
CLEVIS BRACKET KIT - PIN INCLUDED



BORE SIZE	KIT NO.	LETTER DIMENSION AB	CB	CC	CD	CD1	DD*	E	FA	FL	L
3/4	12901	.750	.254	.750	.250	.250	#6	1.000	.360	1.187	.500
1 & 1-1/8	12903	1.000	.379	.875	.375	.375	#10	1.375	.500	1.250	.531

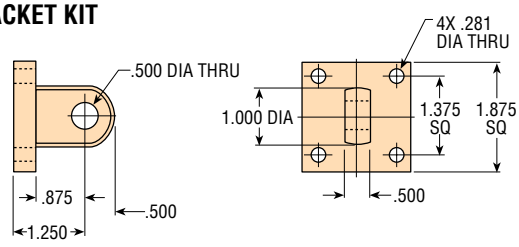
*For 3/4 bore thru hole only.

ROD CLEVIS KIT - PIN INCLUDED



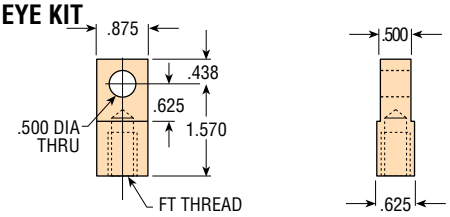
BORE SIZE	KIT NO.	LETTER DIMENSION CA	CB	CC	CC1	CD	CD1	FT
3/4	12904	.812	.254	.750	.437	.250	.250	1/4-28 TO SLOT
1	12906	.875	.379	.875	.562	.375	.375	5/16-24 TO SLOT
1-1/8	12908	.875	.379	.875	.562	.375	.375	3/8-24 TO SLOT

EYE BRACKET KIT



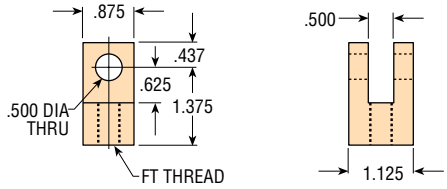
BORE SIZE	PART NO.
1-3/8	1330

ROD EYE KIT



BORE SIZE	PART NO.	LETTER DIMENSION FT
1-3/8	1375-01	3/8-24 x .750 DP
1-3/8	1375-02	7/16-20 x .750 DP

ROD CLEVIS KIT - PIN INCLUDED



BORE SIZE	KIT NO.	LETTER DIMENSION FT
1-3/8	12909	3/8-24 TO SLOT
1-3/8	12910	7/16-20 TO SLOT

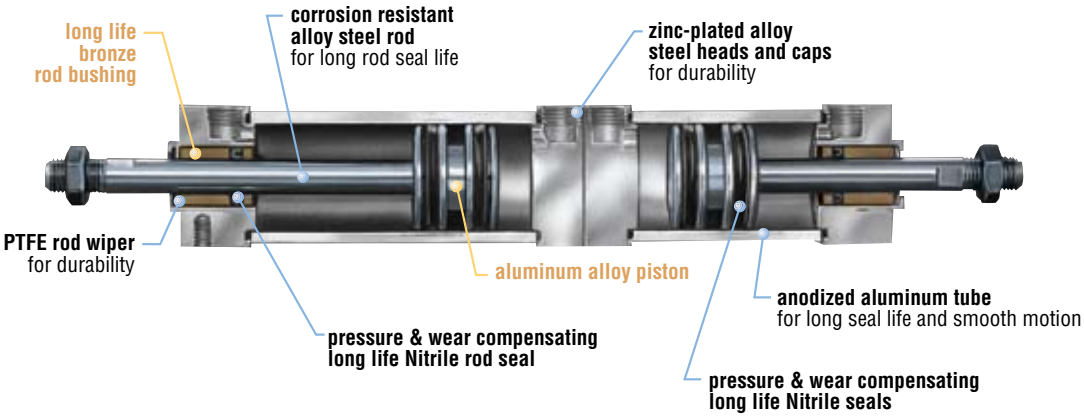
All dimensions are reference only unless specifically toleranced.

AV2, HV2, A2

tom thumb®

SERIES AV2, HV2, A2 BACK-TO-BACK 3/4", 1", 1-1/8", AND 1-3/8" BORE

Series AV2
Cutaway depicts a 1-1/8" bore AV2 unit.



Major Benefits

- Four linear positions with double rod
- Long life design for low maintenance
- NFPA repairable for extended life providing long term savings
- Wide range of options for easy application and reduced design time
- Two working days delivery
- Wide range of mounting styles for easy installation
- Simple four position operation

Industry Uses

- Packaging
- Assembly machines
- Machine loading/unloading
- General industrial automation
- Gate/diverter applications

ORDERING DATA: A2, AV2, HV2, BACK-TO-BACK; 3/4", 1", 1-1/8", 1-3/8" BORE

TO ORDER SPECIFY:
Series, Type, Mounting Style, Bore Size, Cylinder 1 Stroke, Cylinder 2 Stroke, and Options.

BORE SIZE
3/4" BORE
1/4" Rod Dia.
1/4-28 Thread

1" BORE
5/16" Rod Dia.
5/16-24 Thread

1-1/8" BORE
3/8" Rod Dia.
3/8-24 Thread

1-3/8" BORE
1/2" Rod Dia.
3/8-24 Thread

Options may affect unit length. See unit dimension and options pages for adders.

STANDARD STROKE CYLINDER 1

BORE	STROKE
3/4"	1/4" to 6"
1" & 1-1/8"	1/4" to 9"
1-3/8"	1/2" to 12"

Consult PHD for longer lengths.

STANDARD STROKE CYLINDER 2

BORE	STROKE
3/4"	1/4" to 6"
1" & 1-1/8"	1/4" to 9"
1-3/8"	1/2" to 12"

Consult PHD for longer lengths.

CYLINDER SERIES
AV - 150 psi Air
HV - 1500 psi Hyd.
A - 150 psi Air
(Series A not available in 1-3/8" Bore.)

AV 2 B 1-3/8 x 2 x 1 - P-M

TYPE
2 - Back to Back Cylinder

MOUNTING STYLE
F - Foot Mount, C'bored through holes
B - Bottom Mount, Tapped holes in head and cap
R - Rod Mount, Tapped holes on front face of head
T - Thread Mount, Threaded snout on head (shipped with mounting nut)
RF - Rod end flange
*L - Pilot Mount, Threaded snout and pilot diameter on head (shipped with mounting nut)
* Available on 3/4", 1", and 1-1/8" Bore only

OPTIONS
B - Shock Pads on both ends of each cylinder (not available on Series HV2)
D - Cushion on both ends of each cylinder (not available on Series HV2 3/4", 1", and 1-1/8" sizes)
E - Magnetic Pistons on both cylinders for PHD Hall Effect Switches (not available on Series A)
M - Magnetic Pistons on both cylinders for PHD Reed Switches (not available on Series A)
P - Port Controls® on both ends of each cylinder
V - Fluoro-Elastomer Seals

PROXIMITY SWITCH MOUNTING BRACKETS

SERIES	BORE	SIZE NO.
AV, HV	3/4"	-31
	1"	-32
	1-1/8"	-33
	1-3/8"	-34

See Switches and Sensors section for complete ordering information.

SPECIFICATIONS	SERIES AV2	SERIES HV2	SERIES A2
OPERATING PRESSURE	20 to 150 psi air	40 to 1500 psi hyd*	20 to 150 psi air
OPERATING TEMPERATURE	-20° to 180°F [-29° to 82°C]	-20° to 180°F [-29° to 82°C]	-20° to 180°F [-29° to 82°C]
STROKE TOLERANCE	±.032	±.032	±.032
LUBRICATION	Permanently lubricated	—	Permanently lubricated
MAINTENANCE	Field repairable	Field repairable	Field repairable

*Hydraulic rating is based on non-shock hydraulic service.

CYLINDER FORCE TABLE

SERIES	CYLINDER BORE	ROD DIAMETER	ROD DIRECTION	EFFECTIVE AREA FORCE lb/psi	FREE AIR CONSUMPTION 80 lbs CUBIC ft/in OF STROKE	DISPLACEMENT gal./in OF STROKE
AV2, HV2, A2	3/4	1/4	EXTEND	.442	.0016	.0019
			RETRACT	.393	.0014	.0017
	1	5/16	EXTEND	.785	.0029	.0034
			RETRACT	.709	.0026	.0031
	1-1/8	3/8	EXTEND	.994	.0037	.0043
			RETRACT	.883	.0032	.0038
	1-3/8	1/2	EXTEND	1.485	.0055	.0064
			RETRACT	1.289	.0048	.0056

MAXIMUM ALLOWABLE EXTEND STROKE

SERIES	ROD DIAMETER	CYLINDER FORCE (lb) 100	200	500	1000	1500	2000	3000	5000
3/4",1", 1-1/8" AV2, HV2, A2	1/4	12"	9"	6"	4"	3"	2"	—	—
	5/16	18"	13"	8"	6"	5"	4"	—	—
	3/8	26"	18"	12"	9"	7"	6"	—	—
1-3/8" AV2, HV2	1/2	48"	34"	21"	15"	12"	11"	—	—

SERIES	CYLINDER BORE	UNIT WEIGHTS (lb) ZERO STROKE	ADDER PER INCH OF STROKE
AV2 PLAIN	3/4	.42	.04
	1	.87	.07
	1-1/8	.95	.10
	1-3/8	2.56	.12

CYLINDER FORCE CALCULATIONS

IMPERIAL

$F = P \times A$

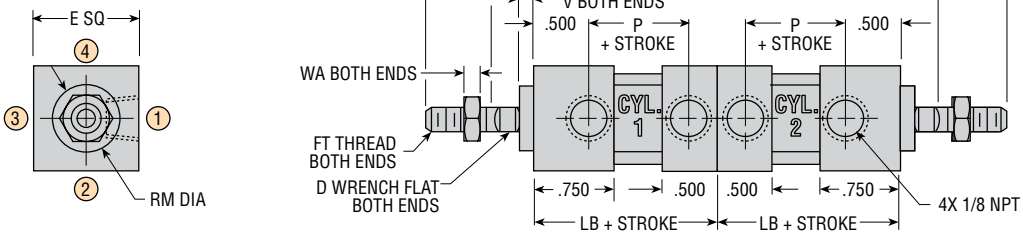
F = Cylinder Force — lbs
P = Operating Pressure — psi
A = Effective Area (Extend or Retract) — in^2

SIZING AND APPLICATION ASSISTANCE

See PHD Product Sizing Catalog for specific and complete sizing information. Online sizing assistance is available at: ***www.phdinc.com/apps/sizing***

DIMENSIONS: SERIES A2, AV2, HV2 BACK-TO-BACK; 3/4", 1", 1-1/8" BORE

BASIC CYLINDER DIMENSIONS



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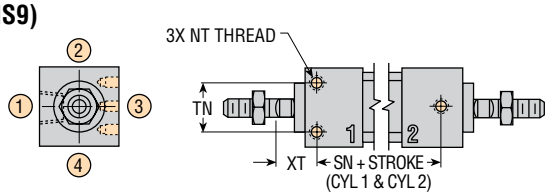
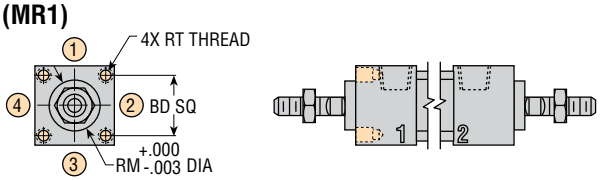


R (MR1)



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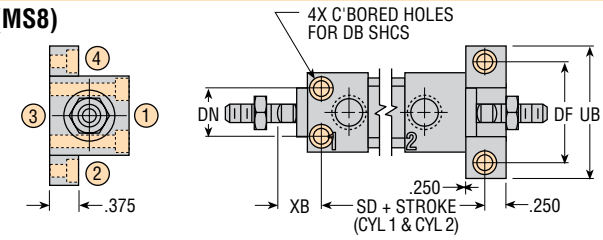

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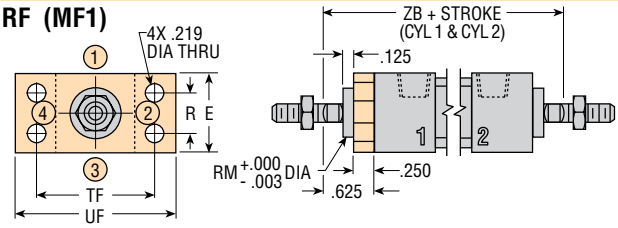
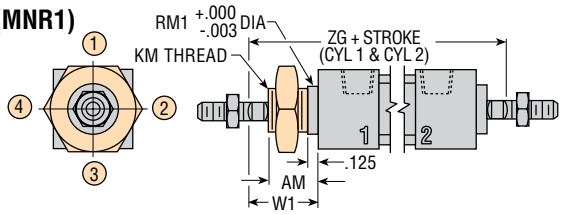


L (MNR1)



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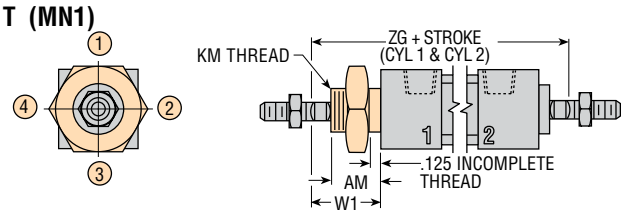


All standard rod ends have four wrench flats (two wrench flats with "I" option).

DIMENSIONS COMMON TO ALL SERIES

BORE SIZE	LETTER DIMENSION															
	BD	D	DB	DF	DN	E	FT	NT	R	RM	RT	TF	TN	UB	UF	WA
3/4	.750	3/16	#8	1.375	.625	1.000	1/4-28	8-32 x .18 DP	.500	.625	8-32 x .25 DP	1.500	.625	1.750	2.000	.156
1	1.000	1/4	#10	1.750	.875	1.375	5/16-24	10-32 x .25 DP	.875	.750	8-32 x .25 DP	1.875	.875	2.125	2.375	.188
1-1/8	1.125	5/16	#10	1.875	1.000	1.500	3/8-24	10-32 x .25 DP	1.000	.750	10-32 x .25 DP	2.000	1.000	2.250	2.500	.219

SERIES A2 CYLINDERS

BORE SIZE	LETTER DIMENSION													
	AM	KM	LB	P	RM1	SD	SN	V	W1	XB	XT	ZB	ZG	ZR
3/4	.625	5/8-18	1.750	1.000	.687	3.562	3.062	.125	.875	.562	.562	4.500	4.750	4.250
1	.625	3/4-16	1.750	1.000	.812	3.500	3.000	.125	.875	.625	.625	4.500	4.750	4.250
1-1/8	.625	3/4-16	1.750	1.000	.812	3.500	3.000	.125	.875	.625	.625	4.500	4.750	4 250

SERIES AV2 CYLINDERS

BORE SIZE	LETTER DIMENSION													
	AM	KM	LB	P	RM1	SD	SN	V	W1	XB	XT	ZB	ZG	ZR
3/4	.625	5/8-18	2.250	1.500	.687	4.562	4.062	.125	.875	.562	.562	5.500	5.750	5.250
1	.625	3/4-16	2.250	1.500	.812	4.500	4 .000	.125	.875	.625	.625	5.500	5.750	5.250
1-1/8	.875	1-14	2.250	1.500	1.062	4.500	4.000	.125	1.125	.625	.625	5.500	6.000	5.250

SERIES HV2 CYLINDERS

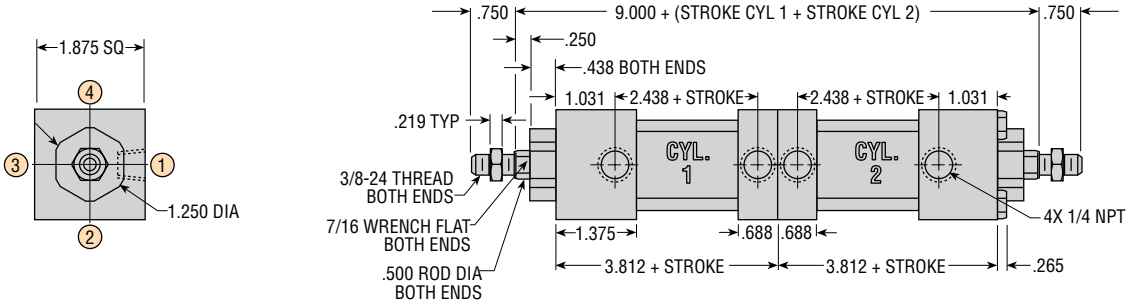
BORE SIZE	LETTER DIMENSION													
	AM	KM	LB	P	RM1	SD	SN	V	W1	XB	XT	ZB	ZG	ZR
3/4	.625	5/8-18	2.250	1.500	.687	4.562	4.062	.375	.875	.812	.812	5.750	6.000	5.750
1	.625	3/4-16	2.250	1.500	.812	4.500	4.000	.375	.875	.875	.875	5.750	6.000	5.750
1-1/8	.875	1-14	2.250	1.500	1.062	4.500	4.000	.375	1.125	.875	.875	5.750	6.250	5.750

PORT POSITIONS: INDICATED BY CIRCLED NUMBERS
CUSHIONS: ADD 1" TO ALL (+ STROKE) DIMENSIONS OF CYLINDER 1 AND CYLINDER 2 (2" TOTAL TO OVERALL)
SHOCK PADS: ADD 1/2" TO ALL (+ STROKE) DIMENSIONS OF CYLINDER 1 AND CYLINDER 2 (1" TOTAL TO OVERALL)

All dimensions are reference only unless specifically toleranced.

DIMENSIONS: SERIES AV2, HV2 BACK-TO-BACK; 1-3/8" BORE

BASIC CYLINDER DIMENSIONS



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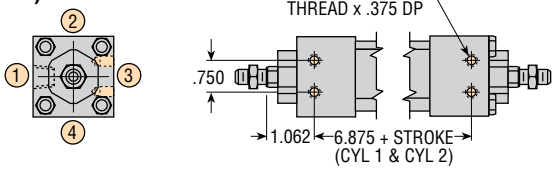

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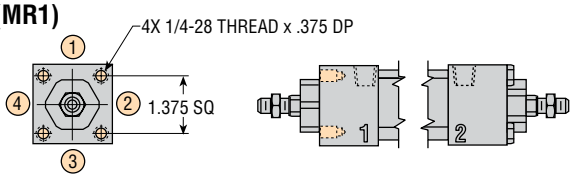
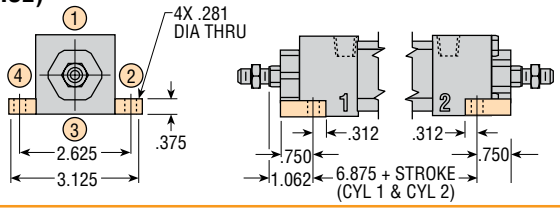
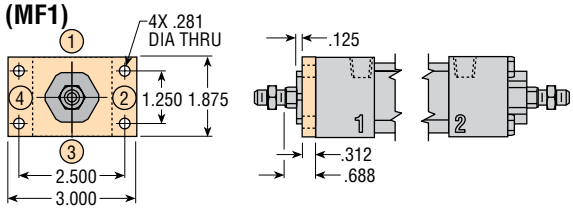


F (MS2)



RF (MF1)



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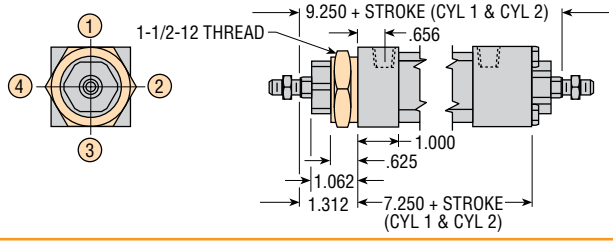


All standard rod ends have four wrench flats (two wrench flats with "I" option).

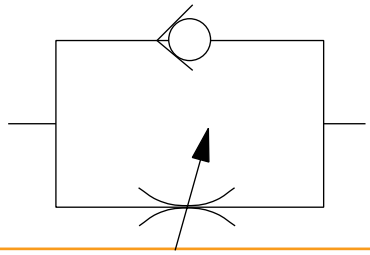
PORT POSITIONS: INDICATED BY CIRCLED NUMBERS
CUSHIONS: CYLINDER LENGTH IS NOT AFFECTED BY ADDITION OF CUSHIONS
SHOCK PADS: ADD 1/2" TO ALL (+ STROKE) DIMENSIONS OF CYLINDER 1 AND CYLINDER 2 (1" TOTAL TO OVERALL)

OPTIONS: SERIES A2, AV2, HV2 BACK-TO-BACK; 3/4", 1", 1-1/8" , 1-3/8" BORE

P 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 cylinder end cap and are used to control the speed of the cylinder over its entire stroke.

The self-locking needle has micrometer threads and 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 cylinder, but opens to permit full flow of incoming fluids. The PHD Port Control® provides the optimum in speed control for small bore cylinders. It saves space and eliminates the cost of installation and fittings for external flow control valves.



D ADJUSTABLE CUSHION

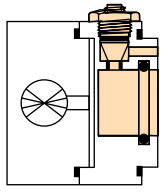
PHD Cushions are designed for smooth deceleration at the end of stroke. When the cushion is activated the remaining volume in the cylinder must exhaust past an adjustable needle which controls the amount of deceleration.

See Dimension pages for dimensional information.

3/4", 1", 1-1/8" Series A2, A2V, H2V = Cushion Block
1-3/8" Series A2V, H2V = Poppet Style

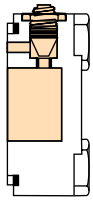
Effective cushion length 1/2"

CUSHION BLOCK



3/4", 1", 1-1/8" BORE

POPPET STYLE

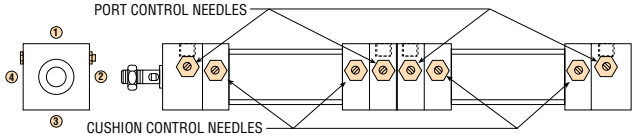


1-3/8" BORE

STANDARD PORT CONTROL® & CUSHION NEEDLE POSITIONS

(3/4", 1", 1-1/8" Bore Series A2, AV2, and HV2 Cylinders)

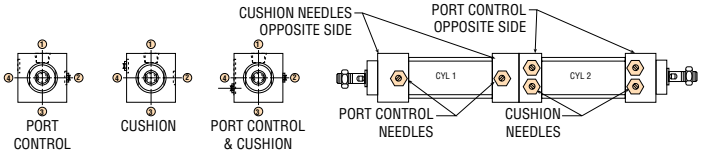
Port Control® and cushion needles are located in position 2 on standard cylinders. They may be located at position 4 when specified on all Series A2, AV2, and HV2. Consult PHD for special Port Control® or cushion needle positions.



STANDARD PORT CONTROL® & CUSHION NEEDLE POSITIONS

(1-3/8" Bore Series AV and HV Cylinders)

Port Control® and cushion needles are located on opposite sides adjacent to port. Please consult distributor or PHD to check availability of special Port Control® or cushion needle positions.

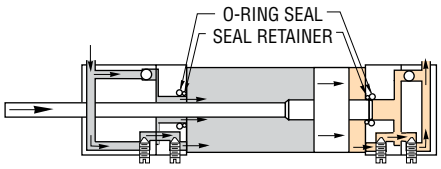


PORT CONTROL® AND ADJUSTABLE CUSHION COMBINATION

(3/4", 1", 1-1/8" Bore Series A2, AV2, and HV2 Cylinders)

Cushion and Port Control® combination arranged in series provides a compact efficient control system for maximum space weight and cost savings. The cushion is activated when the piston extension enters a seal in the cushion block. The remaining volume in the cylinder exhausts past an adjustable needle. A check seal in the adjusting needle is closed during deceleration, but opens to permit full flow for immediate reversing. The cushion seal in the block is an o-ring for air units.

CUSHION BLOCK STYLE

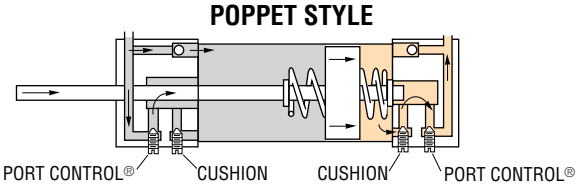


PORT CONTROL® AND ADJUSTABLE CUSHION COMBINATION

(1-3/8" Bore Series AV2 and HV2 Cylinders)

The cushion and Port Control® combination is also available on the 1-3/8" Bore. This cushion is activated when a seal, which is traveling with the piston, seals against the cylinder end cap. This causes the remaining volume in the cylinder to exhaust past an adjustable needle which controls the amount of deceleration. The spring, which extends the seal from the piston, permits the seal to act as a check valve to allow full flow back into the cylinder for immediate reversing. The cushion seal for air units is made of urethane while seals for oil units are close tolerance metal.

POPPET STYLE



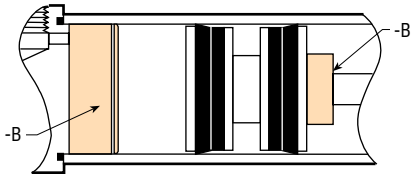
OPTIONS: SERIES A2, AV2, HV2 BACK-TO-BACK; 3/4", 1", 1-1/8" , 1-3/8" BORE

B SHOCK PADS

Polyurethane pads for absorption of shock and noise (not available on hydraulic units). Reducing shock permits higher piston velocities for shorter cycle times. Reducing noise levels provides improved environment for increased productivity. Eliminates metal to metal contact between piston and end caps.

Available together with all options EXCEPT -

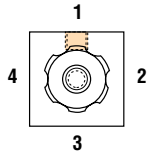
- **Same end as Cushion (-D)**
- **Both ends of both cylinders**



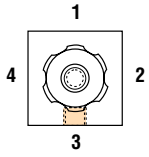
PORT POSITIONS

Port position 1 is standard on all cylinders.

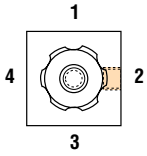
PORT POSITION 1 (STANDARD)



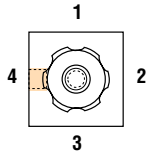
T PORT POSITION 3



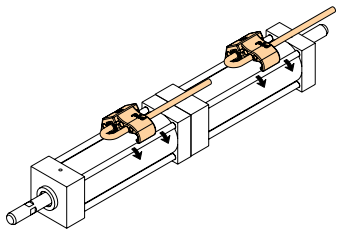
R PORT POSITION 2



U PORT POSITION 4



MAGNETIC PISTON FOR USE WITH PHD PROXIMITY SWITCHES



E HALL EFFECT SWITCHES

PHD Cylinders may be equipped with a magnetic band (specify -E) on the piston which activates externally mounted PHD Hall Effect Switches. These switches allow the interfacing of the Tom Thumb® air or hydraulic cylinder 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 10-30 VDC
17504-2-06	PNP Type 10-30 VDC
17523-2	NPN Type 10-30 VDC, Quick Connect
17524-2	PNP Type 10-30 VDC, Quick Connect

See Switches and Sensors section for complete switch information.

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 piston 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 10-30 VDC
17509-3-06	AC Type 110-120 VAC with Current Limit
17522-2	Sink or Source Type 10-30 VDC, Quick Connect
17529-3	AC Type 110-120 VAC, Quick Connect with Current Limit

See Switches and Sensors section for complete switch information.

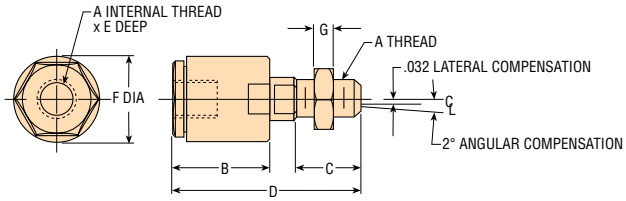
V FLUORO-ELASTOMER SEALS

ACCESSORIES: A2, AV2, HV2 MOUNTING ATTACHMENTS 3/4", 1", 1-1/8" , 1-3/8"

SELF-ALIGNING PISTON ROD COUPLERS

To order, specify the model number.

MODEL NO.	LETTER DIMENSION						
	A	B	C	D	E	F	G
250	1/4-28	1.000	.625	1.875	.500	.875	.156
312	5/16-24	1.000	.625	1.875	.500	.875	.187
375	3/8-24	1.000	.625	1.875	.500	.875	.219
437	7/16-20	1.125	.650	2.187	.500	1.000	.250



Rod Couplers eliminate expensive precision machining for mounting fixed or rigid cylinder on guide or slide applications.

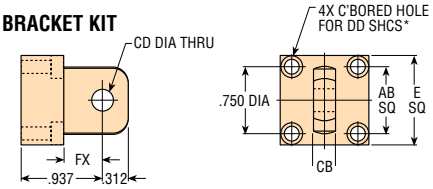
Cylinder efficiency is increased by eliminating friction caused by misalignment. Couplers compensate for 2° angular error and 1/32" lateral misalignment on push and pull stroke.

Couplers provide greater reliability and reduce cylinder and component wear, simplifying alignment problems in the field.

Rod Couplers are manufactured from high tensile and hardened steel components.

For metric piston rod couplers, see page 1-44.

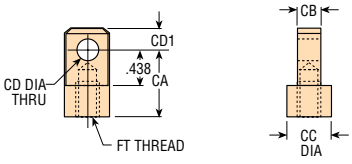
EYE BRACKET KIT



BORE SIZE	CYL SERIES	PART NO.	LETTER DIMENSION					
			AB	CB	CD	DD*	E	FX
3/4	A2, AV2, HV2	1077-01	.750	.248	.250	#6	1.000	.577
1 &	A2	1077-02	1.000	.373	.250	#10	1.375	.437
1-1/8	AV2, HV2	1077-03	1.000	.373	.375	#10	1.375	.437

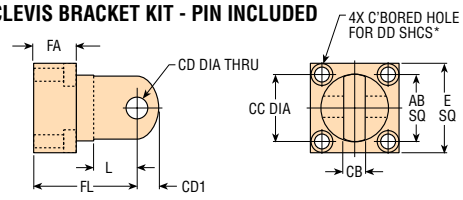
*For 3/4 bore thru hole only.

ROD EYE KIT



BORE SIZE	CYL SERIES	PART NO.	LETTER DIMENSION					
			CA	CB	CC	CD	CD1	FT
3/4	A2, AV2	1075-01	.750	.248	.500	.250	.250	1/4-28 x .375 DP
1	A2	1075-02	.875	.373	.750	.250	.375	5/16-24 x .375 DP
	AV2	1075-04	.875	.373	.750	.375	.375	5/16-24 x .375 DP
1-1/8	A2	1075-03	.875	.373	.750	.250	.375	3/8-24 x .312 DP
	AV2	1075-05	.875	.373	.750	.375	.375	3/8-24 x .312 DP

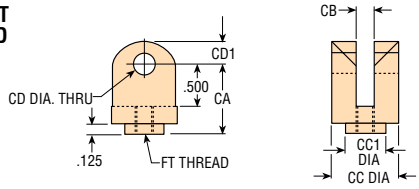
CLEVIS BRACKET KIT - PIN INCLUDED



BORE SIZE	CYL SERIES	KIT NO.	LETTER DIMENSION								
			AB	CB	CC	CD	CD1	DD*	E	FA	FL	L
3/4	A2, AV2	12901	.750	.254	.750	.250	.250	#6	1.000	.360	1.187	.500
1 &	A2	12902	1.000	.379	.875	.250	.375	#10	1.375	.500	1.250	.531
1-1/8	AV2	12903	1.000	.379	.875	.375	.375	#10	1.375	.500	1.250	.531

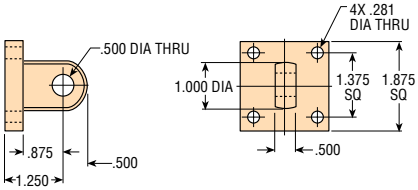
*For 3/4 bore thru hole only.

ROD CLEVIS KIT - PIN INCLUDED



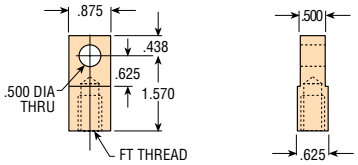
BORE SIZE	CYL SERIES	KIT NO.	LETTER DIMENSION						
			CA	CB	CC	CC1	CD	CD1	FT
3/4	A2, AV2	12904	.812	.254	.750	.437	.250	.250	1/4-28 TO SLOT
1	A2	12905	.875	.379	.875	.562	.250	.375	5/16-24 TO SLOT
	AV2	12906	.875	.379	.875	.562	.375	.375	5/16-24 TO SLOT
1-1/8	A2	12907	.875	.379	.875	.562	.250	.375	3/8-24 TO SLOT
	AV2	12908	.875	.379	.875	.562	.375	.375	3/8-24 TO SLOT

EYE BRACKET KIT



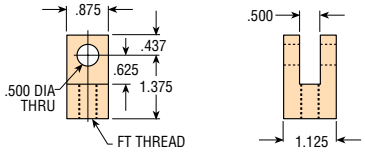
BORE SIZE	CYL SERIES	PART NO.
1-3/8	AV2, HV2	1330

ROD EYE KIT



BORE SIZE	CYL SERIES	PART NO.	LETTER DIMENSION FT
1-3/8	AV2, HV2	1375-01	3/8-24 x .750 DP

ROD CLEVIS KIT - PIN INCLUDED

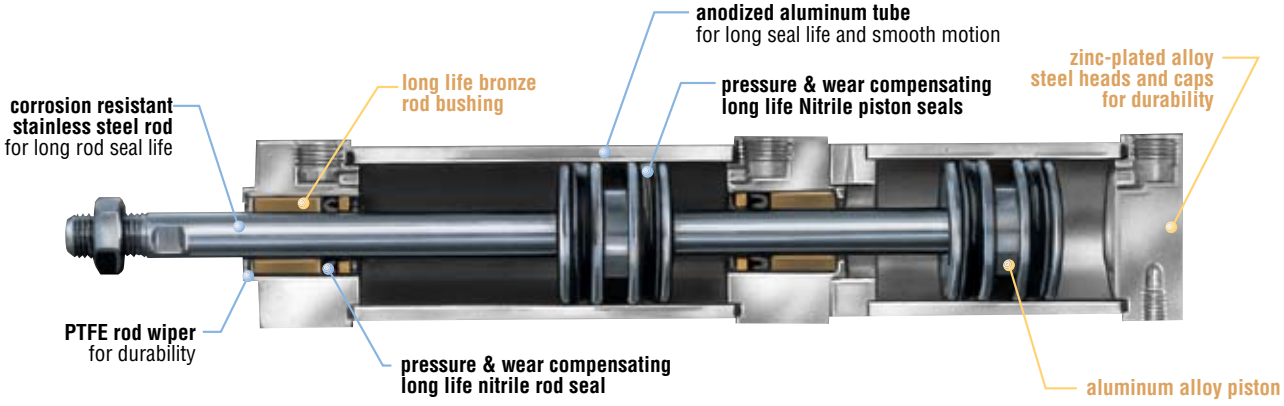


BORE SIZE	CYL SERIES	KIT NO.	LETTER DIMENSION FT
1-3/8	AV2, HV2	12909	3/8-24 TO SLOT

tom thumb®

SERIES A3V, H3V, A3 THREE POSITION 3/4", 1", 1-1/8", AND 1-3/8" BORE

SERIES A3V
Cutaway depicts a 1-1/8" bore A3V unit.



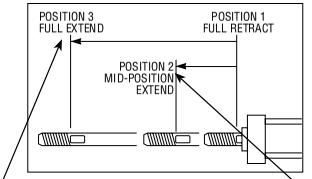
Major Benefits

- Four linear positions from piston rod
- Long life design for low maintenance
- NFPA repairable for extended life providing long term savings
- Wide range of options for easy application and reduced design time
- Two working days delivery
- Wide range of mounting styles for easy installation
- Simple three position operation

Industry Uses

- Packaging
- Assembly machines
- Machine loading/unloading
- General industrial automation
- Gate/diverter applications

ORDERING DATA: SERIES A3, A3V, H3V 3/4", 1", 1-1/8", 1-3/8", 1-3/8" BORE



TO ORDER SPECIFY:
Series, Type, Mounting Style, Bore Size, Cylinder 1 Stroke, Cylinder 2 Stroke, and Options.

CAUTION: HYDRAULIC THREE POSITION CYLINDER (H3V) MUST BE VALVED PROPERLY TO PREVENT BLOCKING OF FLOW FROM THE CENTER PORT WHEN PRESSURIZING THE REAR (CAP) PORT. FAILURE TO DO SO MAY RESULT IN AN INTENSIFICATION OF PRESSURE IN CYLINDER NUMBER 1 CAUSING TIEROD FAILURE.

CYLINDER SERIES
AV - 150 psi Air
HV - 1500 psi Hyd.
A - 150 psi Air
(Series A not available in 1-3/8" Bore.)

BORE SIZE
3/4" BORE
1/4" Rod Dia.
1/4-28 Thread

1" BORE
5/16" Rod Dia.
5/16-24 Thread

1-1/8" BORE
3/8" Rod Dia.
3/8-24 Thread

1-3/8" BORE
1/2" Rod Dia.
3/8-24 Thread

STANDARD STROKE CYLINDER 1 (TOTAL STROKE)
3/4" BORE SIZE
1/4" to 6"
1" and 1-1/8" BORE SIZES
1/4" to 9"
in 1/4" increments

1-3/8" BORE SIZE
1/2" to 12"
in 1/2" increments

For Longer Strokes, Consult PHD.

STANDARD STROKE CYLINDER 2 (FROM RETRACT TO MID POSITION)
3/4" BORE SIZE
1/4" to 6"
1" and 1-1/8" BORE SIZES
1/4" to 9"
in 1/4" increments

1-3/8" BORE SIZE
1/2" to 12"
in 1/2" increments

For Longer Strokes, Consult PHD.

A 3 V R - 3/4 x 1 x 1/2 - P-M

TYPE
3 - Three Position Cylinder

MOUNTING STYLE
F - Foot Mount, C'bored through holes
B - Bottom Mount, Tapped holes in head and cap
R - Rod Mount, Tapped holes on front face of head
T - Thread Mount, Threaded snout on head (shipped with mounting nut)
RF - Rod End Flange
CF - Cap End Flange
*L - Pilot Mount, Threaded snout and pilot diameter on head (shipped with mounting nut)
*P - Pivot Mount, Pivot on cap
**K - Clevis Mount, Clevis on cap
* Available on 3/4", 1", and 1-1/8" Bore only
** Available on 1-3/8" Bore only

OPTIONS
B - Shock Pads on full extension and retraction only (not available on Series HV)
D - Cushion on full extension and retraction only (not available on Series HV 3/4", 1", and 1-1/8" sizes)
E - Magnetic Pistons on both cylinders for PHD Hall Effect Switches (not available on Series A)
M - Magnetic Pistons on both cylinders for PHD Reed Switches (not available on Series A)
P - Port Controls® on all heads and cap, full extension and retraction only, not on mid-position extension
V - Fluoro-Elastomer Seals

Options may affect unit length. See unit dimension and options pages for adders.

PROXIMITY SWITCH MOUNTING BRACKETS

SERIES	BORE	SIZE NO.
AV, HV	3/4"	-31
	1"	-32
	1-1/8"	-33
	1-3/8"	-34

See Switches and Sensors section for complete ordering information.

SPECIFICATIONS	SERIES AV3	SERIES HV3	SERIES A3
OPERATING PRESSURE	20 to 150 psi air	40 to 1500 psi hyd*	20 to 150 psi air
OPERATING TEMPERATURE	-20° to 180°F [-29° to 82°C]	-20° to 180°F [-29° to 82°C]	-20° to 180°F [-29° to 82°C]
STROKE TOLERANCE	±.032	±.032	±.032
LUBRICATION	Permanently lubricated	—	Permanently lubricated
MAINTENANCE	Field repairable	Field repairable	Field repairable

*Hydraulic rating is based on non-shock hydraulic service.

CYLINDER FORCE TABLE

SERIES	CYLINDER BORE	ROD DIAMETER	ROD DIRECTION	EFFECTIVE AREA FORCE lb/psi	FREE AIR CONSUMPTION 80 lbs CUBIC ft/in OF STROKE	DISPLACEMENT gal./in OF STROKE
A3V, H3V, A3	3/4	1/4	EXTEND	.442	.0016	.0019
			RETRACT	.393	.0014	.0017
	1	5/16	EXTEND	.785	.0029	.0034
			RETRACT	.709	.0026	.0031
	1-1/8	3/8	EXTEND	.994	.0037	.0043
			RETRACT	.883	.0032	.0038
	1-3/8	1/2	EXTEND	1.485	.0055	.0064
			RETRACT	1.289	.0048	.0056

MAXIMUM ALLOWABLE EXTEND STROKE

SERIES	ROD DIAMETER	CYLINDER FORCE (lb) 100	200	500	1000	1500	2000	3000	5000
3/4",1", 1-1/8" A3V, H3V, A3	1/4	12"	9"	6"	4"	3"	—	—	—
	5/16	18"	13"	8"	6"	5"	—	—	—
	3/8	26"	18"	12"	9"	7"	—	—	—
1-3/8" A3V, H3V	1/2	48"	34"	21"	15"	12"	—	—	—

SERIES	CYLINDER BORE	UNIT WEIGHTS (lb) ZERO STROKE	ADDER PER INCH OF STROKE
AVR	3/4	.42	.04
	1	.87	.07
	1-1/8	.95	.10
	1-3/8	2.56	.12

CYLINDER FORCE CALCULATIONS

IMPERIAL

$F = P \times A$

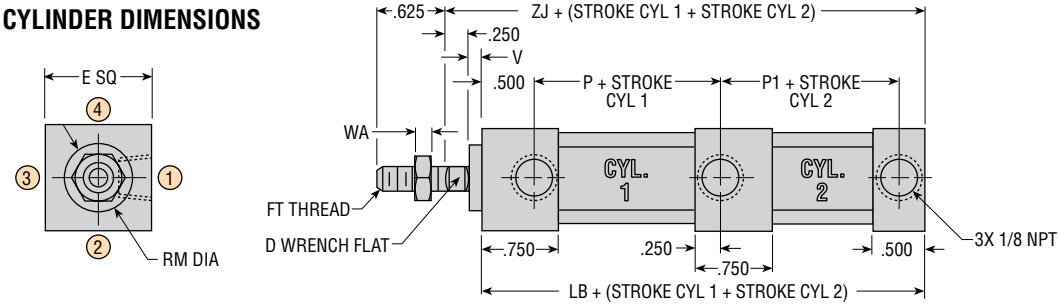
F = Cylinder Force — lbs
P = Operating Pressure — psi
A = Effective Area (Extend or Retract) — in^2

SIZING AND APPLICATION ASSISTANCE

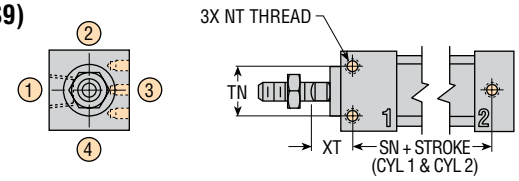
See PHD Product Sizing Catalog for specific and complete sizing information. Online sizing assistance is available at: ***www.phdinc.com/apps/sizing***

DIMENSIONS: SERIES A3, A3V, H3V 3/4", 1", 1-1/8", BORE

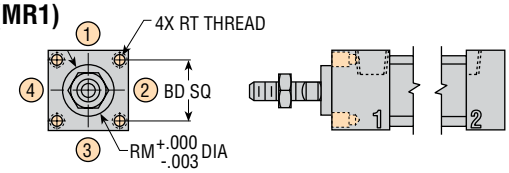
BASIC CYLINDER DIMENSIONS



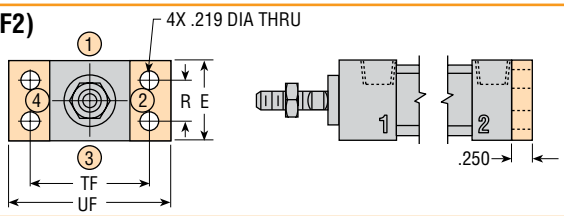
B (MS9)



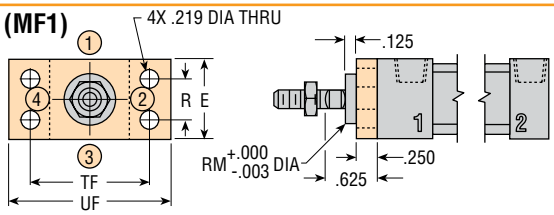
R (MR1)



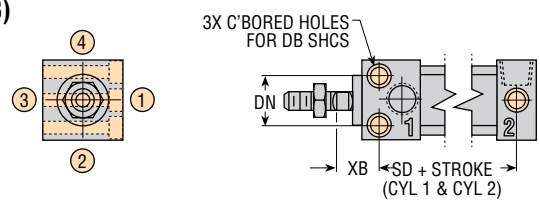
CF (MF2)



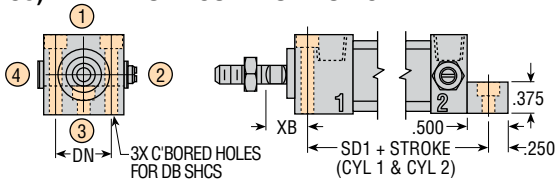
RF (MF1)



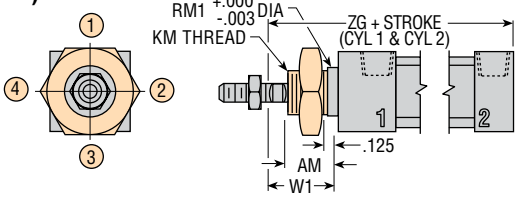
F (MS8)



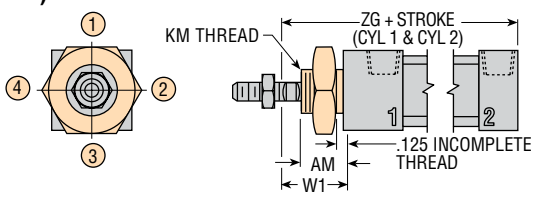
F (MS8) - WITH PORT CONTROL® ON CAP END



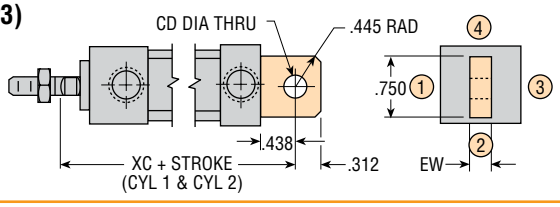
L (MNR1)



T (MN1)



P (MP3)



All standard rod ends have four wrench flats (two wrench flats with "I" option).

PORT POSITIONS: INDICATED BY CIRCLED NUMBERS
CUSHIONS: ADD 1/2" TO (+ STROKE) DIMENSIONS OF CYLINDER 1 AND CYLINDER 2 FOR CUSHIONS (ADD TOTAL OF 1" TO OVERALL LENGTH)
SHOCK PADS: ADD 1/4" TO (+ STROKE) DIMENSIONS OF CYLINDER 1 AND CYLINDER 2 FOR SHOCK PADS (ADD TOTAL OF 1/2" TO OVERALL LENGTH)

DIMENSIONS COMMON TO ALL SERIES

BORE SIZE	LETTER DIMENSION																
	BD	D	DB	DF	DN	E	EW	FT	NT	R	RM	RT	TF	TN	UB	UF	WA
3/4	.750	3/16	#8	1.375	.625	1.000	.250	1/4-28	8-32 x .18 DP	.500	.625	8-32 x .25 DP	1.500	.625	1.750	2.000	.156
1	1.000	1/4	#10	1.750	.875	1.375	.375	5/16-24	10-32 x .25 DP	.875	.750	8-32 x .25 DP	1.875	.875	2.125	2.375	.188
1-1/8	1.125	5/16	#10	1.875	1.000	1.500	.375	3/8-24	10-32 x .25 DP	1.000	.750	10-32 x .25 DP	2.000	1.000	2.250	2.500	.219

SERIES A3 CYLINDERS

BORE SIZE	LETTER DIMENSION															
	AM	CD	KM	LB	P	P1	RM1	SD	SD1	SN	V	W1	XB	XC	XT	ZG	ZJ
3/4	.625	.250	5/8-18	3.312	1.000	1.562	.687	2.875	3.375	2.875	.125	.875	.562	4.125	.562	4.187	3.687
1	.625	.250	3/4-16	3.312	1.000	1.562	.812	2.812	3.312	2.812	.125	.875	.625	4.125	.625	4.187	3.687
1-1/8	.625	.250	3/4-16	3.312	1.000	1.562	.812	2.812	3.312	2.812	.125	.875	.625	4.125	.625	4.187	3.687

SERIES A3V CYLINDERS

BORE SIZE	LETTER DIMENSION															
	AM	CD	KM	LB	P	P1	RM1	SD	SD1	SN	V	W1	XB	XC	XT	ZG	ZJ
3/4	.625	.250	5/8-18	4.312	1.500	2.062	.687	3.875	4.375	3.875	.125	.875	.562	5.125	.562	5.187	4.687
1	.625	.375	3/4-16	4.312	1.500	2.062	.812	3.812	4.312	3.812	.125	.875	.625	5.125	.625	5.187	4.687
1-1/8	.875	.375	1-14	4.312	1.500	2.062	1.062	3.812	4.312	3.812	.125	1.125	.625	5.125	.625	5.437	4.687

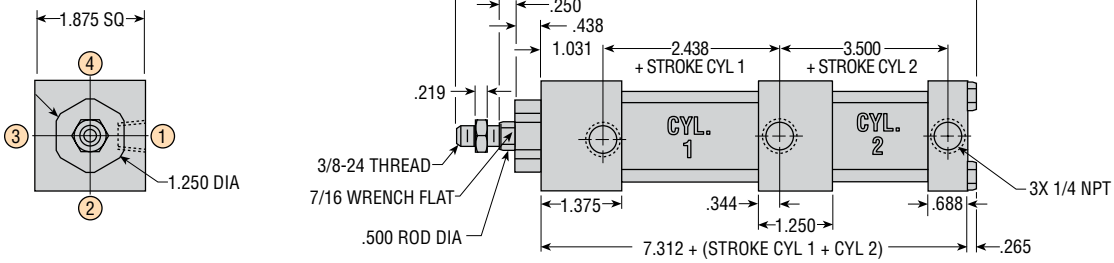
SERIES H3V CYLINDERS

BORE SIZE	LETTER DIMENSION																
	AM	CD	KM	LB	P	P1	RM1	SD	SD1	SN	V	W1	XB	XC	XT	ZG	ZJ
3/4	.625	.250	5/8-18	4.312	1.500	2.062	.687	3.875	4.375	3.875	.375	.875	.812	5.375	.812	5.187	4.937
1	.625	.375	3/4-16	4.312	1.500	2.062	.812	3.812	4.312	3.812	.375	.875	.875	5.375	.875	5.187	4.937
1-1/8	.875	.375	1-14	4.312	1.500	2.062	1.062	3.812	4.312	3.812	.375	1.125	.875	5.375	.875	5.437	4.937

All dimensions are reference only unless specifically toleranced.

DIMENSIONS: SERIES A3V, H3V 1-3/8" BORE

BASIC CYLINDER DIMENSIONS



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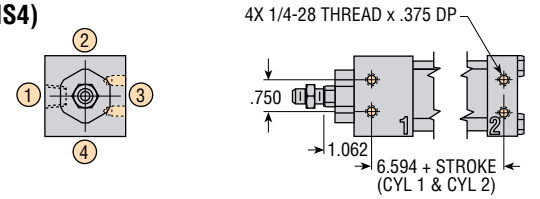
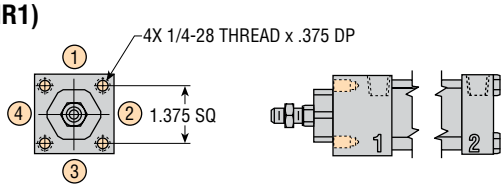
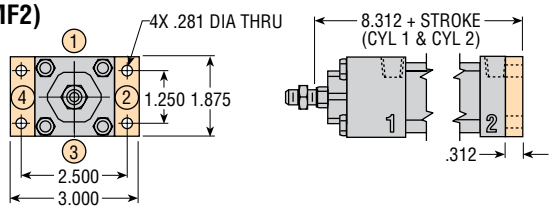


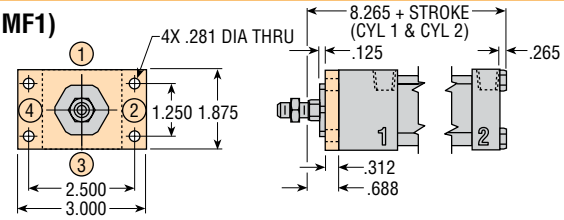
R (MR1)



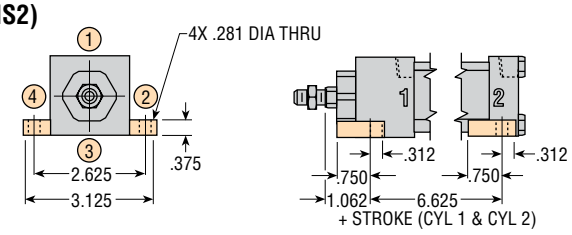
CF (MF2)



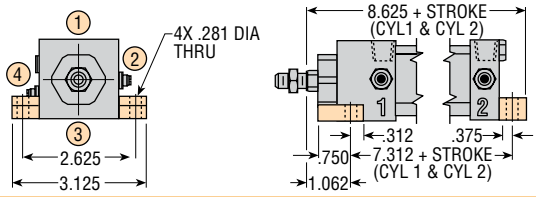
RF (MF1)



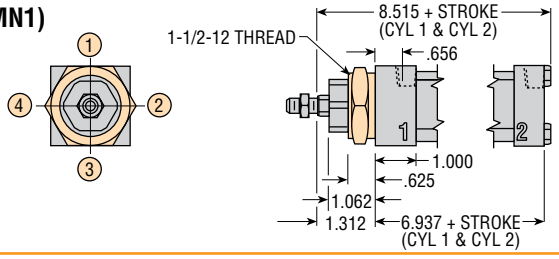
F (MS2)



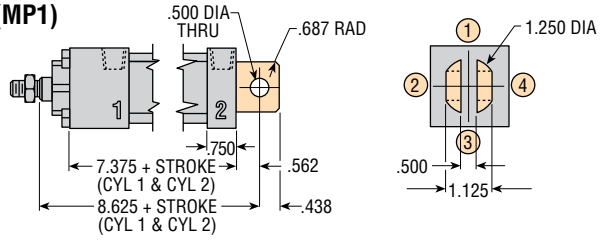
F (MS2)-WITH PORT CONTROL® & CUSHION ON CAP END



T (MN1)



K (MP1)



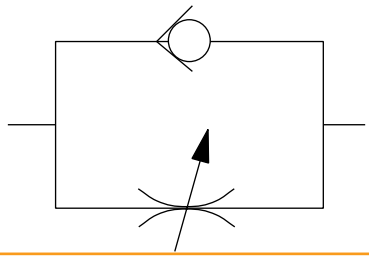
All standard rod ends have four wrench flats (two wrench flats with "I" option).

PORT POSITIONS: INDICATED BY CIRCLED NUMBERS
CUSHIONS: CYLINDER LENGTH IS NOT AFFECTED BY ADDITION OF CUSHIONS
SHOCK PADS: ADD 1/4" TO (+ STROKE) DIMENSIONS OF EACH CYLINDER 1 AND CYLINDER 2 (ADD A TOTAL OF 1/2" TO OVERALL LENGTH)

P 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 cylinder end cap and are used to control the speed of the cylinder over its entire stroke.

The self-locking needle has micrometer threads and 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 cylinder, but opens to permit full flow of incoming fluids. The PHD Port Control® provides the optimum in speed control for small bore cylinders. It saves space and eliminates the cost of installation and fittings for external flow control valves.



D ADJUSTABLE CUSHION

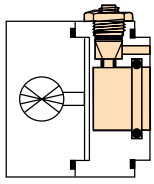
PHD Cushions are designed for smooth deceleration at the end of stroke. When the cushion is activated the remaining volume in the cylinder must exhaust past an adjustable needle which controls the amount of deceleration.

See Dimension pages for dimensional information.

3/4", 1", 1-1/8" Series A3, A3V, and H3V = Cushion Block
1-3/8" Series A3V and H3V = Poppet Style

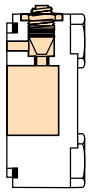
Effective cushion length 1/2"

CUSHION BLOCK



3/4", 1", 1-1/8" BORE

POPPET STYLE

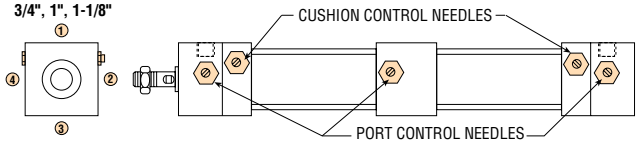


1-3/8" BORE

STANDARD PORT CONTROL® & CUSHION NEEDLE POSITIONS

(3/4", 1", 1-1/8" Bore Series A3, A3V, and H3V Cylinders)

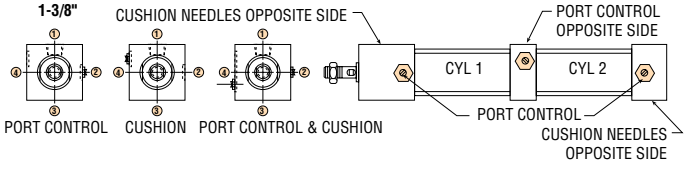
Port Control® and cushion needles are located in position 2 on standard cylinders. They may be located at position 4 when specified on all Series A3, A3V, and H3V. Consult PHD for special Port Control® or cushion needle positions.



STANDARD PORT CONTROL® & CUSHION NEEDLE POSITIONS

(1-3/8" Bore Series A3V and H3V Cylinders)

Port Control® and cushion needles are located on opposite sides adjacent to port. Please consult distributor or PHD to check availability of special Port Control® or cushion needle positions.

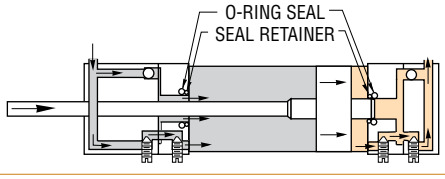


PORT CONTROL® AND ADJUSTABLE CUSHION COMBINATION

(3/4", 1", 1-1/8" Bore Series A3, A3V, and H3V Cylinders)

Cushion and Port Control® combination arranged in series provides a compact efficient control system for maximum space weight and cost savings. The cushion is activated when the piston extension enters a seal in the cushion block. The remaining volume in the cylinder exhausts past an adjustable needle. A check seal in the adjusting needle is closed during deceleration, but opens to permit full flow for immediate reversing. The cushion seal in the block is an o-ring for air units.

CUSHION BLOCK STYLE

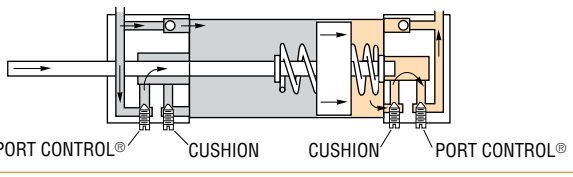


PORT CONTROL® AND ADJUSTABLE CUSHION COMBINATION

(1-3/8" Bore Series A3V and H3V Cylinders)

The cushion and Port Control® combination is also available on the 1-3/8" Bore. This cushion is activated when a seal, which is traveling with the piston, seals against the cylinder end cap. This causes the remaining volume in the cylinder to exhaust past an adjustable needle which controls the amount of deceleration. The spring, which extends the seal from the piston, permits the seal to act as a check valve to allow full flow back into the cylinder for immediate reversing. The cushion seal for air units is made of urethane while seals for oil units are close tolerance metal.

POPPET STYLE

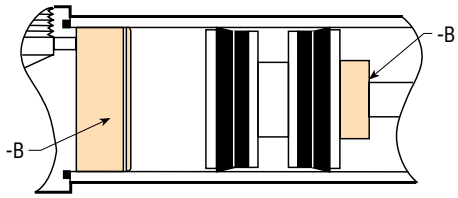


B SHOCK PADS

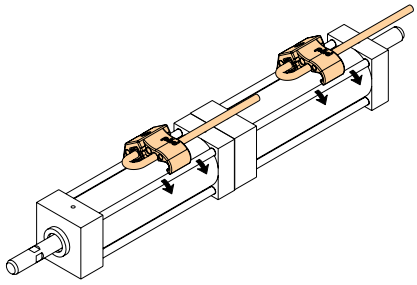
Polyurethane pads for absorption of shock and noise (not available on hydraulic units). Reducing shock permits higher piston velocities for shorter cycle times. Reducing noise levels provides improved environment for increased productivity. Eliminates metal to metal contact between piston and end caps.

Available together with all options EXCEPT -

- **Same end as Cushion (-D)**



MAGNETIC PISTON FOR USE WITH PHD PROXIMITY SWITCHES



E HALL EFFECT SWITCHES

PHD Cylinders may be equipped with a magnetic band (specify -E) on the piston which activates externally mounted PHD Hall Effect Switches. These switches allow the interfacing of the Tom Thumb® air or hydraulic cylinder 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 10-30 VDC
17504-2-06	PNP Type 10-30 VDC
17523-2	NPN Type 10-30 VDC, Quick Connect
17524-2	PNP Type 10-30 VDC, Quick Connect

See Switches and Sensors section for complete switch information.

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 piston 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 10-30 VDC
17509-3-06	AC Type 110-120 VAC with Current Limit
17522-2	Sink or Source Type 10-30 VDC, Quick Connect
17529-3	AC Type 110-120 VAC, Quick Connect with Current Limit

See Switches and Sensors section for complete switch information.

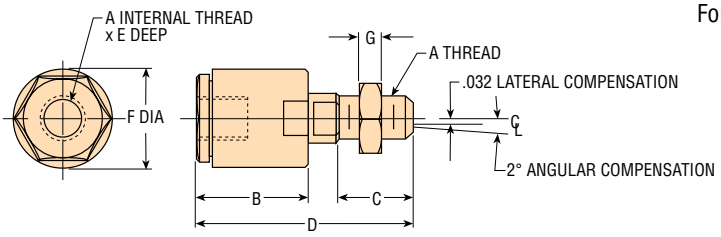
V FLUORO-ELASTOMER SEALS

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.

SELF-ALIGNING PISTON ROD COUPLERS

To order, specify the model number.

MODEL NO.	LETTER DIMENSION						
	A	B	C	D	E	F	G
250	1/4-28	1.000	.625	1.875	.500	.875	.156
312	5/16-24	1.000	.625	1.875	.500	.875	.187
375	3/8-24	1.000	.625	1.875	.500	.875	.219
437	7/16-20	1.125	.650	2.187	.500	1.000	.250



Rod Couplers eliminate expensive precision machining for mounting fixed or rigid cylinder on guide or slide applications.

Cylinder efficiency is increased by eliminating friction caused by misalignment. Couplers compensate for 2° angular error and 1/32" lateral misalignment on push and pull stroke.

Couplers provide greater reliability and reduce cylinder and component wear, simplifying alignment problems in the field.

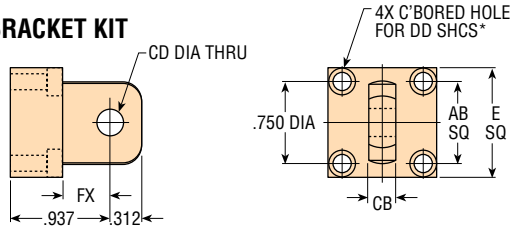
Rod Couplers are manufactured from high tensile and hardened steel components.

For metric piston rod couplers, see page 1-44.

All dimensions are reference only unless specifically toleranced.

ACCESSORIES: SERIES A3, A3V, H3V 3/4", 1", 1-1/8", 1-3/8", 1-3/8" BORE

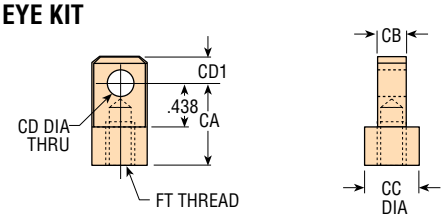
EYE BRACKET KIT



BORE SIZE	CYL SERIES	PART NO.	LETTER DIMENSION AB	CB	CD	DD*	E	FX
3/4	A3, A3V, H3V	1077-01	.750	.248	.250	#6	1.000	.577
1 &	A3	1077-02	1.000	.373	.250	#10	1.375	.437
1-1/8	A3V, H3V	1077-03	1.000	.373	.375	#10	1.375	.437

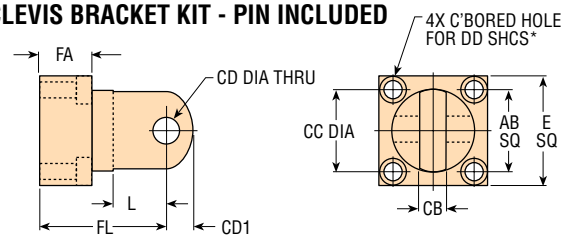
*For 3/4 bore thru hole only.

ROD EYE KIT



BORE SIZE	CYL SERIES	PART NO.	LETTER DIMENSION CA	CB	CC	CD	CD1	FT
3/4	A3, A3V, H3V	1075-01	.750	.248	.500	.250	.250	1/4-28 x .375 DP
1	A3	1075-02	.875	.373	.750	.250	.375	5/16-24 x .375 DP
	A3V, H3V	1075-04	.875	.373	.750	.375	.375	5/16-24 x .375 DP
1-1/8	A3	1075-03	.875	.373	.750	.250	.375	3/8-24 x .312 DP
	A3V, H3V	1075-05	.875	.373	.750	.375	.375	3/8-24 x .312 DP

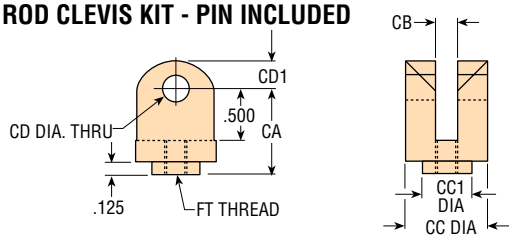
CLEVIS BRACKET KIT - PIN INCLUDED



BORE SIZE	CYL SERIES	KIT NO.	LETTER DIMENSION AB	CB	CC	CD	CD1	DD*	E	FA	FL	L
3/4	A3, A3V, H3V	12901	.750	.254	.750	.250	.250	#6	1.000	.360	1.187	.500
1 &	A3	12902	1.000	.379	.875	.250	.375	#10	1.375	.500	1.250	.531
1-1/8	A3V, H3V	12903	1.000	.379	.875	.375	.375	#10	1.375	.500	1.250	.531

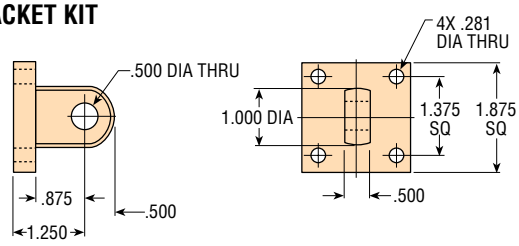
*For 3/4 bore thru hole only.

ROD CLEVIS KIT - PIN INCLUDED



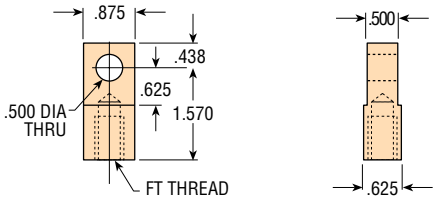
BORE SIZE	CYL SERIES	KIT NO.	LETTER DIMENSION CA	CB	CC	CC1	CD	CD1	FT
3/4	A3, A3V, H3V	12904	.812	.254	.750	.437	.250	.250	1/4-28 TO SLOT
1	A3	12905	.875	.379	.875	.562	.250	.375	5/16-24 TO SLOT
	A3V, H3V	12906	.875	.379	.875	.562	.375	.375	5/16-24 TO SLOT
1-1/8	A3	12907	.875	.379	.875	.562	.250	.375	3/8-24 TO SLOT
	A3V, H3V	12908	.875	.379	.875	.562	.375	.375	3/8-24 TO SLOT

EYE BRACKET KIT



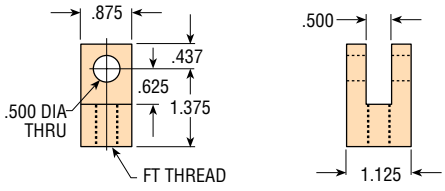
BORE SIZE	CYL SERIES	PART NO.
1-3/8	A3V, H3V	1330

ROD EYE KIT



BORE SIZE	CYL SERIES	PART NO.	LETTER DIMENSION FT
1-3/8	A3V, H3V	1375-01	3/8-24 x .750 DP

ROD CLEVIS KIT - PIN INCLUDED



BORE SIZE	CYL SERIES	KIT NO.	LETTER DIMENSION FT
1-3/8	A3V, H3V	12909	3/8-24 TO SLOT

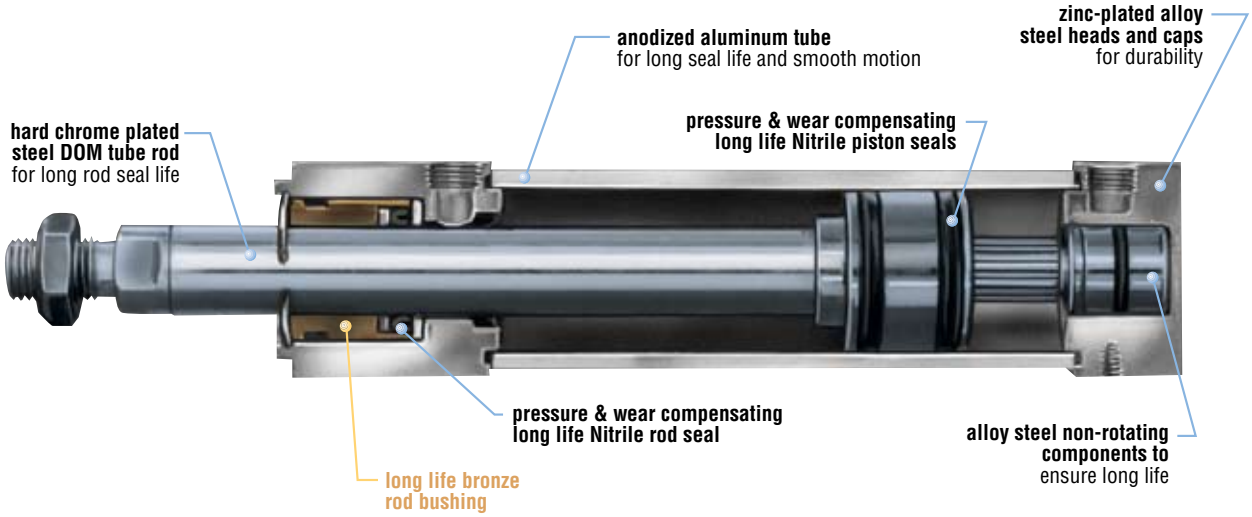
All dimensions are reference only unless specifically toleranced.

NPG, NHG

tom thumb®

NON-ROTATING ROD CYLINDERS
1-1/8" AND 1-3/8" BORE

Series NP
Cutaway depicts
a 1-1/8" bore NPG unit.



Major Benefits

- Non-rotating piston rod for consistent tooling position
- Piston rod provides superior sealing performance
- Repairable construction for extended life and long term savings
- Precision non-rotating rod adjustable design
- Long life design for low maintenance
- Wide range of options for easy application and reduced design time
- Wide range of mounting styles for easy installation

Industry Uses

- Packaging
- Assembly machines
- Machine loading/unloading
- General industrial automation

ORDERING DATA: SERIES NPG & NHG CYLINDERS

TO ORDER SPECIFY:
Spring Return, Series, Mounting Style, Bore Size, Stroke, and Options.

SPRING RETURN
SC - Spring on cap end
SR - Spring on rod end
(Spring Return available on Series NPG Cylinders up to 3" of stroke in 1/4" increments.)

MOUNTING STYLE
MF1 - Head End Flange
MF2 - Cap End Flange
MT1 - Head Trunnion
MP1 - Clevis Mount, Cap end (furnished with pin)
MR1 - Rod Mount, Tapped holes front face of head
MS9 - Bottom Mount - 3 holes total Tapped in head and cap
MS10 - Side Tab Mount with C'bore and through holes
MN1 - Threaded Nose on head (shipped with mounting nut)

STANDARD STROKE LENGTHS
STOCK STROKE LENGTHS
1/2" to 18"
in 1/2" increments
Longer Strokes Available, Consult PHD.

SHOCK PAD
B - Shock Pads on both ends
BR - Shock Pad on rod end
BC - Shock Pad on cap end
Shock Pads and Spring Return are not available on the same end of cylinder. Shock Pads are not available for Hydraulic use.)

SC NPG MF1 1-1/8 x 2 - P - B - N-V-Z1

CYLINDER SERIES
NPG - 150 psi Air
NHG - 1500 psi Hydraulic

BORE SIZE
1-1/8" BORE
5/8" Rod Dia.
7/16-20 Threads

1-3/8" BORE
3/4" Rod Dia.
9/16-18 Threads

PORT CONTROL®
BUILT-IN METER OUT FLOW CONTROL VALVE
P - Flow control both ends
PR - Flow control on head end
PC - Flow control on cap end

OPTIONS
E - Magnetic Piston for PHD Hall Effect Switches (not applicable on Series NHG)
H - Plain keyed rod end
M - Magnetic Piston for PHD Reed Switches (not applicable on Series NHG)
N - Plain Rod End
S - Keyed and Threaded Rod End
V - Fluoro-Elastomer Seals
W - Close Tolerance Stroke, ± .005 Stroke Length
Z1 - Electroless Nickel Plate all ferrous parts

PROXIMITY SWITCH MOUNTING BRACKETS

SERIES	BORE	SIZE NO.
NPG, NHG	1-1/8"	-33
	1-3/8"	-36

See Switches and Sensors section for complete ordering information.

NOTE: SAE Ports available. Consult PHD for sizes.

SPECIFICATIONS	SERIES NPG	SERIES NHG
OPERATING PRESSURE	20 to 150 psi air	40 to 1500 psi hyd*
OPERATING TEMPERATURE	-20° to 180°F [-28° to 82°C]	-20° to 180°F [-28° to 82°C]
STROKE TOLERANCE	±.032 inch	±.032 inch
REPEATABILITY	±0.001 of original position	±0.001 of original position
LUBRICATION	Permanently lubricated	—
MAINTENANCE	Field repairable	Field repairable

*Hydraulic rating is based on non-shock hydraulic service.

CYLINDER FORCE AND WEIGHT TABLE

BORE	ROD DIA in	ROD DIRECTION	EFFECTIVE AREA FORCE lb/psi	FREE AIR CONSUMPTION @ 80 lb CUBIC ft/in OF STROKE	DISPLACEMENT GAL/in OF STROKE	BASE WEIGHT	ADDER PER 1" OF STROKE
1-1/8	5/8	EXTEND	0.994	.0037	.0043	1.55	.14
		RETRACT	.687	.0026	.0300		
1-3/8	3/4	EXTEND	1.485	.0055	.0064	2.16	.19
		RETRACT	1.043	.0039	.0045		

MAXIMUM ALLOWABLE EXTEND STROKE

BORE	ROD DIA in	CYLINDER FORCE 100	200	500	1000	1500	2000	3000
1-1/8	5/8	44	44	28	20	16	14	—
1-3/8	3/4	44	44	41	29	23	20	—

CYLINDER FORCE CALCULATIONS

IMPERIAL

$F = P \times A$

F	=	Cylinder Force	lbs
P	=	Operating Pressure	psi
A	=	Effective Area (Extend or Retract)	in^2

SIZING AND APPLICATION ASSISTANCE

See PHD Product Sizing Catalog for specific and complete sizing information. Online sizing assistance is available at: ***www.phdinc.com/apps/sizing***

SIDELOADING

Care should be taken to consider allowable side load versus stroke in the same manner as standard cylinders, including stop tubes and transverse support members as needed. Where appreciable sideloads are expected, the use of powered slides, shown in the slide section of this catalog, is recommended. Rod deflection may be calculated according to the formula at right.

BORE	C VALUE
1-1/8	470,000
1-3/8	990,000

$$D = \frac{W \times L^3}{C}$$

D = Deflection at rod end
L = Distance in inches from bushing to applied sideload
W = Sideload in pounds

TORSION AND BACKLASH

Clearance between spline and broached teeth in piston is less than 1/2°. Additional deflection caused by rotational moments can be calculated using the following formula:

$$\theta = T \left[\frac{L_1}{K_1} + \frac{L_2}{K_2} + C \right]$$

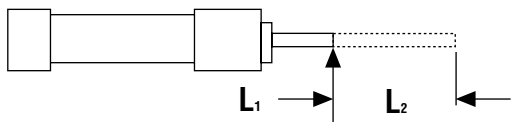
BORE	SERIES	K_1	K_2	C
1-1/8	NP	8.7	34.8	.18
1-3/8	NP	15.6	74.8	.10

Where:

θ = Angular deflection in minutes of arc

T = Torque applied (in/lb)

L_1 = Distance that rod is extended



RETRACTED POSITION

L_2 = Stroke length

K_1 = Constant reflecting the polar moment of inertia and the modulus of rigidity for the spline rod

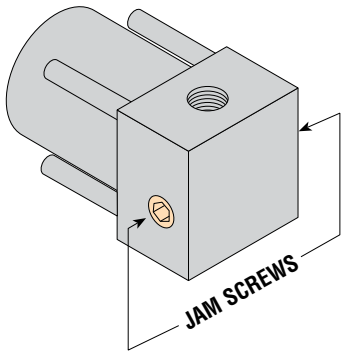
K_2 = Constant reflecting the polar moment of inertia and the modulus of rigidity for the piston rod

C = Constant value of deflection on spline and piston rod regardless of piston position

MAXIMUM ALLOWABLE TORQUE

Table shows maximum recommended torsional loads which may be applied to piston rod without spline rotating relative to cylinder cap. Safety factor equals approximately 4:1. Cylinder will encounter fractional losses due to torsional loads.

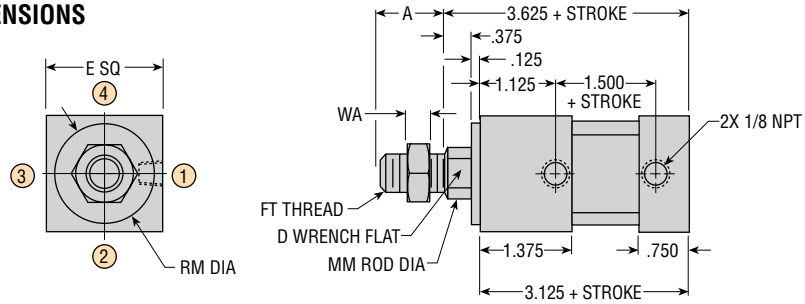
BORE	MAX. TORQUE in-lb	TIGHTENING TORQUE ON JAM SCREWS in-lb
1-1/8	48	85
1-3/8	72	85



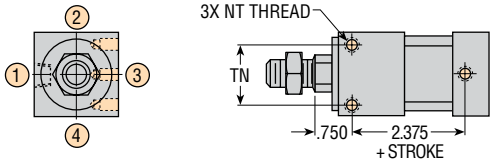
All dimensions are reference only unless specifically toleranced.

DIMENSIONS: SERIES NPG & NHG CYLINDERS

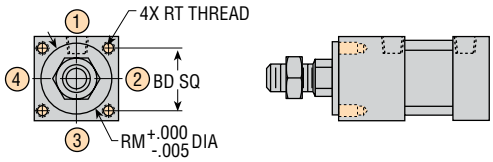
BASIC CYLINDER DIMENSIONS



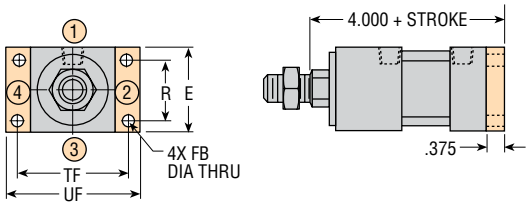
MS9



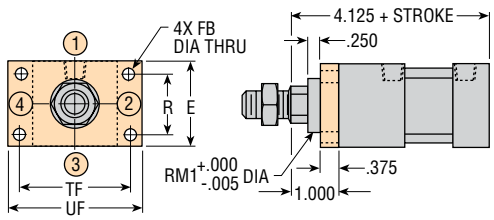
MR1



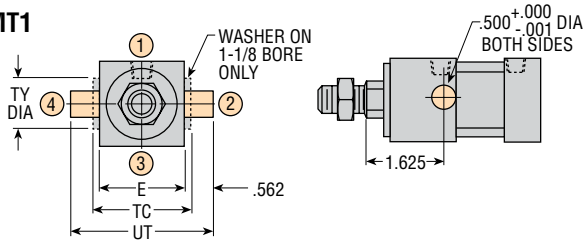
MF2



MF1



MT1



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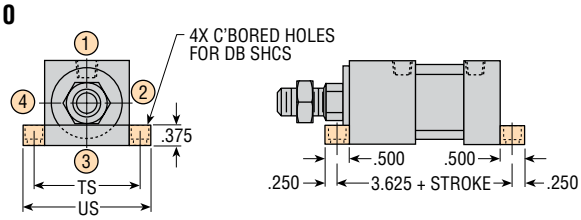
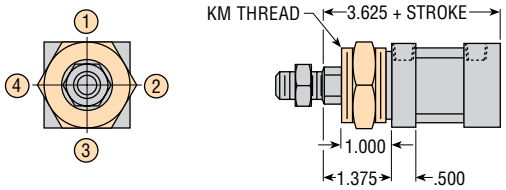
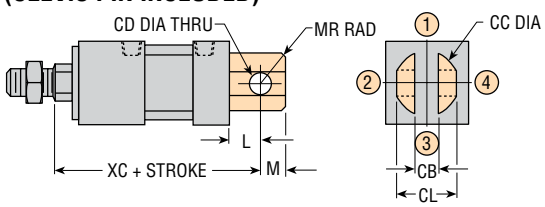


MN1



MP1 (CLEVIS PIN INCLUDED)



All standard rod ends have four wrench flats (two wrench flats with "I" option).

BORE SIZE	LETTER DIMENSION																
	A	BD	CB	CC	CD	CL	D	DB	E	FB	FT	KM	L	M	MM	MR	NT
1-1/8	.750	1.125	.375	.875	.375	.875	.500	#10	1.500	.219	7/16-20	1-1/4–12	.750	.375	.625	.440	10-32 x .25 DP
1-3/8	1.000	1.375	.500	1.250	.500	1.125	.625	1/4	1.750	.281	9/16-18	1-1/2–12	.625	.500	.750	.720	1/4-28 x .38 DP

BORE SIZE	LETTER DIMENSION													
	R	RM	RM1	RT	TC	TF	TN	TS	TY	UF	US	UT	WA	XC
1-1/8	1.000	1.250	1.000	10-32 x.25 DP	1.750	2.000	1.000	1.875	1.000	2.500	2.250	2.625	.250	4.375
1-3/8	1.250	1.500	1.125	1/4-28 x.38 DP	N/A	2.250	1.250	2.188	N/A	2.750	2.625	2.875	.312	4.250

PORT POSITIONS: INDICATED BY CIRCLED NUMBERS
SHOCK PADS: ADD 1/4" TO ALL (+ STROKE) DIMENSIONS FOR EACH SHOCK PAD
SPRING RETURN: ADD ADDITIONAL STROKE LENGTH TO ALL (+ STROKE) DIMENSIONS (2 x STROKE)

All dimensions are reference only unless specifically toleranced.

MAGNETIC PISTON FOR USE WITH PHD PROXIMITY SWITCHES

E HALL EFFECT SWITCHES

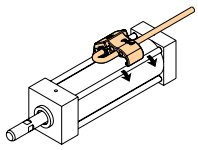
PHD Cylinders may be equipped with a magnetic band (specify -E) on the piston which activates externally mounted PHD Hall Effect Switches. These switches allow the interfacing of the Tom Thumb® air cylinder to various logic systems. This option is for use with the following switches.

COMPACT HALL EFFECT SWITCHES

PART NO.	DESCRIPTION
17503-2-06	NPN Type 10-30 VDC
17504-2-06	PNP Type 10-30 VDC
17523-2	NPN Type 10-30 VDC, Quick Connect
17524-2	PNP Type 10-30 VDC, Quick Connect

See Switches and Sensors section for magnetic piston ordering information.

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 piston 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

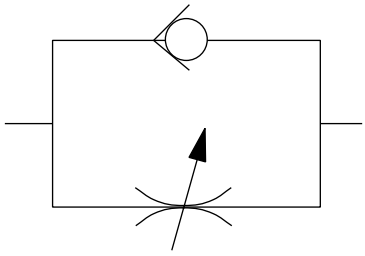
PART NO.	DESCRIPTION
17502-2-06	Sink or Source Type 10-30 VDC
17509-3-06	AC Type 110-120 VAC with Current Limit
17522-2	Sink or Source Type 10-30 VDC, Quick Connect
17529-3	AC Type 110-120 VAC, Quick Connect with Current Limit

See Switches and Sensors section for magnetic piston ordering information.

P PC PR 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 cylinder end cap and are used to control the speed of the cylinder over its entire stroke.

The self-locking needle has micrometer threads and 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 cylinder, but opens to permit full flow of incoming fluids. The PHD Port Control® provides the optimum in speed control for small bore cylinders. It saves space and eliminates the cost of installation and fittings for external flow control valves.



N PLAIN ROD END

See page 1-111

S KEYED AND THREADED ROD ENDS

See page 1-111

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.

H PLAIN KEYED ROD ENDS

See page 1-111

W CLOSE TOLERANCE STROKE

This option may be specified when a precise stroke length is required and stroke adjustment is not acceptable. By specifying this option, a stroke length with a tolerance of ± .005 will be supplied. Standard stroke tolerance is ± .032.

Maximum stroke for cylinders with close tolerance is 18".

NOTE: This option is not available with shock pads (-B).

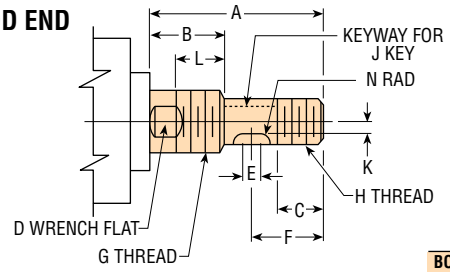
Z1 ELECTROLESS NICKEL PLATING

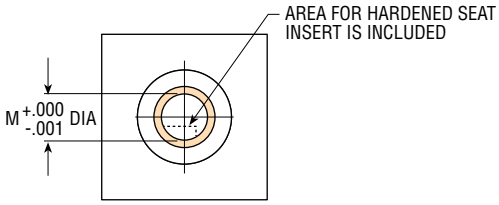
Electroless nickel plating is done on all externally exposed ferrous parts except rods and rod end, or parts made of stainless steel or aluminum. This optional plating treatment gives an alternative method of protecting the cylinder from severe environments.

NOTE: Standard plating is Brite Zinc.

OPTIONS/ACCESSORIES: SERIES NPG & NHG CYLINDERS

S ROD END

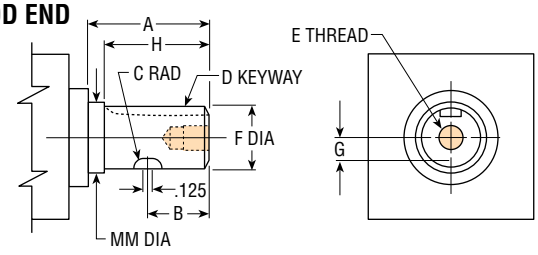




KEYWAY ORIENTATION: FULLY ADJUSTABLE
KEY & JAM NUTS: INCLUDED

BORE SIZE	LETTER DIMENSION												
	A	B	C	D	E	F	G	H	J	K	L	M	N
1-1/8	2.187	1.000	.562	1/2	.215	.852	5/8-18	1/2-20	1/8 x 1/8 x 5/8	.125	.625	.500	.093
1-3/8	2.375	1.000	.625	5/8	.242	.977	3/4-16	5/8-18	3/16 x 3/16 x 3/4	.156	.625	.625	.125

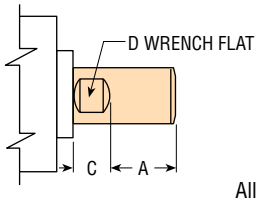
H ROD END



BORE SIZE	LETTER DIMENSION								
	A	B	C	D	E	F	G	H	MM
1-1/8	1.500	.375	.156	1/8 x 1/16 x 1.00	10-32 x .31 DP	.500	.094	1.375	.625
1-3/8	1.625	.812	.219	3/16 x 3/32 x 1.10	5/16-24 x .44 DP	.750	.156	N/A	N/A

KEYWAY ORIENTATION: FULLY ADJUSTABLE
KEY: INCLUDED FOR "D" KEYWAY

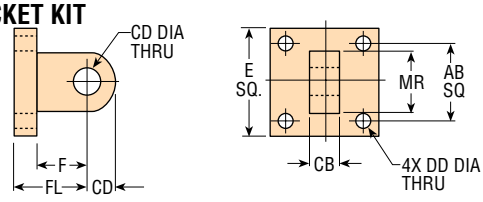
N ROD END



BORE SIZE	ROD DIA	LETTER DIMENSION		
		A	C	D
1-1/8	.625	.970	.530	1/2
1-3/8	.750	1.095	.530	5/8

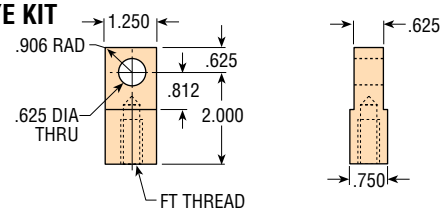
All standard rod ends have four wrench flats.

EYE BRACKET KIT



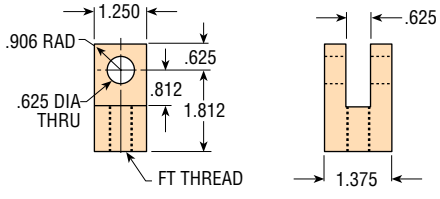
BORE SIZE	CYL SERIES	PART NO.	LETTER DIMENSION							
			AB	CB	CD	DD	E	F	FL	MR
1-1/8	NPG, NHG	2412-01	1.000	.375	.375	.219	1.375	.812	1.125	.750
1-3/8	NPG, NHG	1330	1.375	.500	.500	.281	1.875	.875	1.250	1.000

ROD EYE KIT



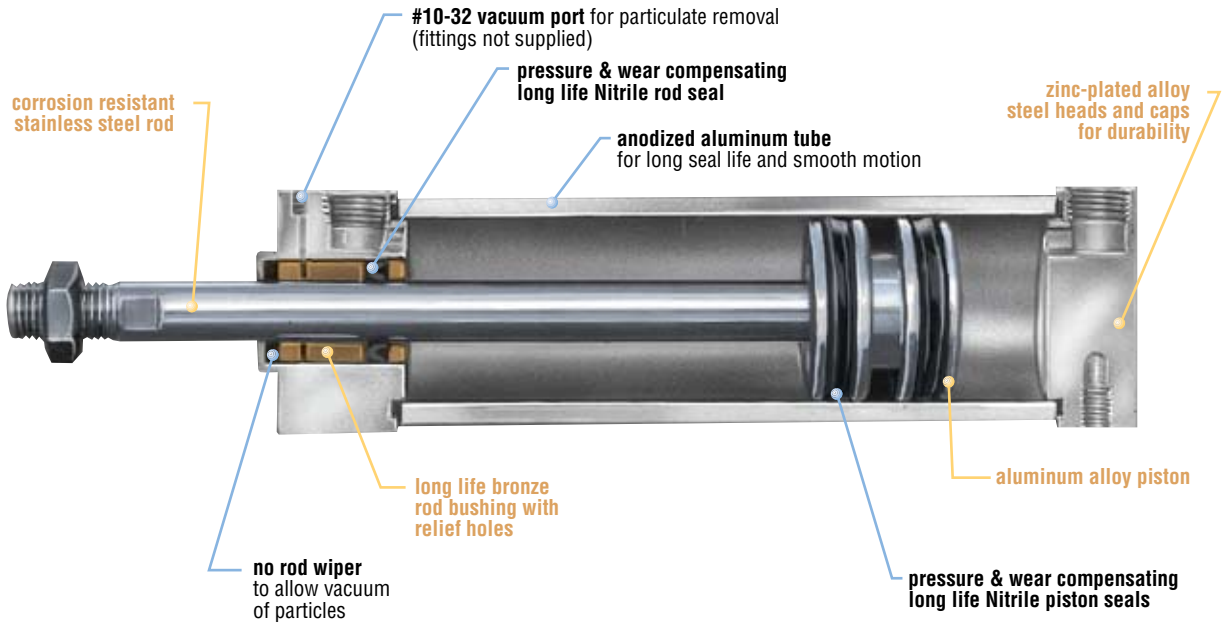
BORE SIZE	PART NO.	LETTER DIMENSION FT
1-1/8	2414-02	7/16-20 X 1.00 DP
1-3/8	2414-03	9/16-18 X 1.00 DP

ROD CLEVIS KIT - PIN INCLUDED



BORE SIZE	KIT NO	LETTER DIMENSION FT
1-1/8	12914	7/16-20
1-3/8	12915	9/16-18

SERIES AV & A 3/4", 1", & 1-1/8" BORE CLASS 100 CLEANROOM APPLICATIONS (REQUIRES -O)



Major Benefits

- This option allows PHD Tom Thumb® Cylinders to be used in Class 100 cleanroom applications
- Vacuum port and special bushing minimize particles from rod gland area
- Wide range of mounting styles for easy installation

Industry Uses

- Class 100 cleanroom
- Food processing
- Medical
- Assembly machines
- Machine loading/unloading
- Semi-conductor
- Laboratory

ORDERING DATA: CLEANROOM

TO ORDER SPECIFY:
Series, Mounting Style, Bore Size, Stroke, and Options.

BORE SIZE
3/4" BORE
1/4" Rod Dia.
1/4-28 Thread

1" BORE
5/16" Rod Dia.
5/16-24 Thread

1-1/8" BORE
3/8" Rod Dia.
3/8-24 Thread

SERIES
AV - 150 psi Air
A - 150 psi Air

REQUIRED OPTION
O - Cleanroom Vacuum Port

OPTION
Z1 - Electroless Nickel Plate all ferrous parts excluding Rod Ends.

AV F 1 x 2 - O - Z1

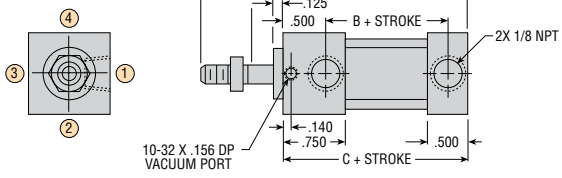
MOUNTING STYLE
F - Foot Mount, C'bored through holes
B - Bottom Mount, Tapped holes in head and cap
R - Rod Mount, Tapped holes on front face of head
T - Thread Mount, Threaded snout on head (shipped with mounting nut)
RF - Rod End Flange
CF - Cap End Flange
L - Pilot Mount, Threaded snout and pilot diameter on head (shipped with mounting nut)
P - Pivot Mount, Pivot on cap

STANDARD STROKE LENGTHS
3/4" BORE SIZE
1/4" to 12"
1" and 1-1/8" BORE SIZES
1/4" to 8"
in 1/4" increments

NOTES:
1) Some cleanroom applications may require -Z1 electroless nickel plating of all ferrous parts.
2) Consult PHD for any special lubrication requirements.
3) PHD Tom Thumb® Cylinders with vacuum ports have been tested and comply with class 100 cleanroom requirements for particle count and size.

ENGINEERING DATA & DIMENSIONS:

SPECIFICATIONS	SERIES AV	SERIES A
OPERATING PRESSURE		
STANDARD CYLINDER	20 to 150 psi air	20 to 150 psi air
OPERATING TEMPERATURE	-20° to 180°F [-29° to 82°C]	-20° to 180°F [-29° to 82°C]
STROKE TOLERANCE	± .032	± .032
LUBRICATION	Permanently lubricated	Permanently lubricated
MAINTENANCE	Field repairable	Field repairable



BORE SIZE 3/4", 1", 1-1/8"	LETTER DIMENSION A	B	C
SERIES AV	2.625	1.500	2.250
SERIES A	2.125	1.000	1.750

See Cylinder A, AV, HV section of catalog for complete cylinder dimensions and mounting styles.

CYLINDER FORCE TABLE

SERIES	CYLINDER BORE	ROD DIAMETER	ROD DIRECTION	EFFECTIVE AREA FORCE lb/psi	FREE AIR CONSUMPTION 80 lbs CUBIC ft/in OF STROKE	DISPLACEMENT gal./in OF STROKE
AV, A	3/4	1/4	EXTEND	.442	.0016	.0019
			RETRACT	.393	.0014	.0017
	1	5/16	EXTEND	.785	.0029	.0034
			RETRACT	.709	.0026	.0031
	1-1/8	3/8	EXTEND	.994	.0037	.0043
			RETRACT	.883	.0032	.0038

MAX. ALLOWABLE EXTEND STROKE

SERIES	ROD DIAMETER	CYLINDER FORCE 100 lb
3/4",1", 1-1/8" AV, HV, A	1/4	12"
	5/16	18"
	3/8	26"

SERIES	CYLINDER BORE	UNIT WEIGHTS (lb) ZERO STROKE	ADDER PER INCH OF STROKE
PLAIN UNIT	3/4	.42	.04
	1	.87	.07
	1-1/8	.95	.10

CYLINDER FORCE CALCULATIONS

IMPERIAL

$F = P \times A$

F = Cylinder Force — lbs
P = Operating Pressure — psi
A = Effective Area (Extend or Retract) — in^2

VACUUM RATING

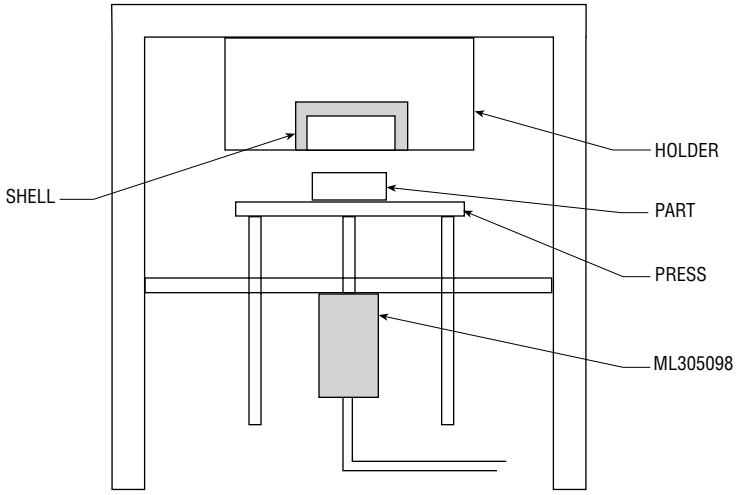
Vacuum Port - up to 25 In. Hg.

VACUUM CONNECTIONS

Manufacturer fittings differ. Due to close proximity of vacuum port to cylinder head port, the 10-32 vacuum port may require the use of a 10-32 barb fitting depending on fitting manufacturer used.

SIZING AND APPLICATION ASSISTANCE
See PHD Product Sizing Catalog for specific and complete sizing information.
Online sizing assistance is available at: ***www.phdinc.com/apps/sizing***

LARGE BORE, LOW PROFILE MODEL# ML305098



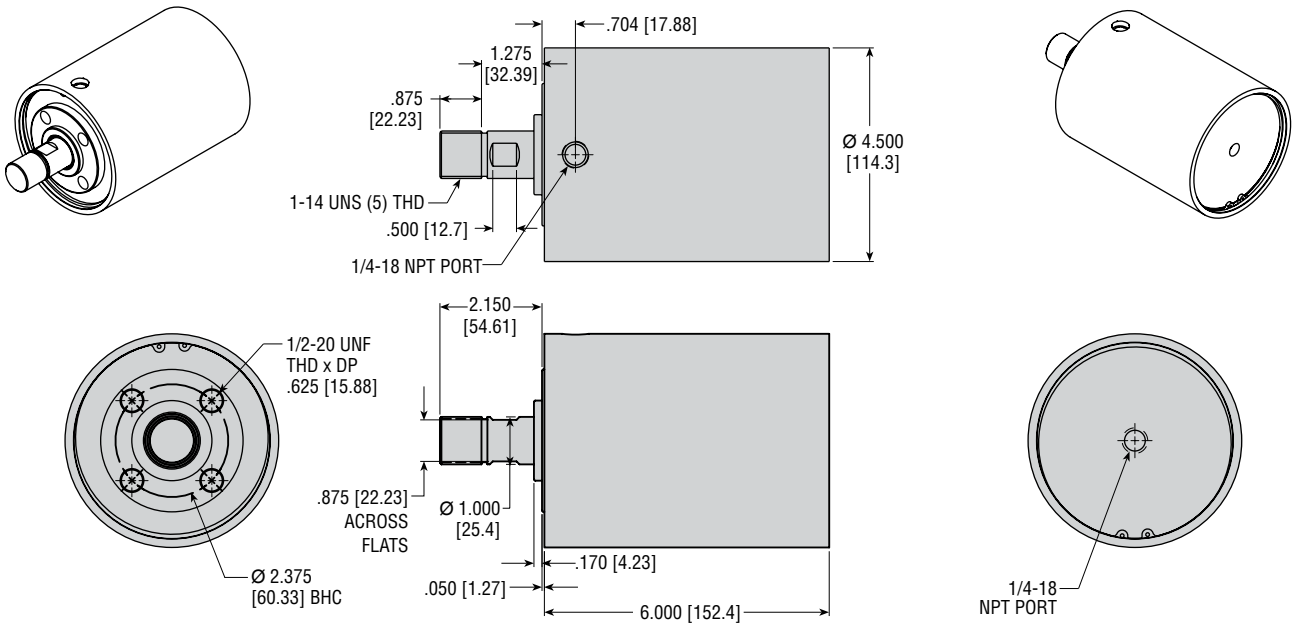
Major Benefits

- Direct replacement for competitor unit
- Incorporated PHD designed bushing & rod seals
- Field repairable

Industry Uses

- Pharmaceutical
- Powder/sintered metals
- Tire manufacturer

DIMENSIONS: LARGE BORE, LOW PROFILE MODEL# ML305098



All dimensions are reference only unless specifically toleranced.

DIVERTER CYLINDER MODEL# ML306345 & MODEL# ML306554

Major Benefits

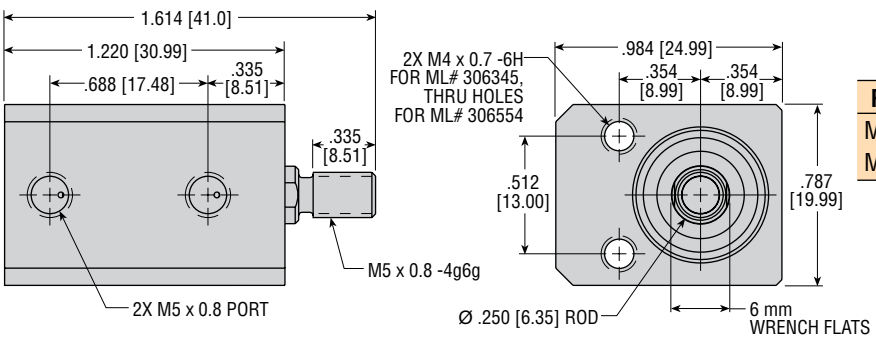
- Direct replacement for Bosch #0822010501 short stroke cylinder used to divert clothing on overhead conveyors.
- Available with threaded mounting holes (ML# 306345) or with thru mounting holes (ML# 306554). Both have a 12 mm bore size and a 10 mm stroke.
- ML# 306345 and ML# 306554, PHD's diverter cylinders, mount into the same space with the same bolt pattern as the Bosch cylinder.
- Superior delivery
- Cost competitive
- Double acting (single acting available)
- Available with dry film lubrication
- Other sizes available
- Designed and manufactured by PHD, Inc. USA - Over 50 years of automation solutions experience.
- 2 work day delivery

MODEL# ML306345

MODEL# ML306554

Industry Uses

- Pharmaceutical
- Powder/sintered metals
- Tire manufacturer
- Laundry industry



ACCESSORY KITS

PART NO.	DESCRIPTION
ML 306576	Spacer to limit stroke to 7.5 mm
ML 306577	External rod spring and rod end cap

NOTES:
1) ALL DIMENSIONS ARE REFERENCE UNLESS SPECIFICALLY TOLERANCED
2) UNIT SHOWN: BORE = Ø 12 mm STROKE = 10 mm

phd Unlimited™ UNIQUE SOLUTIONS

Unique

ISO CYLINDER WITH HEAD OR CAP MOUNTED TRUNNION

OPTION 1

OPTION 2 - ISO Cylinder, Head Attached

OPTION 3 - ISO Cylinder, Adjustable Center Trunnion Mount

Major Benefits

- Front or rear trunnion mount available for all sizes
- Two designs available
- Cost competitive
- Full unit description required with trunnion quote number
- Built-in shock pads are standard on all sizes, absorbing impact energy and eliminating metal to metal contact
- Standard alloy steel and optional corrosion resistant stainless steel piston rods are hard chrome plated for maximum life and durability

Industry Uses

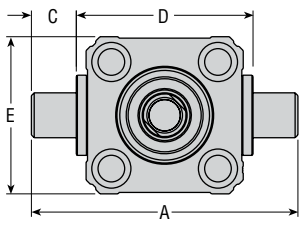
- Pharmaceutical
- Powder/sintered metals
- Tire manufacturer

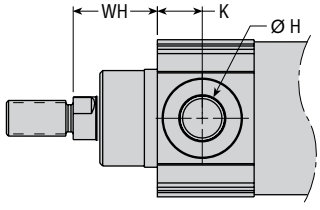
DIMENSIONS: ISO CYLINDER WITH HEAD OR CAP MOUNTED TRUNNION MODEL# ML305098

OPTION 1

BORE SIZE mm	A	C	D	E	ØH	K	WH
20	66	10	46	37	6	10	24
25	66	10	46	40	6	10	28
32	74	12	50	49.5	12	15	26
40	95	16	63	56	16	15	30
50	107	16	75	68.5	16	20	37
63	130	20	90	80	20	20	37
80	150	20	110	98	20	25	46
100	182	25	132	115	25	25	51

BORE SIZE mm	TRUNNION ADDER QUOTE NO.
20	218959
25	218959
32	218944
40	218758
50	218945
63	218946
80	218947
100	218948

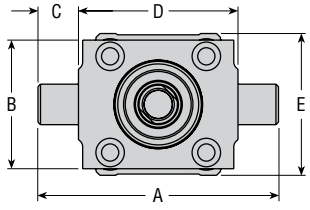


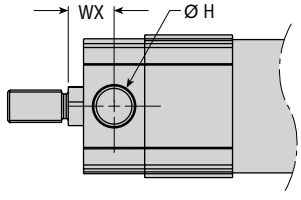


OPTION 2

BORE SIZE mm		B	C	D	E	H	WX
20	66	38.1	10	46	37	6	20
25	66	38.1	10	46	40	6	24
32	74	44.5	12	50	49.5	12	18
40	95	50.8	16	63	56	16	20
50	107	63.5	16	75	68.5	16	25
63	130	76.2	20	90	80	20	25
80	150	95.2	20	110	98	20	32
100	182	114.3	25	132	115	25	32

BORE SIZE mm	TRUNNION ADDER QUOTE NO.
20	219438
25	219439
32	219440
40	219128
50	219441
63	219442
80	219443
100	219444

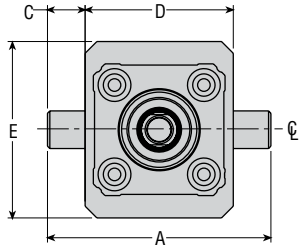


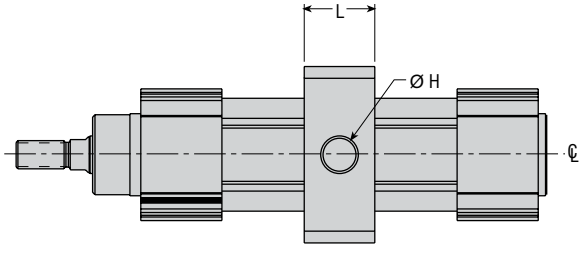


OPTION 3

BORE SIZE mm	LETTER DIMENSION A	C	D	E	H	L
32	74	12	50	71	12	30
40	95	16	63	75	16	30
50	105	16	73	95	16	40
63	130	20	90	106	20	40
80	148	20	108	133	20	50
100	181	25	131	155	25	50

BORE SIZE mm	TRUNNION ADDER QUOTE NO.
32	218615
40	218616
50	218617
63	218618
80	216186
100	218619





All dimensions are reference only unless specifically toleranced.

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UNIQUE SOLUTIONS

Unique

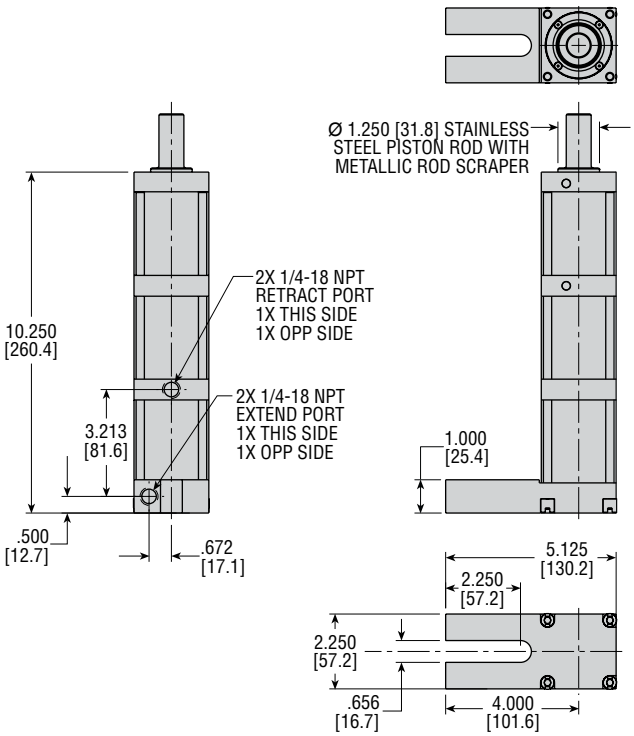
TRIPLE POWER WELD GUN CYLINDER
MODEL# ML307938

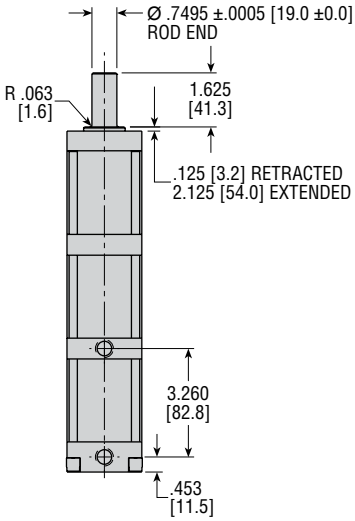
Major Benefits

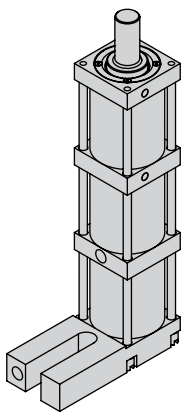
- 2 inch bore, 2 inch stroke, other bores and strokes are available
- Triple power extend, single power retract
- Available with or without manifold mount for direct valve mounting which increases speed and reduces plumbing requirements
- Tie rod construction for field repairability
- Robust, non-rotating design
- Weld-field tolerant proximity switches

Industry Uses

- Welding applications

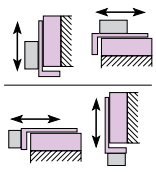
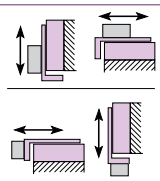
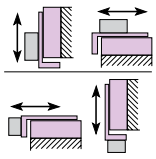
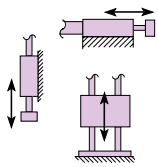
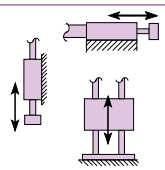
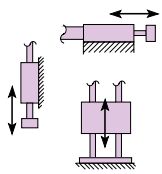
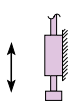




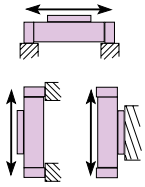
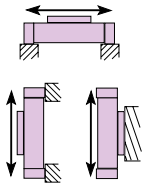
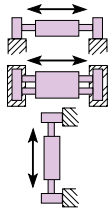
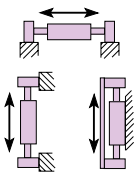


NOTES:
1) ALL DIMENSIONS ARE REFERENCE ONLY UNLESS SPECIFICALLY TOLERANCED.
2) UNIT IS A REPLACEMENT FOR SAV-AIR CYLINDER PER: C-G3-840-8N (2 in BORE x 2 in STROKE, NON-ROTATING, TRIPLE POWER EXTEND, AND SINGLE POWER RETRACT).

All dimensions are reference only unless specifically toleranced.

SERIES		MODEL	MAXIMUM STANDARD TRAVEL in [mm]	TYPICAL LOAD lb [N]	MAJOR BENEFITS	APPLICATION TYPE	INDUSTRY USE
STP (Profile Rail) page 2-5		STPDx08	3 [75]	1-2 [4-8.9]	• Compact • Smooth, precise rail bearing technology • Travel adjustment • Shock absorbers		• High speed automation • Precision assembly • Semiconductor • Assembly machine builders • Optical • Automotive • Material handling
		STPDx12	4 [100]	2-4 [8.9-17.8]			
		STPDx16	5 [125]	4-8 [17.8-35.6]			
		STPDx20	6 [150]	8-16 [35.6-71.1]			
		STPDx25	6 [150]	16-32 [71.1-142.2]			
SHP (Rail) page 2-15		SHPx08	1.57 [40]	0 - .84 [0 -3.75]	• Compact • Smooth, precise movement • Rail bearing technology • Travel adjustment & shock pads		• Assembly machine builders • Precision assembly equipment • Testing equipment • Life science • Semiconductor • Medical
		SHPx12	1.57 [40]	.23 - 1.69 [1 - 7.5]			
		SHPx16	2.17 [55]	.34 - 2.53 [1.5 - 11.25]			
SIP (Rail) page 2-21		SIP512	1.69 [50]	0 - 2.03 [0 - 9]	• Very compact • Smooth, precise movement • Rail bearing technology • Travel adjustment & shock pads • Low profile		• Assembly machine builders • Precision assembly equipment • Testing equipment • Life science • Semiconductor • Medical
		SIP516	2.953 [75]	.68 - 3.38 [3 - 15]			
		SIP520	2.953 [75]	.90 - 4.50 [4 - 20]			
SxL & SxH page 2-27		SxH08	1-1/2 [40]	.5 - 1 [2.2 - 4.5]	• Compact • Lightweight • High side loads • Low cost • Travel adjustment & shock pads • Industry standard		• Material handling • Semiconductor • Assembly machine builders • Labeling equipment • Bearing manufacturing • Automotive
		SxL10/SxH10	4 [40]	1 - 2 [4.5 - 8.9]			
		SxL14/SxH14	6 [40]	2 - 6 [8.9 - 26.7]			
		SxL20/SxH20	8 [75]	6 - 12 [26.7 - 53.4]			
		SxL25/SxH25	8 [75]	10 - 16 [45.5 - 71.2]			
		SxL32/SxH32	8 [75]	12 - 25 [53.4 - 111]			
		SxH40	4 [100]	16 - 75 [71 - 334]			
		SxH50	4 [100]	25 - 100 [111 - 445]			
		SxH63	4 [100]	75 - 100 [334 - 668]			
SD & SE page 2-37		SDx22/SEx22	12.0 / 16.0	8 —	• Wide variety of travels and sizes • Oversize shafts with PHD's rugged TC bushings provide excellent value		• Assembly machine builders • Automotive • Labeling equipment • Packaging • Optical • Medical • General purpose
		SDx23/SEx23	14.0 / 18.0	15 —			
		SDx24/SEx24	18.0 / 24.0	25 —			
		SDx25/SEx25	18.0 / 24.0	35 —			
		SDx26/SEx26	22.0 / 28.0	50 —			
SK & SL page 2-55		SKx81/SLx81	[300 / 300]	— [30]	• Wide variety of metric travels and sizes • Oversize shafts with PHD's rugged TC bushings • ISO cylinder compatible		• Assembly machine builders • Automotive • Labeling equipment • Packaging • Optical • Medical • General purpose
		SKx82/SLx82	[300 / 300]	— [35]			
		SKx83/SLx83	[300 / 450]	— [60]			
		SKx84/SLx84	[450 / 600]	— [90]			
		SKx85/SLx85	[450 / 600]	— [150]			
		SKx86/SLx86	[550 / 700]	— [250]			
SCV page 2-73		SCVx2/SCVx3	6.0 [150]	8 / 15 [36/67]	• Ideal for non-rotating vertical applications • Powered by rugged Series CV Cylinders • Available with Hushcontrol®		• Material handling • Snack food • Assembly machine builders
		SCVx4/SCVx5	8.0 [200]	25 / 35 [111/156]			
		SCVx6/SCVx7	10.0 [250]	50 / 75 [222/334]			
		SCVx8/SCVx9	12.0 [300]	100 / 150 [445/667]			

SEE THE NEXT PAGE FOR MORE SLIDES

SERIES	MODEL	MAXIMUM STANDARD TRAVEL in [mm]	TYPICAL LOAD lb [N]	MAJOR BENEFITS	APPLICATION TYPE	INDUSTRY USE
SFP (Rodless-Enclosed) page 2-83 	SFP527 SFP540	70.8 [1800] 133.8 [3400]	0 - 100 [0 - 440] 20 - 250 [89 - 1100]	• Space saving design • Smooth, precise movement • High load capacity with very low deflection		• General automation • Packaging • Assembly machine builders • Medical • Semiconductor • Optical • Plastics • Automotive
SFM page 2-93 	SFM527 SFM540	70.8 [1800] 133.8 [3400]	0 - 100 [0 - 440] 20 - 250 [89 - 1100]	• Space saving design • Smooth, precise movement • High load capacity with very low deflection • Multiple mid-positions		• General automation • Packaging • Assembly machine builders • Medical • Semiconductor • Optical • Plastics • Automotive
SM (Dual Bore) page 2-107 	SMxx08 SMxx12 SMxx16 SMxx25 SMxx32	3 [75] 4 [100] 5 [125] 6 [150] 6 [150]	.5 - 2 [2 -9] 2 - 8 [9 - 35] 8 - 15 [35 - 67] 15 - 35 [67 - 155] 35 - 70 [155 - 311]	• Long life • Increased stopping capability • Full range of travel adjustment • Low cost		• Optical • Medical • Life science • Cosmetic • Light bulb • Assembly machine builders • Semiconductor
SG page 2-117 	SGxx1 SGxx2 SGxx3 SGxx4 SGxx5 SGxx6	12.0 [305] 12.0 [305] 16.0 [405] 20.0 [510] 24.0 [610] 36.0 [915]	40 [178] 50 [222] 65 [289] 160 [712] 300 [1334] 500 [2224]	• Long travel • Highest load capacity saddle type slide • Lowest cost per travel length and load		• Assembly machine builders • Material handling • Optical • Automotive

SEE THE PHD CLASSICS CATALOG FOR THE FOLLOWING PHD SLIDES:

Series B, C, M, N, R, SJP, SGxM & T Slides

phd Unlimited™
UNIQUE SOLUTIONS

unique solutions

Corrosion Resistant Plastic Slide
Model# ML305773
100% corrosion resistant
PET & stainless steel
page 2-131

Corrosion Resistant Compact Heavy Duty Slide
Model# ML307246
Hardcoated body and tool plate
page 2-133

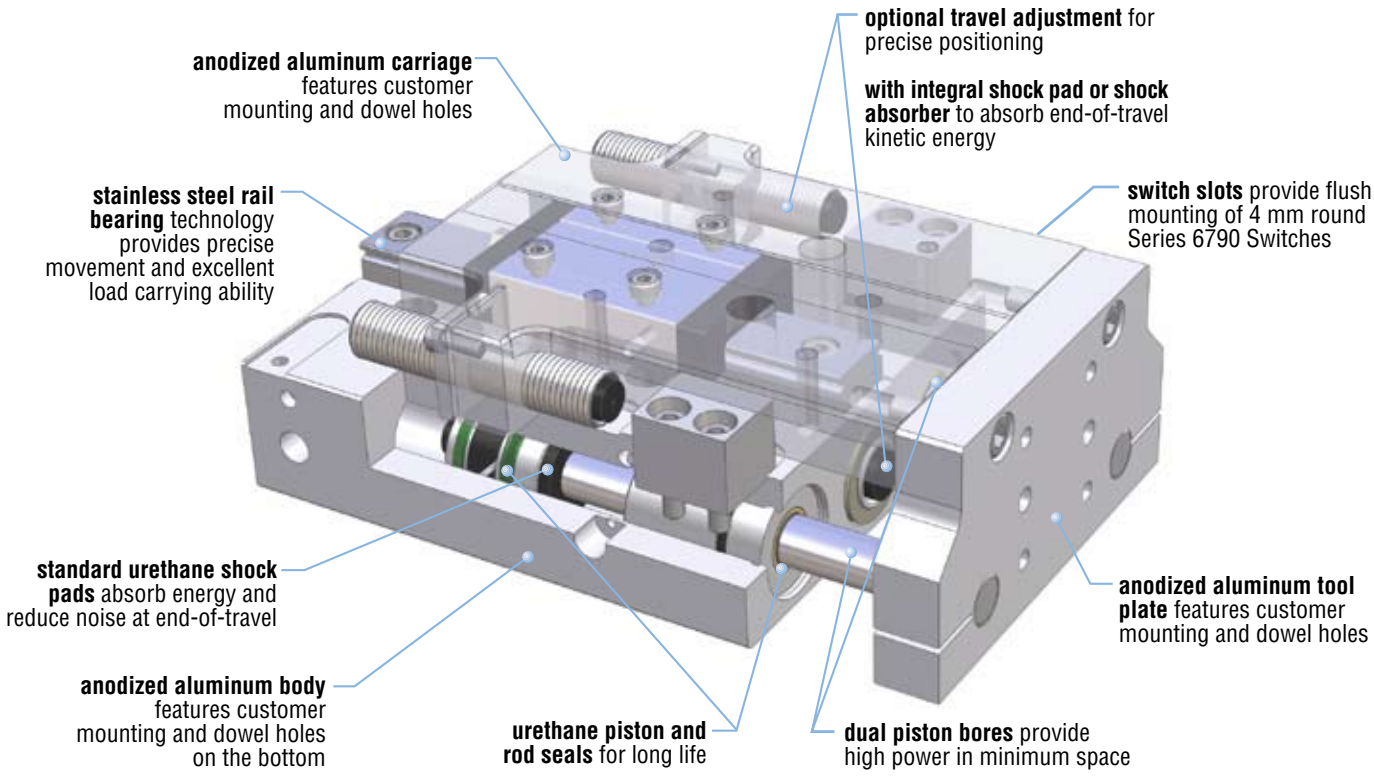
Series SFP with Feedback
Model# ML309003
Uses BIL Balluff transducer
20 pulses/.001 in
page 2-135

Glass Bottle Pusher Slide
Model# ML305605
Direct replacement for customer unit
High temperature application
High speed
page 2-137

Series SAH with Bellows
Model# ML307248
Compact heavy duty slide
High load capacity
page 2-139

STP

COMPACT PRECISION RAIL BEARING TECHNOLOGY



Major Benefits

- Built for high speed, high accuracy, and high load applications
- Precision movement
- All adjustments made from rear of slide
- Travel adjustments stop load evenly, eliminating internal side loads for maximum life and position accuracy
- Five bore sizes with three travel lengths per bore size
- Direct mounting of same bore sizes without tool plates
- Two day delivery

Industry Uses

- High speed automation
- Precision assembly
- Semiconductor
- Assembly machine builders
- Optical
- Automotive
- Material Handling
- Medical

ORDERING DATA: SERIES STP SLIDES WITH RAIL BEARING

TO ORDER SPECIFY:
Product, Series, Bearing Type, Carriage Style, Design No., Size, Travel, Travel Adjustment, Shock Absorber Installed, and Miscellaneous Options.

PRODUCT
S - Slide

BEARING TYPE
P - Profile rail

DESIGN NO.
1 - Imperial
5 - Metric

BORE SIZE	TRAVEL IMPERIAL (in)	TRAVEL METRIC (mm)
08	1, 2, 3	25, 50, 75
12	1, 2-1/2, 4	25, 60, 100
16	1-1/2, 3, 5	38, 75, 125
20	2, 4, 6	50, 100, 150
25	2, 4, 6	50, 100, 150

SHOCK ABSORBER INSTALLED OPTION
NE1x - Shock absorber installed on extend, position 1
NE2x - Shock absorber installed on extend, position 2
NRx - Shock absorber installed on retract
"x" indicates shock absorber dampening constant (2 or 3) which must be specified by the customer.

S T P D 5 25 x 50 – AR – NE1x – M – Q6

SERIES
T - Compact Thruster

CARRIAGE STYLE
D - Dual stop

BORE SIZE
08
12
16
20
25

TRAVEL ADJUSTMENT OPTION
AE1 - Travel adjustment and shock pad on extend, position 1
AE2 - Travel adjustment and shock pad on extend, position 2
AR - Travel adjustment and shock pad on retract

MISCELLANEOUS OPTIONS
J3 - Transitional fit dowel holes
J8 - Precision fit dowel holes
M - Magnetic piston for use with PHD Series 6790 Switches
Q6 - Complete corrosion resistant guide shafts

SERIES 6790 SWITCHES

PART NO.	DESCRIPTION
67902-1-02	NPN (Sink) or PNP (Source) DC Reed, 2 m cable
67902-1-05	NPN (Sink) or PNP (Source) DC Reed, 5 m cable
67903-1-02	NPN (Sink) DC Solid State, 2 m cable
67903-1-05	NPN (Sink) DC Solid State, 5 m cable
67904-1-02	PNP (Source) DC Solid State, 2 m cable
67904-1-05	PNP (Source) DC Solid State, 5 m cable
67922-1	NPN (Sink) or PNP (Source) DC Reed, Quick Connect
67929-2	AC Reed, Current Limited, Quick Connect
67923-1	NPN (Sink) DC Solid State, Quick Connect
67924-1	PNP (Source) DC Solid State, Quick Connect
63549-02	2 m Cordset with Quick Connect
63549-05	5 m Cordset with Quick Connect

SHOCK ABSORBER REPLACEMENTS

BORE SIZE	PART NO.
08	68149-01-x
12	68149-01-x
16	68015-01-x
20	70861-01-x
25	67127-01-x

"x" indicates shock absorber dampening constant (2 or 3) which must be specified by the customer.

SPECIFICATIONS	SERIES STP
OPERATING PRESSURE	20 psi min to 150 psi [1.4 bar min to 10 bar max] air
OPERATING TEMPERATURE	20° to 180°F [-6° to 82°C]
TRAVEL TOLERANCE	+.098/-.000 [+2.5/-0.0 mm]
REPEATABILITY	±0.001 of original position
VELOCITY	30 to 36 in/sec [0.75 m/sec] extend, 24 in/sec [0.61 m/sec] retract, (zero load at 87 psi [6 bar])
LUBRICATION	Factory lubricated for life
MAINTENANCE	Field repairable

SIZE	TRAVEL in	TRAVEL mm	SHAFT DIAMETER in	SHAFT DIAMETER mm	BORE DIAMETER in	BORE DIAMETER mm	EXTEND PISTON AREA in²	EXTEND PISTON AREA mm²	RETRACT PISTON AREA in²	RETRACT PISTON AREA mm²	BASE WEIGHT lb	BASE WEIGHT kg	TYPICAL DYNAMIC LOAD lb	TYPICAL DYNAMIC LOAD N
08	1	25	.157	4	.315	8	.16	101	.12	75	0.55	0.25	0-2	0-9
	2	50									0.81	0.37		
	3	75									1.01	0.46		
12	1	25	.236	6	.472	12	.35	229	.27	172	1.12	0.51	2-4	8-18
	2-1/2	60									1.71	0.78		
	4	100									2.26	1.03		
16	1-1/2	38	.315	8	.630	16	.62	402	.47	302	2.10	0.95	4-8	18-36
	3	75									2.68	1.22		
	5	125									3.63	1.65		
20	2	50	.394	10	.787	20	.97	628	.73	470	3.62	1.64	8-16	36-71
	4	100									5.24	2.38		
	6	150									6.64	3.01		
25	2	50	.472	12	.984	25	1.52	982	1.17	756	5.46	2.48	16-32	71-142
	4	100									7.55	3.43		
	6	150									9.55	4.34		

NOTE: Thrust capacity, allowable mass, and dynamic moment capacity must be considered when selecting a slide. Refer to PHD's sizing software or the product sizing catalog for complete sizing and selection information.

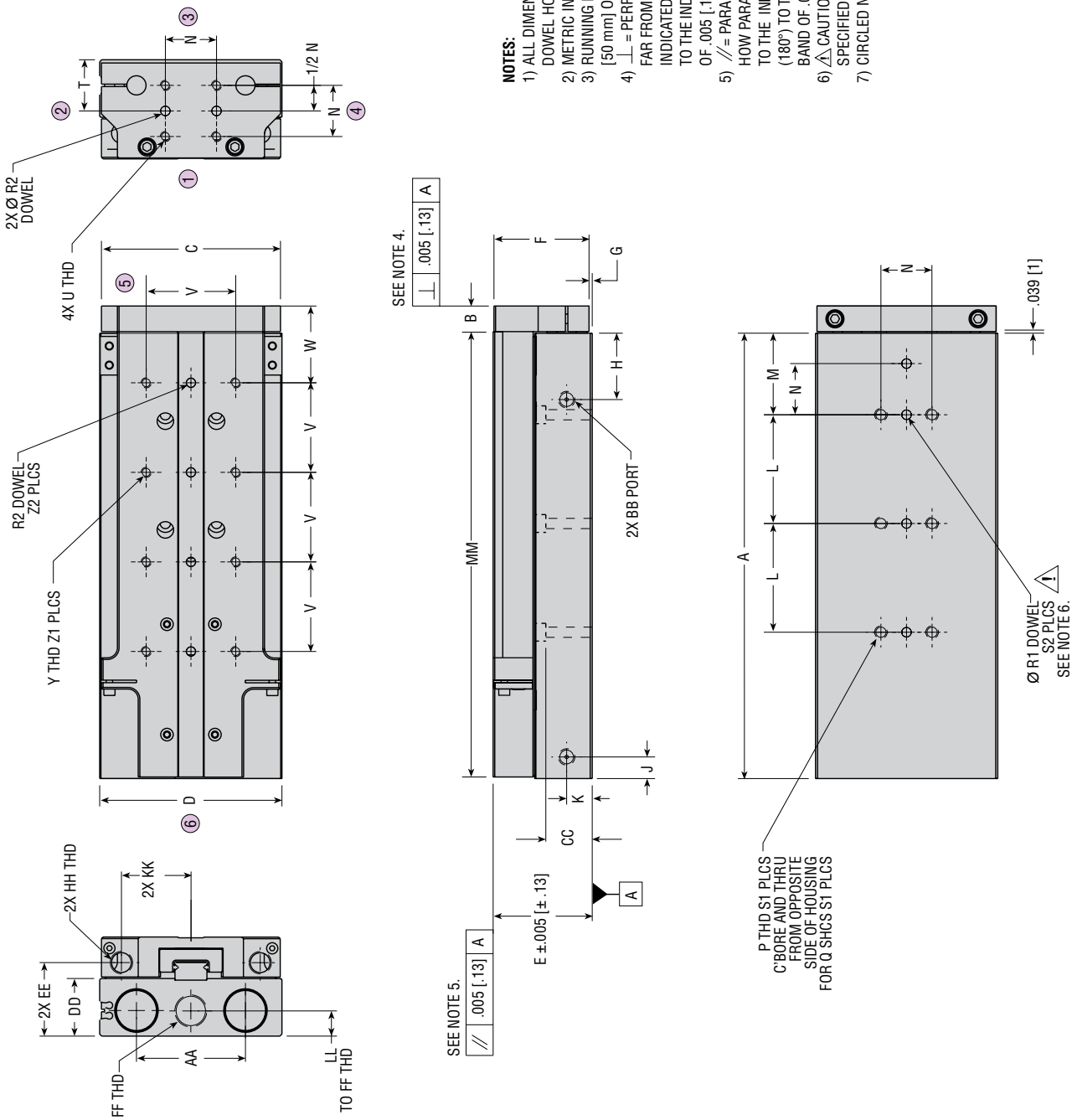
CYLINDER FORCE CALCULATIONS

	IMPERIAL F = P x A	METRIC F = 0.1 x P x A
F = Cylinder Force	lbs	N
P = Operating Pressure	psi	bar
A = Effective Area (Extend or Retract)	in²	mm²

SIZE	TRAVEL in	TRAVEL mm	OPTION ADDERS -AR lb	-AR kg	-NRx lb	-NRx kg	-AEx OR NEx lb	-AEx OR NEx kg
08	1	25	0.03	0.014	0.11	0.05	0.06	0.03
	2	50	0.04	0.018	0.11	0.05		
	3	75	0.05	0.023	0.11	0.05		
12	1	25	0.10	0.05	0.09	0.04	0.09	0.04
	2-1/2	60	0.15	0.07	0.178	0.08		
	4	100	0.20	0.09	0.298	0.14		
16	1-1/2	38	0.22	0.10	0.19	0.09	0.13	0.06
	3	75	0.29	0.13	0.26	0.12		
	5	125	0.40	0.18	0.37	0.17		
20	2	50	0.65	0.30	0.32	0.15	0.27	0.12
	4	100	0.85	0.39	0.512	0.23		
	6	150	1.03	0.47	0.687	0.31		
25	2	50	0.57	0.26	0.42	0.19	0.29	0.13
	4	100	0.87	0.39	0.73	0.33		
	6	150	1.16	0.53	1.02	0.46		

SIZING AND APPLICATION ASSISTANCE
See PHD Product Sizing Catalog for specific and complete sizing information.
Online sizing assistance is available at: ***www.phdinc.com/apps/sizing***

NOTES:
1) ALL DIMENSIONS ARE SYMMETRICAL ABOUT CENTERLINE OF DOWEL HOLES UNLESS OTHERWISE SPECIFIED.
2) METRIC INFORMATION SHOWN IN [ ].
3) RUNNING PARALLELISM TO DATUM A IS .002 in [.05 mm] AT 2 in [50 mm] OF TRAVEL.
4) ⊥ = PERPENDICULARITY TOLERANCE, THIS DETERMINES HOW FAR FROM 90° THAT THE INDICATED FEATURES CAN BE TO THE INDICATED DATUM FEATURES. THIS SURFACE IS ORIENTED (90°) TO THE INDICATED DATUM SURFACES WITHIN A TOLERANCE BAND OF .005 [.13].
5) // = PARALLELISM TOLERANCE, THIS TOLERANCE DETERMINES HOW PARALLEL (180°) THAT THE INDICATED FEATURES CAN BE TO THE INDICATED DATUM FEATURES. THE SURFACE IS PARALLEL (180°) TO THE INDICATED DATUM SURFACES WITHIN A TOLERANCE BAND OF .005 [.13].
6) ⚠ CAUTION: PRESSING DOWEL PINS DEEPER THAN DEPTH SPECIFIED MAY CAUSE INTERNAL DAMAGE ON -AR OPTION.
7) CIRCLED NUMBERS INDICATE POSITIONS.



All dimensions are reference only unless specifically toleranced.

LETTER DIM.	BORE SIZE																											
	08						12						16						20						25			
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
TRAVEL	1	25	2	50	3	75	1	25	2.5	60	4	100	1-1/2	38	3	75	5	125	2	50	4	100	6	150	2	50	4	100	6	150
A	2.953	75.0	4.587	116.5	5.866	149.0	3.544	90.0	5.671	144.0	7.795	198.0	4.528	115.0	6.024	153.0	8.544	217.0	5.433	138.0	8.327	211.5	10.965	278.5	5.531	140.5	8.327	211.5	10.965	278.5
B	0.315		8.0				0.394		10.0				0.433		11.0				0.512		13.0				0.630		16.0			
C	2.087		53.0				2.559		65.0				3.425		87.0				3.7		94.0				4.409		112.0			
D	2.165		55.0				2.638		67.0				3.504		89.0				3.779		96.0				4.488		114.0			
E	0.983		25.0				1.37		34.8				1.574		40.0				1.969		50.0				2.440		62.0			
F	0.924		23.5				1.271		32.3				1.476		37.5				1.87		47.5				2.341		59.5			
G	0.039		1.0				0.079		2.0				0.079		2.0				0.079		2.0				0.079		2.0			
H	0.924		23.5				0.797		20.2				1.437		36.5				1.2		30.5				1.634		41.5			
J	0.492		12.5				0.797		20.2				0.531		13.5				1.2		30.5				0.532		13.5			
K	0.217		5.5				0.378		9.6				0.453		11.5				0.566		14.4				0.630		16.0			
L	1.102		28.0				1.496		38.0				1.929		49.0				2.205		56.0				2.677		68.0			
M	1.142		29.0				1.024		26.0				1.713		43.5				1.613		41.0				2.008		51.0			
N	0.551		14.0				0.67		17.0				0.905		23.0				1.024		26.0				1.260		32.0			
P	8-32 x .394 [M4 x 0.7 x 10]						10-24 x .632 [M5 x 0.8 x 16]						1/4-20 x .689 [M6 x 1.0 x 17.5]						1/4-20 x .910 [M6 x 1.0 x 23]						5/16-18 x 1.142 [M8 x 1.25 x 29]					
Q	#5 [M3]						#6 [M4]						#10 [M5]						#10 [M5]						1/4 [M6]					
R1	3 mm x 2.5 mm DP						4 mm x 2.5 mm DP						5 mm x 3 mm DP						5 mm x 3 mm DP						6 mm x 5.5 mm DP					
R2	3 mm x 3 mm DP						4 mm x 4 mm DP						5 mm x 5 mm DP						5 mm x 5 mm DP						6 mm x 6 mm DP					
S1	4		4		6		4		4		6		4		4		6		4		4		6		4		4		6	
S2	3		3		4		3		3		4		3		3		4		3		3		4		3		3		4	
T	0.5315		13.5				0.713		18.1				0.9055		23.0				1.078		27.4				1.260		32.0			
U	5-40 x .315 DP [M3 x 8 DP]						6-32 x .394 DP [M4 x 10 DP]						10-24 x .433 DP [M5 x 11 DP]						10-24 x .512 DP [M5 x 13 DP]						1/4-20 x .630 DP [M6 x 16 DP]					
V	0.866		22.0				1.102		28.0				1.496		38.0				1.654		42.0				2.205		56.0			
W	1.102		28.0				1.300		33.0				1.378		35.0				1.85		47.0				1.890		48.0			
Y	5-40 x .275 DP [M3 x 7 DP]						8-32 x .375 DP [M4 x 9.5 DP]						10-24 x .375 DP [M5 x 9.5 DP]						10-24 x .375 DP [M5 x 9.5 DP]						1/4-20 x .500 DP [M6 x 13 DP]					
Z1	4		6		8		4		6		8		4		6		8		4		6		8		4		6		8	
Z2	2		3		4		2		3		4		2		3		4		2		3		4		2		3		4	
AA	1.142		29.0				1.496		38.0				1.969		50.0				2.264		57.5				2.684		68.2			
BB	10-32 PORT [M5 x 0.8 PORT]						10-32 PORT [M5 x 0.8 PORT]						10-32 PORT [M5 x 0.8 PORT]						1/8 NPT PORT [1/8 BSPP PORT]						1/8 NPT PORT [1/8 BSPP PORT]					
CC	0.401		10.2				0.612		15.5				0.684		17.4				0.91		23.1				1.143		29.0			
DD	0.551		14.0				0.795		20.2				0.906		23.0				1.132		28.8				1.418		36.0			
EE	0.752		19.1				1.022		26.0				1.181		30.0				1.447		36.8				1.810		46.0			
FF	M6 x 1.0 x 32 DP						7/16-20 x 1.800 DP						M14 x 1.5 x 55 DP						M16 x 1.5 x 57 DP						M20 x 1.5 x 60 DP					
HH	M8 x 1.0 x 12.5 DP						M8 x 1.0 x 12.5 DP						M10 x 1.0 x 18.5 DP						M12 x 1.0 x 19 DP						M14 x 1.5 x 19.5 DP					
KK	0.743		18.9				0.955		24.3				1.26		32.0				1.417		36.0				1.712		43.5			
LL	0.217		5.5				0.319		8.1				0.394		10.0				0.566		14.4				0.620		15.7			
MM	2.953	75.0	4.587	116.5	5.866	149.0	3.377	85.8	5.671	144.0	7.795	198.0	4.528	115.0	6.024	153.0	8.544	217.0	5.433	138.0	8.327	211.5	10.965	278.5	5.531	140.5	8.327	211.5	10.965	278.5

METRIC INFORMATION SHOWN IN [ ].

All dimensions are reference only unless specifically toleranced.

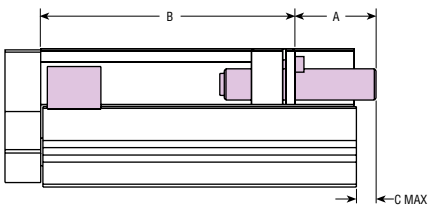
AE1 TRAVEL ADJUSTMENT AND SHOCK PAD ON EXTEND IN POSITION 1

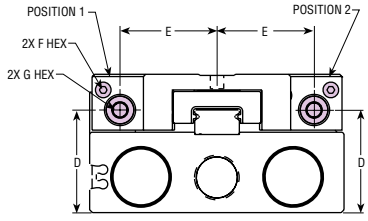
This option provides travel adjustment with a shock pad on extend in position 1. Shock pads provide excellent noise reduction and energy absorption capability. Travel on extend can be reduced by a maximum of 'A' shown in the table below. Adjust travel adjustment screw to the required position using 'G' hex wrench and lock into place using 'F' hex wrench. See PHD Product Sizing Catalog for stopping capacity of the shock pad. Online sizing assistance is available at: www.phdinc.com/apps/sizing.

AE2 TRAVEL ADJUSTMENT AND SHOCK PAD ON EXTEND IN POSITION 2

This option provides travel adjustment with a shock pad on extend in position 2. Shock pads provide excellent noise reduction and energy absorption capability. By using -AE1 and -AE2 options together, yaw moments are greatly reduced and may eliminate the need for a shock absorber. Travel on extend can be reduced by a maximum of 'A' shown in the table below. Adjust travel adjustment screw to the required position using 'G' hex wrench and lock into place using 'F' hex wrench. See PHD Product Sizing Catalog for stopping capacity of the shock pad.

SIZE	TRAVEL in	TRAVEL mm	A in	A mm	B in	B mm	C in	C mm	D in	D mm	E in	E mm	F HEX	G HEX
08	1	25	.650	16.5	2.953	75.0	.591	15.0	.752	19.1	0.74	18.9	2 mm	3 mm
	2	50	.827	21.0	3.779	96.0	–	–						
	3	75	.827	21.0	4.783	121.5	–	–						
12	1	25	.749	19.0	2.755	70.0	.120	3.0	1.022	26.0	0.96	24.3	2.5 mm	3 mm
	2-1/2	60	.944	24.0	4.490	114.0	–	–						
	4	100	1.122	28.5	6.081	154.5	–	–						
16	1-1/2	38	.945	24.0	3.662	93.0	.039	1.0	1.181	30.0	1.260	32	2.5 mm	5 mm
	3	75	1.122	28.5	4.981	126.5	–	–						
	5	125	1.102	28.0	6.989	177.5	–	–						
20	2	50	1.281	32.5	4.152	105.5	–	–	1.447	36.8	1.42	36	2.5 mm	6 mm
	4	100	1.654	42.0	6.576	167.0	–	–						
	6	150	1.299	33.0	8.896	226.0	–	–						
25	2	50	1.437	36.5	4.487	114.0	.354	9.0	1.810	46.0	1.71	43.5	3 mm	6 mm
	4	100	1.181	30.0	6.732	171.0	–	–						
	6	150	1.122	28.5	8.800	223.5	–	–						

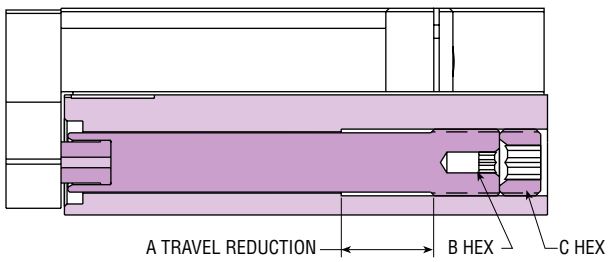


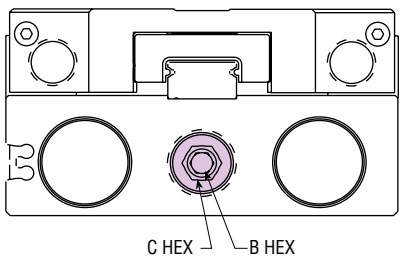


AR TRAVEL ADJUSTMENT AND SHOCK PAD ON RETRACT

This option provides travel adjustment with a shock pad on retract. Shock pads provide excellent noise reduction and energy absorption capability. Travel on retract can be reduced by a maximum of 'A' shown in the table below. Adjust travel adjustment screw to the required position using 'B' hex wrench and lock into place using 'C' hex wrench. See PHD Product Sizing Catalog for stopping capacity of the shock pad. **Caution:** When using dowel pins, do not exceed depth noted on dimensional page. Internal damage to screw may occur.

SIZE	A in	A mm	B HEX	C HEX
08	.512	13.0	2.5 mm	3 mm
12	.669	17.0	4 mm	5 mm
16	.984	25.0	5 mm	6 mm
20	1.063	27.0	6 mm	8 mm
25	1.063	27.0	6 mm	10 mm





All dimensions are reference only unless specifically toleranced.

J3 TRANSITIONAL FIT DOWEL PIN HOLES

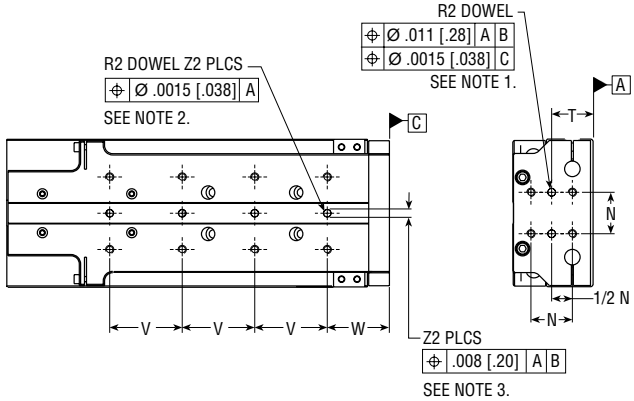
This option provides a compromise fit between clearance and interference. Transitional fits are used where accuracy of location is important, but a small amount of clearance is permissible.

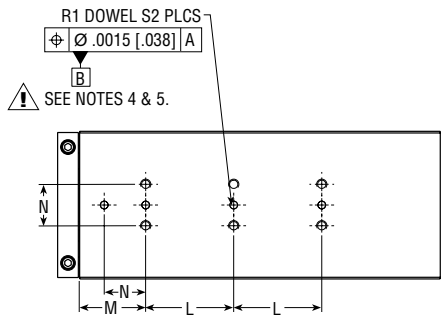
J8 PRECISION FIT DOWEL PIN HOLES

This option provides H7 tolerance precision fit with dowel pins. Precision fits are used where accuracy of location is of prime importance and for parts requiring rigidity and alignment.

LETTER DIM	SIZE 08						SIZE 12						SIZE 16						SIZE 20						SIZE 25					
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
TRAVEL	1	25	2	50	3	75	1	25	2.5	60	4	100	1-1/2	38	3	75	5	125	2	50	4	100	6	150	2	50	4	100	6	150
L	1.102	28.0					1.496	38.0					1.929	49.0					2.205	56.0					2.677	68.0				
N	.551	14.0					.670	17.0					.905	23.0					1.024	26.0					1.260	32.0				
R1	3 mm x 2.5 mm DP						4 mm x 2.5 mm DP						5 mm x 3 mm DP						5 mm x 3 mm DP						6 mm x 5.5 mm DP					
R2	3 mm x 3 mm DP						4 mm x 4 mm DP						5 mm x 5 mm DP						5 mm x 5 mm DP						6 mm x 6 mm DP					
S2	3		3		4		3		3		4		3		3		4		3		3		4		3		3		4	
T	.532	13.5					.713	18.1					.906	23.0					1.078	27.4					1.260	32.0				
V	.866	22.0					1.102	28.0					1.496	38.0					1.654	42.0					2.205	56.0				
W	1.102	28.0					1.300	33.0					1.378	35.0					1.851	47.0					1.890	48.0				
Z2	2		3		4		2		3		4		2		3		4		2		3		4		2		3		4	

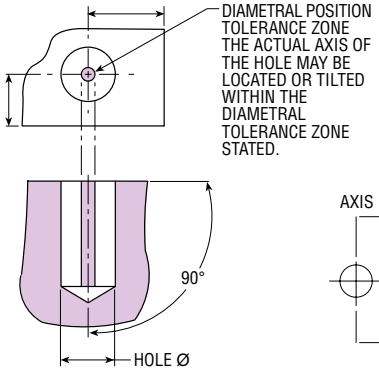
Ø R DOWEL HOLE	TOLERANCE		
	STANDARD	J3 OPTION	J8 OPTION
3 mm	+.0004/-.0009 [+.010/-.024]	+.0013/+.0003 [+.033/+.008]	+.0004/-.0000 [+.010/-.000]
4 mm	+.0004/-.0009 [+.010/-.024]	+.0015/+.0005] [+.033/+.008]	+.0005/-.0000 [+.010/-.000]
5 mm	+.0004/-.0009 [+.010/-.024]	+.0015/+.0004] [+.038/+.010]	+.0005/-.0000 [+.012/-.000]
6 mm	+.0004/-.0009 [+.010/-.024]	+.0015/+.0005] [+.038/+.013]	+.0005/-.0000 [+.012/-.000]



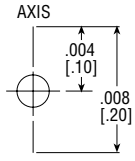


NOTES:

1) THE AXIS OF THESE DOWEL HOLES ARE LOCATED TO SURFACE A (DATUM) AND DOWEL HOLE PATTERN B (DATUM) WITHIN A .011 DIAMETRAL TOLERANCE ZONE. ADDITIONALLY THE AXIS OF THE HOLES ARE LOCATED TO EACH OTHER AND PERPENDICULAR TO SURFACE C (DATUM) WITHIN A .0015 DIAMETRAL TOLERANCE ZONE.
2) THE AXIS OF THE DOWEL HOLES ARE LOCATED TO EACH OTHER AND PERPENDICULAR TO SURFACE A (DATUM) WITHIN A .0015 [.038] DIAMETRAL TOLERANCE ZONE.
3) THE AXIS OF THESE HOLES ARE LOCATED TO SURFACE A (DATUM) AND DOWEL HOLE PATTERN B (DATUM) WITHIN .008 BILATERAL TOLERANCE ZONE.
4) THE AXIS OF THESE DOWEL HOLES ARE LOCATED TO EACH OTHER AND PERPENDICULAR TO SURFACE A (DATUM) WITHIN A .0015 [.038] DIAMETRAL TOLERANCE ZONE.
5) ⚠ CAUTION: DO NOT EXCEED DOWEL HOLE DEPTH WHEN INSTALLING DOWEL PINS. INTERNAL DAMAGE MAY OCCUR.
6) ⌖ = POSITION TOLERANCE, THIS TOLERANCE DETERMINES THE LOCATION OF THE HOLES AND THE PERPENDICULARITY TO THE INDICATED DATUM FEATURES.



DIAMETRAL ZONE



BILATERAL ZONE

M MAGNET FOR PHD SERIES 6790 MINIATURE REED AND SOLID STATE SWITCHES

This option equips the unit with a magnetic piston for use with PHD's Series 6790 Switch. The switch housing is completely contained by the slide housing and provides a very compact switch design. The switches mount easily into two small grooves located on the side of the slide housing and are locked into place with a set screw. See Switches and Sensors section for complete switch information.

PART NO.	DESCRIPTION
67902-1-02	NPN (Sink) or PNP (Source) DC Reed, 2 m cable
67902-1-05	NPN (Sink) or PNP (Source) DC Reed, 5 m cable
67903-1-02	NPN (Sink) DC Solid State, 2 m cable
67903-1-05	NPN (Sink) DC Solid State, 5 m cable
67904-1-02	PNP (Source) DC Solid State, 2 m cable
67904-1-05	PNP (Source) DC Solid State, 5 m cable
67922-1	NPN (Sink) or PNP (Source) DC Reed, Quick Connect
67929-2	AC Reed, Current Limited, Quick Connect
67923-1	NPN (Sink) DC Solid State, Quick Connect
67924-1	PNP (Source) DC Solid State, Quick Connect
63549-02	2 m Cordset with Quick Connect
63549-05	5 m Cordset with Quick Connect

NOTES:
1) Switch set screw torque to 16 in-oz [.11 Nm] max.
2) See Switches and Sensors section for additional switch information and complete specification.

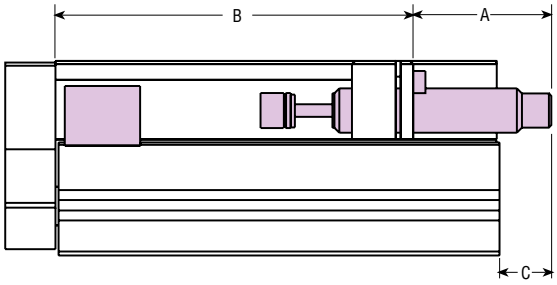
NE1x SHOCK ABSORBER INSTALLED ON EXTEND IN POSITION 1

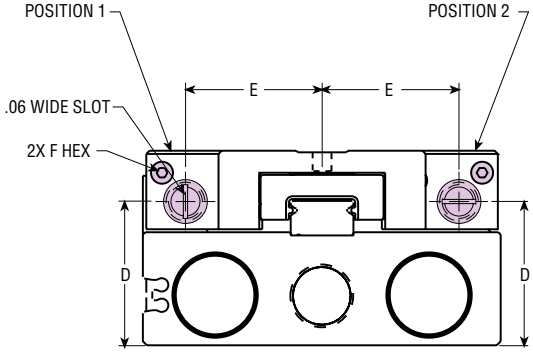
This option provides shock absorbers and travel adjustment on extend in position 1. Travel on extend can be reduced by a maximum of 'A' shown in the table below. Adjust shock absorber screw to the required position using a large screwdriver and lock into place using 'F' hex wrench. **NOTE:** The "x" indicates shock absorber damping constant which must be specified by customer. (See PHD Product Sizing Catalog for shock absorber selection requirements.)

NE2x SHOCK ABSORBER INSTALLED ON EXTEND IN POSITION 2

This option provides shock absorbers and travel adjustment on extend in position 2. Travel on extend can be reduced by a maximum of 'A' shown in the table below. Adjust shock absorber screw to the required position using a large screwdriver and lock into place using 'F' hex wrench. **NOTE:** The "x" indicates shock absorber damping constant which must be specified by customer. (See PHD Product Sizing Catalog for shock absorber selection requirements.)

SIZE	TRAVEL in	TRAVEL mm	A in	A mm	B in	B mm	C in	C mm	D in	D mm	E in	E mm	F HEX
08	1	25	.650	16.5	2.953	75.0	.591	15.0	.752	19.1	0.743	18.9	2 mm
	2	50	.827	21.0	3.779	96.0	–	–					
	3	75	.827	21.0	4.783	121.5	–	–					
12	1	25	1.064	27.0	2.755	70.0	.433	11.0	1.022	26.0	0.96	24.4	2.5 mm
	2-1/2	60	0.828	21.0	4.490	114.0	–	–					
	4	100	0.866	22.5	6.081	154.5	–	–					
16	1-1/2	38	.945	24.0	3.662	93.0	.039	1.0	1.181	30.0	1.260	32	2.5 mm
	3	75	1.122	28.5	4.981	126.5	–	–					
	5	125	1.102	28.0	6.989	177.5	–	–					
20	2	50	1.280	32.5	4.152	105.5	–	–	1.447	36.8	1.42	36	2.5 mm
	4	100	1.280	32.5	6.576	167.0	–	–					
	6	150	1.280	32.5	8.896	226.0	–	–					
25	2	50	1.772	45.0	4.487	114.0	.669	17.0	1.810	46.0	1.712	43.5	3 mm
	4	100	1.516	38.5	6.732	171.0	–	–					
	6	150	1.457	37.0	8.800	223.5	–	–					





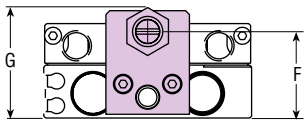
All dimensions are reference only unless specifically toleranced.

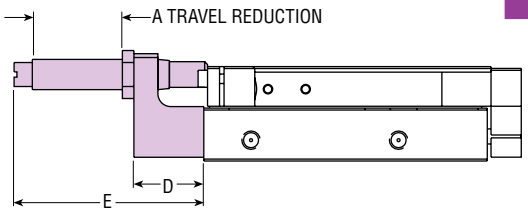
FOR SIZE 08 ONLY

NRx SHOCK ABSORBER INSTALLED ON RETRACT

This option provides shock absorbers and travel adjustment on retract. Travel on retract can be reduced by a maximum of 'A' shown in the table at right. Adjust travel to the required position using a large screwdriver and lock into place using 11 mm hex wrench. **NOTE:** The "x" indicates shock absorber damping constant which must be specified by customer. (See PHD Product Sizing Catalog for shock absorber selection requirements.)

A		D		E		F		G	
in	mm	in	mm	in	mm	in	mm	in	mm
.905	23.0	.728	18.5	2.008	51.0	.901	22.9	1.151	29.2



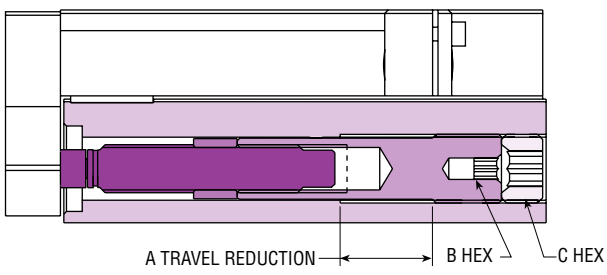


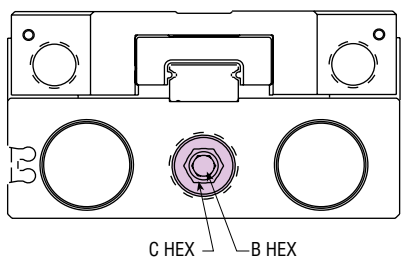
FOR SIZES 12, 16, 20, & 25

NRx SHOCK ABSORBER INSTALLED ON RETRACT

This option provides shock absorbers and travel adjustment on retract. Travel on retract can be reduced by a maximum of 'A' shown in the table. Adjust travel to the required position using 'B' hex wrench and lock into place using 'C' hex wrench. **NOTE:** The "x" indicates shock absorber damping constant which must be specified by customer. (See PHD Product Sizing Catalog for shock absorber selection requirements.)

MODEL	A in	A mm	B HEX	C HEX
STPxx12	.512	13.0	4 mm	5 mm
STPxx16	.984	25.0	5 mm	6 mm
STPxx20	1.063	27.0	6 mm	8 mm
STPxx25	1.063	27.0	6 mm	10 mm



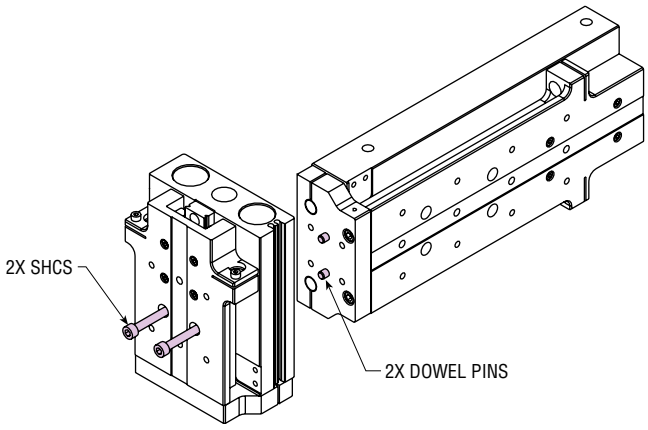


Q6 CORROSION RESISTANT GUIDE SHAFTS

This option provides stainless steel guide shafts with hard chrome plating, for use in applications where the standard shaft ends may corrode.

MODULAR MOUNTING KITS

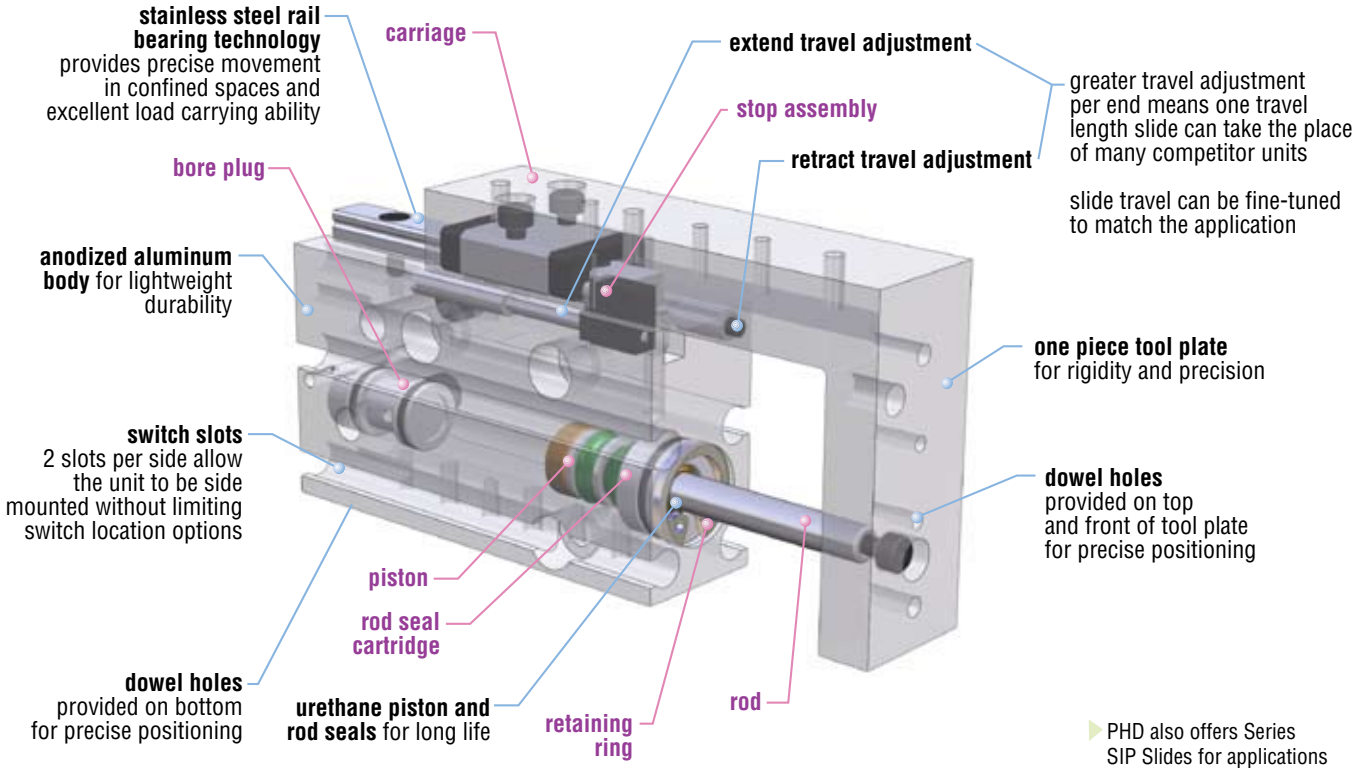
Modular design of the Series STP housings and tool plates allow slide units to bolt and dowel together without the need for a transition plate. See chart for slide compatibility and hardware kits required. Each kit contains 2 dowel pins and 2 SHCS to mount the units together. PHD recommends that a -J3 option (transitional fit) be specified with the slide ordering data to allow the units to dowel together properly. Both units have -J3 dowel hole option as shown.



		KIT NUMBERS	
PRIMARY	SECONDARY	IMPERIAL	METRIC
STPDx08	STPDx08	68125-01	68125-02
STPDx12	STPDx12	70770-01	70770-02
STPDx16	STPDx16	68053-01	68053-02
STPDx20	STPDx20	70870-01	70870-02
STPDx25	STPDx25	68043-01	68043-02

SHP

COMPACT PRECISION RAIL BEARING TECHNOLOGY



PHD also offers Series SIP Slides for applications where space is limited.

Major Benefits

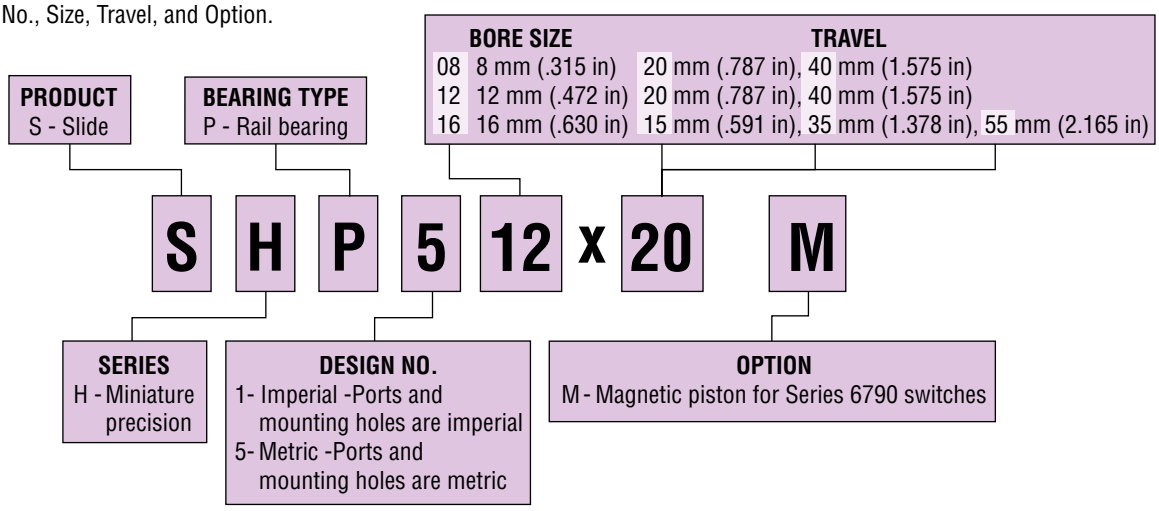
- Built-in travel adjustment to fit your application needs
- Multiple mounting surfaces with dowel holes for flexibility
- Imperial and metric versions available
- High load carrying capacity
- 3 bore sizes offered
- Precision ground rail bearing technology

Industry Uses

- Assembly machine builders
- Precision assembly equipment
- Testing equipment
- Life Science
- Semiconductor
- Medical
- Optical
- Light bulb
- Material handling
- Automotive

ORDERING DATA: SERIES SHP SLIDES

TO ORDER SPECIFY:
Product, Series, Bearing Type, Design No., Size, Travel, and Option.



SERIES 6790 PROXIMITY SWITCHES

PART NO.	DESCRIPTION
67902-1-02	NPN (Sink) or PNP (Source) DC Reed, 2 m cable
67902-1-05	NPN (Sink) or PNP (Source) DC Reed, 5 m cable
67903-1-02	NPN (Sink) DC Solid State, 2 m cable
67903-1-05	NPN (Sink) DC Solid State, 5 m cable
67904-1-02	PNP (Source) DC Solid State, 2 m cable
67904-1-05	PNP (Source) DC Solid State, 5 m cable
67922-1	NPN (Sink) or PNP (Source) DC Reed, Quick Connect
67929-2	AC Reed, Current Limited, Quick Connect
67923-1	NPN (Sink) DC Solid State, Quick Connect
67924-1	PNP (Source) DC Solid State, Quick Connect
63549-02	2 m Cordset with Quick Connect
63549-05	5 m Cordset with Quick Connect

SPECIFICATIONS	SERIES SHP
OPERATING PRESSURE	20 psi min to 100 psi max [1.4 bar min to 6.9 bar max] air
OPERATING TEMPERATURE	-20° to +180°F [-29° to +82°C]
TRAVEL TOLERANCE	Extend and retract travel adjustments standard
REPEATABILITY	± 0.001 inch [± .025 mm] of original position
VELOCITY	21 in/sec [0.53 m/sec] max (zero load at 100 psi [6.9 bar])
LUBRICATION	Factory lubricated for life
MAINTENANCE	Field repairable

SIZING AND APPLICATION ASSISTANCE

See PHD Product Sizing Catalog for specific and complete sizing information. Online sizing assistance is available at:

www.phdinc.com/apps/sizing

SIZE	TRAVEL in	TRAVEL mm	TRAVEL TIME sec	ROD DIAMETER in	ROD DIAMETER mm	BORE DIAMETER in	BORE DIAMETER mm	EXTEND PISTON AREA in²	EXTEND PISTON AREA mm²	RETRACT PISTON AREA in²	RETRACT PISTON AREA mm²	BASE WEIGHT lb	BASE WEIGHT kg	MAX DYNAMIC LOAD lb	MAX DYNAMIC LOAD N	TYPICAL DYNAMIC LOAD lb	TYPICAL DYNAMIC LOAD N
08	0.79 1.57	20 40	0.1 0.18	.157	4	.315	8	.08	50	.06	38	0.20 0.26	0.09 0.12	1.13	5	0-.84	0-3.75
12	0.79 1.57	20 40	0.18 0.22	.236	6	.472	12	.17	110	.13	85	0.38 0.48	0.17 0.22	2.25	10	.23-1.69	1-7.5
16	0.59 1.38 2.17	15 35 55	0.15 0.2 0.25	.236	6	.630	16	.31	200	.27	170	0.56 0.71 0.85	0.25 0.32 0.39	3.38	15	.34-2.53	1.5-11.5

NOTE: Thrust capacity, allowable mass and dynamic moment capacity must be considered when selecting a slide.

TRAVEL ADJUSTMENT

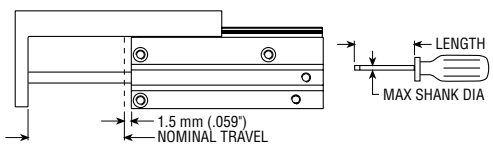
Standard Series SHP Slides provide travel adjustment in both the retract and extend directions. Travel adjustments are made using a small flat bladed or standard screwdriver via the adjustment holes located on the back of the slide. Series SHP Slides are designed to provide nominal travel. Using the travel adjustment screws allows reducing either the extend or retract travel by .394 in [10 mm] (.197 in [5 mm] for SHP08).

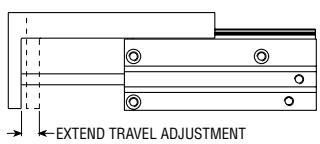
Travel adjustment requires a small flat bladed screwdriver with a minimum shank length and diameter as shown in the table below. Blade thickness should not exceed .030 in [.75 mm]. Travel adjustments should not be adjusted beyond positions shown in illustration. Loss of components or damage to the mechanism may occur if adjusted beyond the recommended limits.

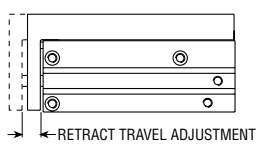
CYLINDER FORCE CALCULATIONS

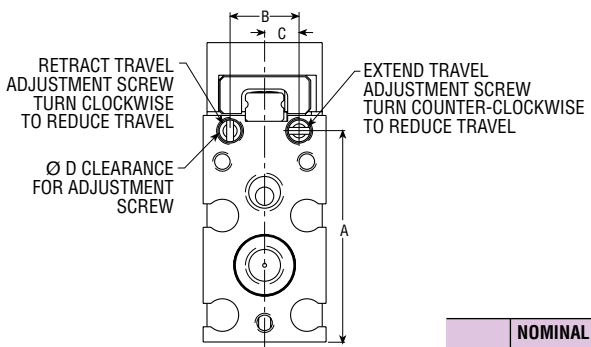
	IMPERIAL F = P x A	METRIC F = 0.1 x P x A
F = Cylinder Force	lbs	N
P = Operating Pressure	psi	bar
A = Effective Area (Extend or Retract)	in²	mm²

TRAVEL ADJUSTMENT







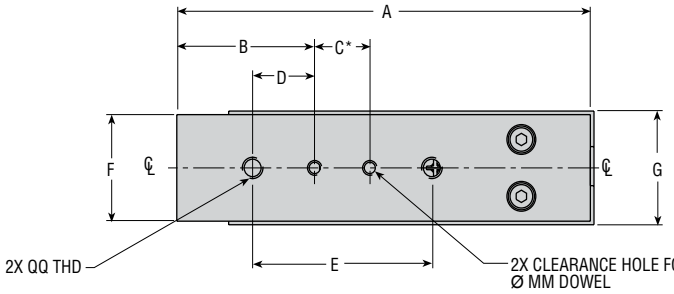


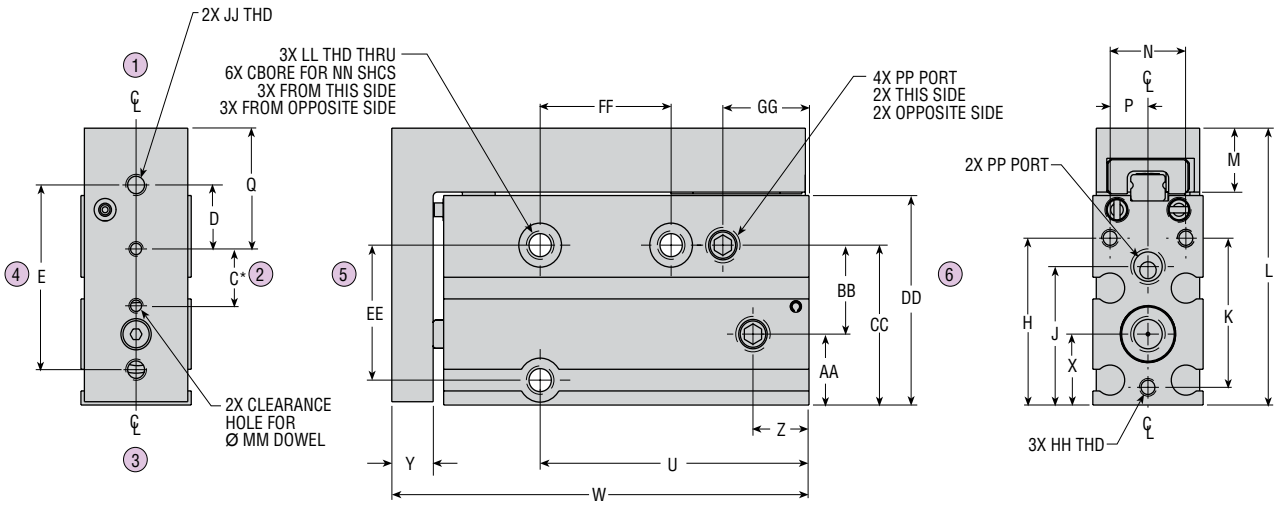
LETTER DIM	SIZE 08 in	08 mm	12 in	12 mm	16 in	16 mm
A	1.082	27.5	1.300	33.0	1.436	36.5
B	0.354	9.0	0.480	12.2	0.570	14.5
C	0.177	4.5	0.240	6.1	0.285	7.2
D	0.125	3.2	0.165	4.2	0.165	4.2

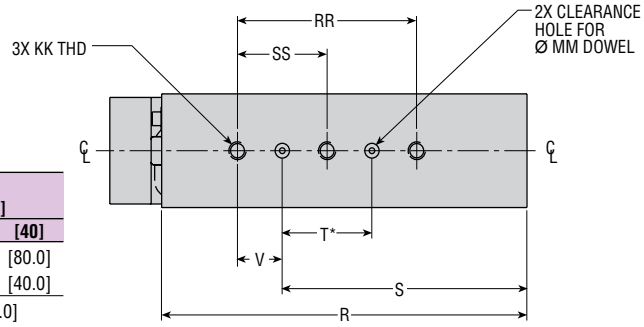
SIZE	NOMINAL TRAVEL in	NOMINAL TRAVEL mm	EXTEND TRAVEL ADJUSTMENT in	EXTEND TRAVEL ADJUSTMENT mm	RETRACT TRAVEL ADJUSTMENT in	RETRACT TRAVEL ADJUSTMENT mm	ADJUSTMENT MIN. SHANK LENGTH in	ADJUSTMENT MIN. SHANK LENGTH mm	SCREWDRIVER MAX. SHANK DIAMETER in	SCREWDRIVER MAX. SHANK DIAMETER mm
08	0.79	20	.197	5	.197	5	1.5	38	.083	2.1
	1.57	40	.197	5	.197	5	2.3	58	.083	2.1
12	0.79	20	.394	10	.394	10	1.1	28	.130	3.3
	1.57	40	.394	10	.394	10	1.2	30	.130	3.3
16	0.59	15	.394	10	.394	10	1.3	33	.130	3.3
	1.38	35	.394	10	.394	10	1.3	33	.130	3.3
	2.17	55	.394	10	.394	10	2.2	55	.130	3.3

All dimensions are reference only unless specifically toleranced.

DIMENSIONS: SERIES SHP SLIDES - SIZE 08







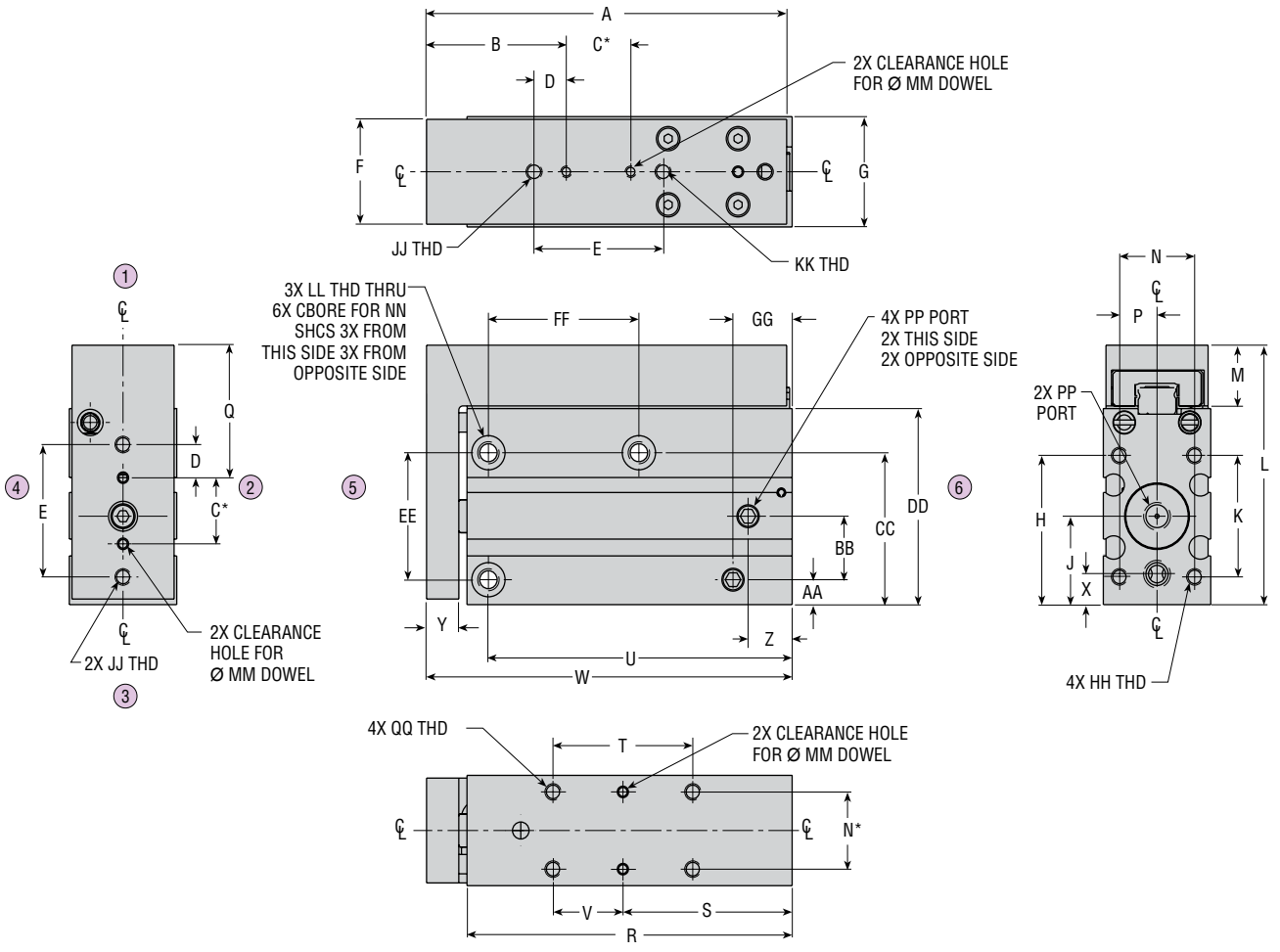
LETTER DIM.	SIZE 08 TRAVEL, in [mm] 0.79 [20]	1.57 [40]
A	2.362 [60.0]	3.149 [80.0]
B	0.787 [20.0]	1.574 [40.0]
C*	0.315 [8.0]	
D	0.354 [9.0]	
E	1.024 [26.0]	
F	0.591 [15.0]	
G	0.630 [16.0]	
H	0.925 [23.5]	
J	0.767 [19.5]	
K	0.827 [21.0]	
L	1.534 [39.0]	
M	0.354 [9.0]	
N	0.433 [11.0]	
P	0.217 [5.5]	
Q	0.669 [17.0]	
R	2.087 [53.0]	2.874 [73.0]
S	1.398 [35.5]	1.791 [45.5]
T*	0.512 [13.0]	
U	1.536 [39.0]	2.323 [59.0]
V	0.256 [6.5]	
W	2.383 [60.5]	3.17 [80.5]
X	0.393 [10.0]	
Y	0.236 [6.0]	
Z	0.320 [8.1]	

LETTER DIM.	SIZE 08 TRAVEL, in [mm] 0.79 [20]	1.57 [40]
AA	.393 [10.0]	
BB	.493 [12.5]	
CC	.886 [22.5]	
DD	1.161 [29.5]	
EE	.748 [19.0]	
FF	0.748 [19.0]	1.535 [39.0]
GG	0.492 [12.5]	
HH	#4-40 UNC x .320 DP	[M2.5 x 0.45 x 8.1 mm DP]
JJ	#4-40 UNC THRU	[M3 x 0.5 THRU]
KK	#4-40 UNC x .140 DP	[M2.5 x 0.45 x 3.5 mm DP]
LL	#8-32 UNC THRU	[M4 x 0.7 THRU]
MM	1/16 x .125 DP	[2 mm x 3.1 mm DP]
NN	#5	[M3]
PP	#10-32 PORT	[M5 x 0.8 PORT]
QQ	#4-40 UNC x .157 DP	[M3 x 0.5 x 4.0 mm DP]
RR	1.024 [26.0]	
SS	.512 [13.0]	

NOTES:
1) DESIGNATED ℄ IS CENTERLINE OF UNIT.
2) METRIC INFORMATION SHOWN IN [ ].
3) CIRCLED NUMBERS INDICATE POSITION.
4) * TOLERANCE IS ± .001 BETWEEN DOWEL PIN HOLES.

All dimensions are reference only unless specifically toleranced.

DIMENSIONS: SERIES SHP SLIDES - SIZES 12 & 16



LETTER DIM.	SIZE 12 TRAVEL, in [mm] 0.79 [20]	1.57 [40]	SIZE 16 TRAVEL, in [mm] 0.59 [15]	1.38 [35]	2.17 [55]
A	2.638 [67.0]	3.425 [87.0]	2.874 [73.0]	3.661 [93.0]	4.449 [113.0]
B	1.024 [26.0]	1.811 [46.0]	1.201 [30.5]	1.988 [50.5]	2.776 [70.5]
C*	0.472 [12.0]		0.472 [12.0]		
D	0.236 [6.0]		0.512 [13.0]		
E	0.945 [24.0]		1.496 [38.0]		
F	0.748 [19.0]		0.945 [24.0]		
G	0.787 [20.0]		0.984 [25.0]		
H	1.064 [27.0]		1.141 [29.0]		
J	0.631 [16.0]		0.669 [17.0]		
K	0.866 [22.0]		0.944 [24.0]		
L	1.851 [47.0]		2.106 [53.5]		
M	0.433 [11.0]		0.551 [14.0]		
N*	0.551 [14.0]		0.630 [16.0]		
P	0.276 [7.0]		0.315 [8.0]		
Q	0.945 [24.0]		0.768 [19.5]		
R	2.382 [60.5]	3.169 [80.5]	2.559 [65.0]	3.346 [85.0]	4.134 [105.0]
S	1.240 [31.5]	1.633 [41.5]	1.338 [34.0]	1.731 [44.0]	2.126 [54.0]
T	1.024 [26.0]		1.181 [30.0]		
U	2.225 [56.5]	3.012 [76.5]	2.362 [60.0]	3.149 [80.0]	3.937 [100.0]
V	0.512 [13.0]		0.591 [15.0]		
W	2.678 [68.0]	3.465 [88.0]	2.895 [73.5]	3.682 [93.5]	4.47 [113.5]
X	0.218 [5.5]		0.197 [5.0]		
Y	0.236 [6.0]		0.276 [7.0]		
Z	0.323 [8.2]		0.372 [9.4]		

LETTER DIM.	SIZE 12 TRAVEL, in [mm] 0.79 [20]	1.57 [40]	SIZE 16 TRAVEL, in [mm] 0.59 [15]	1.38 [35]	2.17 [55]
AA	0.178 [4.5]		0.197 [5.0]		
BB	0.453 [11.5]		0.472 [12.0]		
CC	1.084 [27.5]		1.161 [29.5]		
DD	1.399 [35.5]		1.535 [39.0]		
EE	0.906 [23.0]		0.984 [25.0]		
FF	1.102 [28.0]	1.889 [48.0]	1.181 [30.0]	1.968 [50.0]	2.756 [70.0]
GG	0.433 [11.0]		0.591 [15.0]		
HH	#4-40 UNC x .236 DP	[M3 x 0.5 x 6 mm DP]	#8-32 UNC x .276 DP	[M4 x 0.7 x 7 mm DP]	
JJ	#4-40 UNC x .236 DP	[M3 x 0.5 x 6 mm DP]	#8-32 UNC x .295 DP	[M4 x 07 x 7.5 mm DP]	
KK	#4-40 UNC x .167 DP	[M3 x 0.5 x 4.2 mm DP]	#8-32 UNC x .207 DP	[M4 x 0.7 x 5.2 mm DP]	
LL	#8-32 UNC THRU	[M4 X 0.7 THRU]	#10-32 UNF THRU	[M5 x 0.8 THRU]	
MM	1/16 x .125 DP	[2 mm x 3.1 mm DP]	1/8 x .188 DP	[2 mm x 3 mm DP]	
NN	#5	[M3]	#6	[M4]	
PP	#10-32 PORT	[M5 x 0.8 PORT]	#10-32 PORT	[M5 x 0.8 PORT]	
QQ	#4-40 UNC x .177 DP	[M3 x 0.5 x 4.5 mm DP]	#8-32 UNC x .236 DP	[M4 x 0.7 x 6 mm DP]	

NOTES:
1) DESIGNATED ℄ IS CENTERLINE OF UNIT.
2) METRIC INFORMATION SHOWN IN [ ].
3) CIRCLED NUMBERS INDICATE POSITION.
4) * TOLERANCE IS ± .001 BETWEEN DOWEL PIN HOLES.

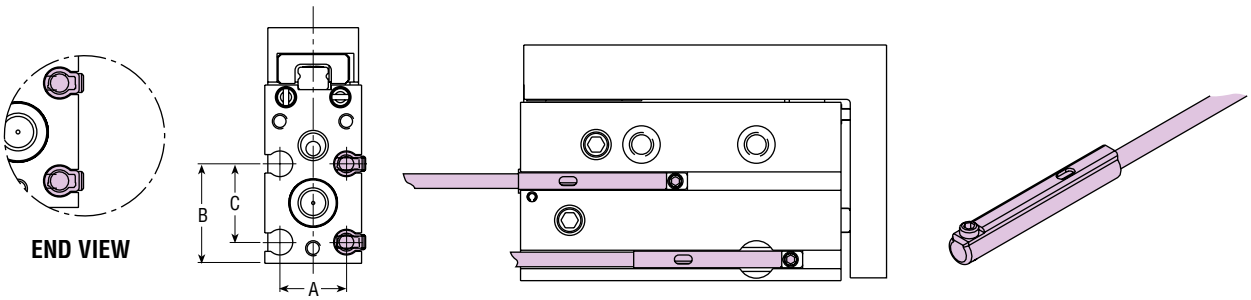
M MAGNET FOR PHD SERIES 6790 MINIATURE REED AND SOLID STATE SWITCHES

This option equips the unit with a magnetic piston for use with PHD's Series 6790 Switch. The switch housing is contained by the slide housing and provides a very compact switch design. The switches mount easily into two small grooves located on the side of the slide housing and are locked into place with a set screw.

PART NO.	DESCRIPTION
67902-1-02	NPN (Sink) or PNP (Source) DC Reed, 2 m cable
67902-1-05	NPN (Sink) or PNP (Source) DC Reed, 5 m cable
67903-1-02	NPN (Sink) DC Solid State, 2 m cable
67903-1-05	NPN (Sink) DC Solid State, 5 m cable
67904-1-02	PNP (Source) DC Solid State, 2 m cable
67904-1-05	PNP (Source) DC Solid State, 5 m cable
67922-1	NPN (Sink) or PNP (Source) DC Reed, Quick Connect
67929-2	AC Reed, Current Limited, Quick Connect
67923-1	NPN (Sink) DC Solid State, Quick Connect
67924-1	PNP (Source) DC Solid State, Quick Connect
63549-02	2 m Cordset with Quick Connect
63549-05	5 m Cordset with Quick Connect

NOTES:

1) Switch set screw torque to 16 in-oz [.11 Nm] max.
2) See Switches and Sensors section for additional switch information and complete specification.



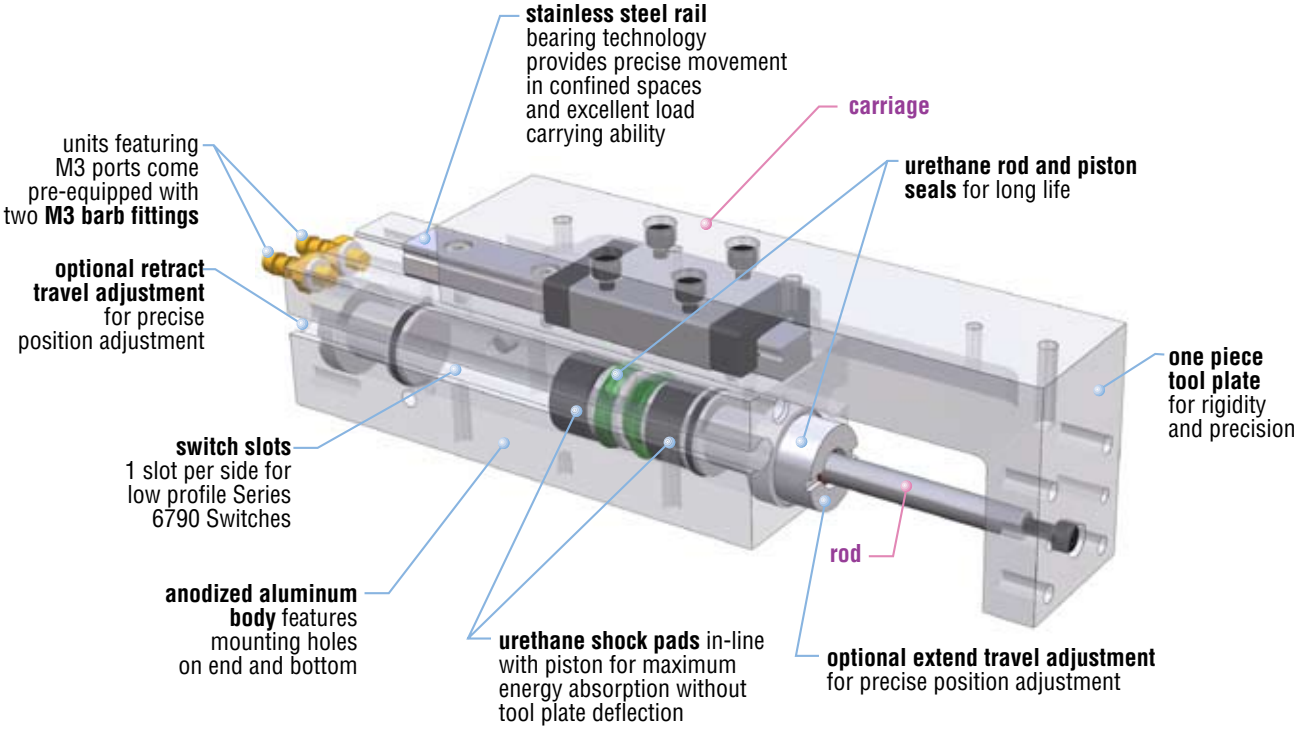
END VIEW

LETTER DIM	SIZE 08		SIZE 12		SIZE 16	
	in	mm	in	mm	in	mm
A	0.433	11.0	0.636	16.2	0.786	20.0
B	0.648	16.5	0.854	21.7	0.892	22.7
C	0.510	13.0	0.446	11.3	0.447	11.4

All dimensions are reference only unless specifically toleranced.

SIP

COMPACT PRECISION RAIL BEARING TECHNOLOGY



Major Benefits

- Compact, low-profile design
- High load carrying capability
- 3 bore sizes (12, 16, and 20 mm)
- Optional travel adjustment
- Profile ground rail bearing technology
- One piece tool plate
- Large internal shock pads for high speeds

Industry Uses

- Assembly machine builders
- Precision assembly equipment
- Testing equipment
- Life science
- Semiconductor
- Medical
- Optical
- Light bulb
- Material handling
- Automotive

ORDERING DATA: SERIES SIP RAIL BEARING SLIDES

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

BORE SIZE*		TRAVEL*
12	12 mm [.472 in]	10 mm [.394 in], 25 mm [.984 in], 50 mm [1.969 in]
16	16 mm [.630 in]	25 mm [.984 in], 50 mm [1.969 in], 75 mm [2.953 in]
20	20 mm [.787 in]	25 mm [.984 in], 50 mm [1.969 in], 75 mm [2.953 in]

PRODUCT
S - Slide

TYPE
P - Precision Rail

S I P 5 12 x 25 – AE – M

SERIES
I - Low profile miniature

DESIGN NO.
5 - Metric - Ports and mounting holes are metric**

OPTIONS
AE - Extend travel adjustment
AR - Retract travel adjustment

OPTION
M - Magnetic piston for PHD Series 6790 switches

SERIES 6790 PROXIMITY SWITCHES

PART NO.	DESCRIPTION
67902-1-02	NPN (Sink) or PNP (Source) DC Reed, 2 m cable
67902-1-05	NPN (Sink) or PNP (Source) DC Reed, 5 m cable
67903-1-02	NPN (Sink) DC Solid State, 2 m cable
67903-1-05	NPN (Sink) DC Solid State, 5 m cable
67904-1-02	PNP (Source) DC Solid State, 2 m cable
67904-1-05	PNP (Source) DC Solid State, 5 m cable
67922-1	NPN (Sink) or PNP (Source) DC Reed, Quick Connect
67929-2	AC Reed, Current Limited, Quick Connect
67923-1	NPN (Sink) DC Solid State, Quick Connect
67924-1	PNP (Source) DC Solid State, Quick Connect
63549-02	2 m Cordset with Quick Connect
63549-05	5 m Cordset with Quick Connect

NOTES:
1)*Consult PHD for additional bore sizes and travel increments.
2)**Port also accepts #10-32 fitting on bore sizes 16 and 20.

UNIQUE SLIDES ARE AVAILABLE. PLEASE CONSULT PHD.

SPECIFICATIONS	SERIES SIP
OPERATING PRESSURE	20 psi min to 100 psi max [1.4 bar min to 9 bar max] air
OPERATING TEMPERATURE	-20° to + 180°F [-29° to + 82°C]
TRAVEL TOLERANCE	Nominal travel, +.039/- .000 in [+ 1.0/- 0.0]
REPEATABILITY	± 0.001 [± .025] of original position and regulated pressure
VELOCITY	30 in/sec [0.76 m/sec] max (zero load at 100 psi [6.9 bar])
LUBRICATION	Factory lubricated for life
MAINTENANCE	Field repairable

SIZE	TRAVEL in	TRAVEL mm	TRAVEL TIME sec	ROD DIAMETER in	ROD DIAMETER mm	BORE DIAMETER in	BORE DIAMETER mm	EXTEND PISTON AREA in²	EXTEND PISTON AREA mm²	RETRACT PISTON AREA in²	RETRACT PISTON AREA mm²	BASE WEIGHT lb	BASE WEIGHT kg	MAX DYNAMIC LOAD lb	MAX DYNAMIC LOAD N	TYPICAL DYNAMIC LOAD lb	TYPICAL DYNAMIC LOAD N
12	0.39	10	0.03	.157	4	.472	12	.17	110	.16	100	0.30	0.14	2.25	10	0 - 2.03	0 - 9
	0.98	25	0.07									0.35	0.16				
	1.97	50	0.14									0.46	0.21				
16	0.98	25	0.07	.236	6	.630	16	.31	200	.27	170	0.71	0.32	3.38	15	.68 - 3.38	3 - 15
	1.97	50	0.14									0.88	0.40				
	2.95	75	0.21									1.04	0.47				
20	0.98	25	0.07	.315	8	.787	20	.49	310	.41	260	1.04	0.47	4.50	20	.90 - 4.5	4 - 20
	1.97	50	0.14									1.26	0.57				
	2.95	75	0.21									1.48	0.67				

NOTE: Thrust capacity, allowable mass and dynamic moment capacity must be considered when selecting a slide.

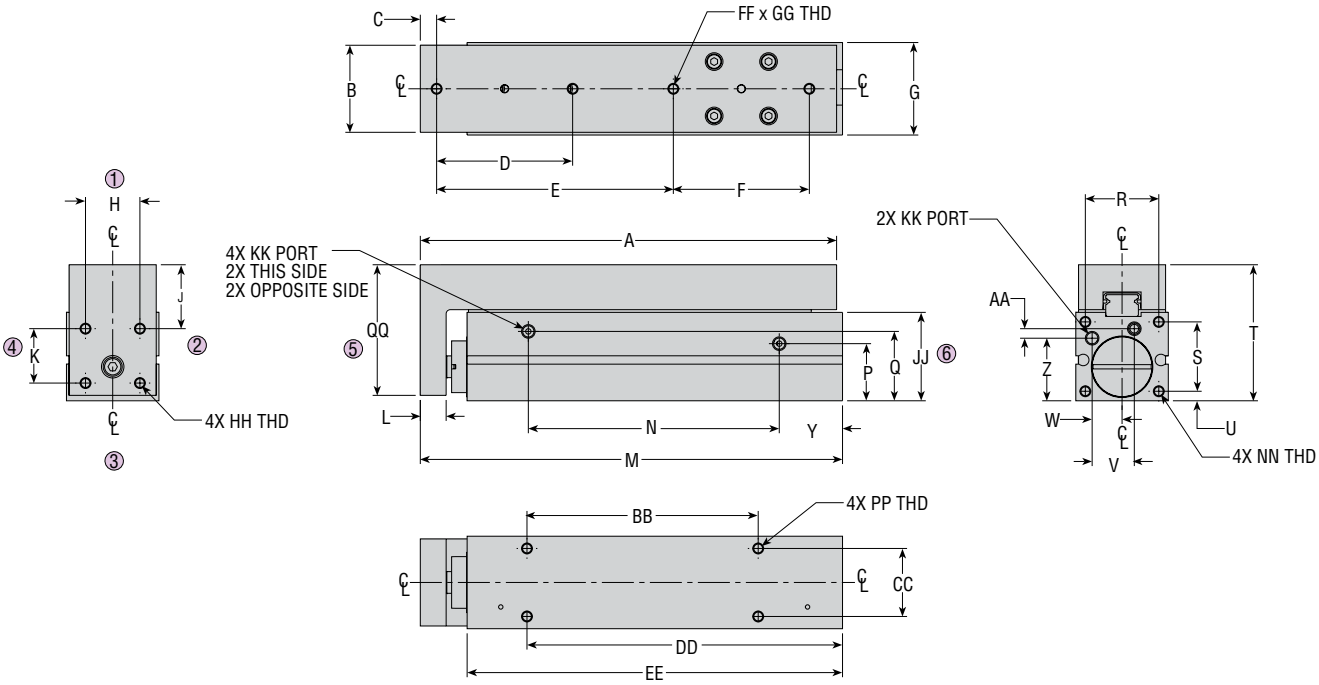
CYLINDER FORCE CALCULATIONS

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

SIZING AND APPLICATION ASSISTANCE

See PHD Product Sizing Catalog for specific and complete sizing information.
Online sizing assistance is available at: ***www.phdinc.com/apps/sizing***

DIMENSIONS: SERIES SIP RAIL BEARING SLIDES



LETTER	SIPx12 TRAVEL, in [mm]						SIPx16 TRAVEL, in [mm]						SIPx20 TRAVEL, in [mm]					
DIM	.394	[10.0]	.984	[25.0]	1.969	[50.0]	.984	[25.0]	1.969	[50.0]	2.953	[75.0]	.984	[25.0]	1.969	[50.0]	2.953	[75.0]
A	2.953	[75.0]	3.543	[90.0]	4.528	[115.0]	4.016	[102.0]	5.000	[127.0]	5.984	[152.0]	4.055	[103.0]	5.039	[128.0]	6.024	[153.0]
B			.827	[21.0]					1.063	[27.0]					1.260	[32.0]		
C			.197	[5.0]					.236	[6.0]					.236	[6.0]		
D			—		.787	[20.0]	—		1.654	[42.0]			—				1.969	[50.0]
E	.827	[21.0]	1.417	[36.0]	2.402	[61.0]	1.614	[41.0]	2.598	[66.0]	3.583	[91.0]	1.457	[37.0]	2.441	[62.0]	3.425	[87.0]
F			1.417	[36.0]					1.654	[42.0]					1.969	[50.0]		
G			.906	[23.0]					1.142	[29.0]					1.339	[34.0]		
H			.551	[14.0]					.709	[18.0]					.787	[20.0]		
J			.591	[15.0]					.748	[19.0]					.925	[23.5]		
K			.551	[14.0]					.709	[18.0]					.787	[20.0]		
L			.276	[7.0]					.295	[7.5]					.374	[9.5]		
M	3.031	[77.0]	3.622	[92.0]	4.606	[117.0]	4.094	[104.0]	5.079	[129.0]	6.063	[154.0]	4.134	[105.0]	5.118	[130.0]	6.102	[155.0]
N	.776	[19.7]	1.366	[34.7]	2.350	[59.7]	1.764	[44.8]	2.748	[69.8]	3.732	[94.8]	1.661	[42.2]	2.646	[67.2]	3.630	[92.2]
P			.256	[6.5]					.197	[5.0]					.827	[21.0]		
Q			.673	[17.1]					.866	[22.0]					1.004	[25.5]		
R			.669	[17.0]					.827	[21.0]					1.063	[27.0]		
S			.591	[15.0]					.827	[21.0]					.984	[25.0]		
T			1.299	[33.0]					1.693	[43.0]					1.969	[50.0]		
U			.138	[3.5]					.157	[4.0]					.157	[4.0]		
V			.276	[7.0]					.413	[10.5]					.610	[15.5]		
W			.098	[2.5]					.256	[6.5]					.433	[11.0]		
Y			.839	[21.3]					.913	[23.2]					.917	[23.3]		
Z			.674	[17.1]					.846	[21.5]					.906	[23.0]		
AA			0.00						.070	[1.8]					.138	[3.5]		
BB	.787	[20.0]	1.378	[35.0]	2.362	[60.0]	1.339	[34.0]	2.323	[59.0]	3.307	[84.0]	1.378	[35.0]	2.362	[60.0]	3.346	[85.0]
CC			.669	[17.0]					.866	[22.0]					.984	[25.0]		
DD	1.890	[48.0]	2.480	[63.0]	3.465	[88.0]	2.677	[68.0]	3.661	[93.0]	4.646	[118.0]	2.598	[66.0]	3.583	[91.0]	4.567	[116.0]
EE	2.461	[62.5]	3.051	[77.5]	4.035	[102.5]	3.504	[89.0]	4.488	[114.0]	5.472	[139.0]	3.465	[88.0]	4.449	[113.0]	5.433	[138.0]
FF	3		3		4		3		4		4		3		3		4	
GG			[M3 x 0.5 x 4.6]						[M4 x 0.7 x 6]						[M4 x 0.7 x 6]			
HH			[M3 x 0.5 x 7]						[M4 x 0.7 x 7.5]						[M4 x 0.7 x 9.5]			
JJ			.827	[21.0]					1.102	[28.0]					1.280	[32.5]		
KK			[M3 x 0.5 x 3.5]						[M5 x 0.8 x 4]						[M5 x 0.8 x 4.0]			
NN			[M3 x 0.5 x 5.5]						[M4 x 0.7 x 8]						[M4 x 0.7 x 8]			
PP			[M3 x 0.5 x 5.5]						[M4 x 0.7 x 6]						[M4 x 0.7 x 6]			
QQ			1.260	[32.0]					1.614	[41.0]					1.890	[48.0]		

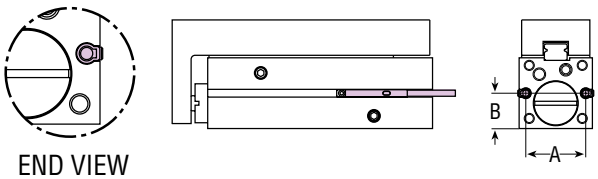
NOTES:
1) DESIGNATED ℄ IS CENTERLINE OF UNIT
2) METRIC INFORMATION SHOWN IN [ ]
3) CIRCLED NUMBERS INDICATE POSITION

All dimensions are reference only unless specifically toleranced.

M MAGNET FOR PHD SERIES 6790 REED AND SOLID STATE SWITCHES

This option equips the unit with a magnetic piston for use with PHD's Series 6790 Switch. The switch housing is contained by the slide housing and provides a very compact switch design. The switches mount easily into two small grooves located on the side of the slide housing and are locked into place with a set screw.

LETTER DIM	SIZE 12 in	SIZE 12 mm	SIZE 16 in	SIZE 16 mm	SIZE 20 in	SIZE 20 mm
A	0.689	17.5	0.933	23.7	1.122	28.5
B	0.492	12.5	0.551	14	0.591	15



END VIEW

PART NO.	DESCRIPTION
67902-1-02	NPN (Sink) or PNP (Source) DC Reed, 2 m cable
67902-1-05	NPN (Sink) or PNP (Source) DC Reed, 5 m cable
67903-1-02	NPN (Sink) DC Solid State, 2 m cable
67903-1-05	NPN (Sink) DC Solid State, 5 m cable
67904-1-02	PNP (Source) DC Solid State, 2 m cable
67904-1-05	PNP (Source) DC Solid State, 5 m cable
67922-1	NPN (Sink) or PNP (Source) DC Reed, Quick Connect
67929-2	AC Reed, Current Limited, Quick Connect
67923-1	NPN (Sink) DC Solid State, Quick Connect
67924-1	PNP (Source) DC Solid State, Quick Connect
63549-02	2 m Cordset with Quick Connect
63549-05	5 m Cordset with Quick Connect

NOTES:

1) Switch set screw torque to 16 in-oz [.11 Nm] max.
2) See Switches and Sensors section for additional switch information and complete specification.

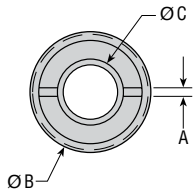
AE AR TRAVEL ADJUSTMENT

The AE and AR options provide travel adjustment by reducing the extend or retract travel respectively. Normal shock pad operation is maintained regardless of travel adjustment setting. Travel adjustments have internal stops to prevent loss of components. Both options may be used together to provide adjustment at both ends of travel.

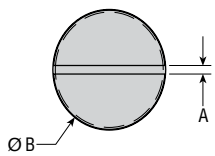
AE- Travel Adjustment on Extend
This option provides up to 5 mm of travel reduction on extend. Travel adjustment is made using a spanner wrench or similar tool to engage the slots in the cartridge. Rotating the cartridge clockwise reduces the travel.

AR- Travel Adjustment on Retract
This option provides up to 5 mm of travel reduction on retract. Travel adjustment is made using a flat-bladed screwdriver to engage the slot in the bore plug. Rotating the bore plug clockwise reduces the travel.

AE
CARTRIDGE SLOT DETAIL



AR
BORE PLUG SLOT DETAIL

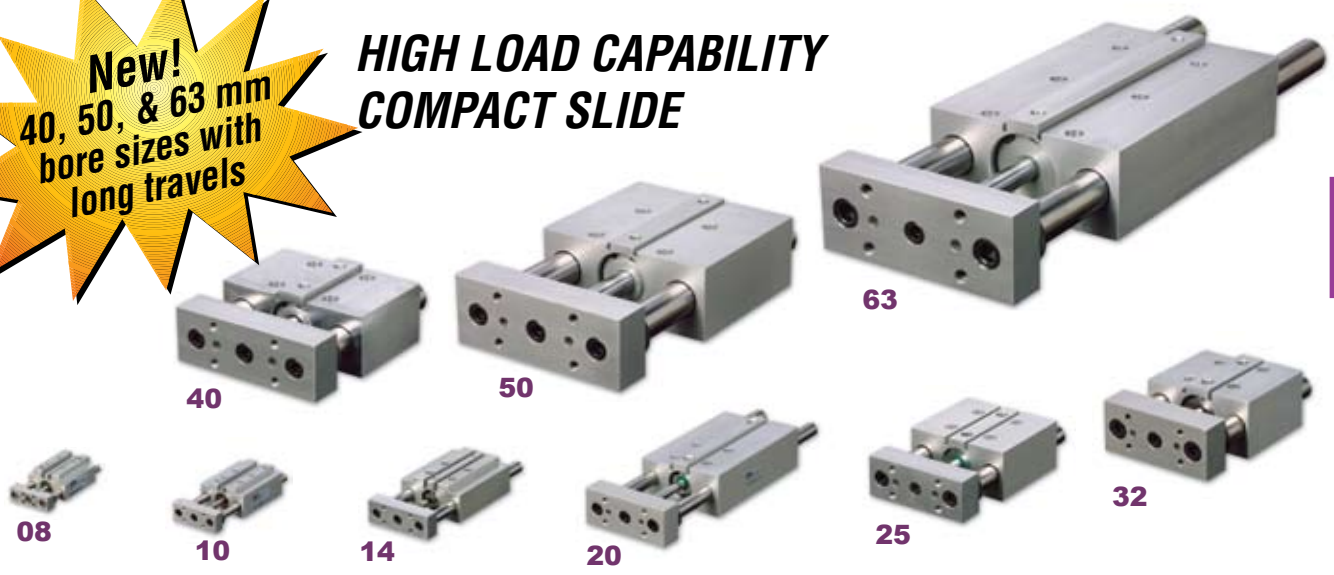


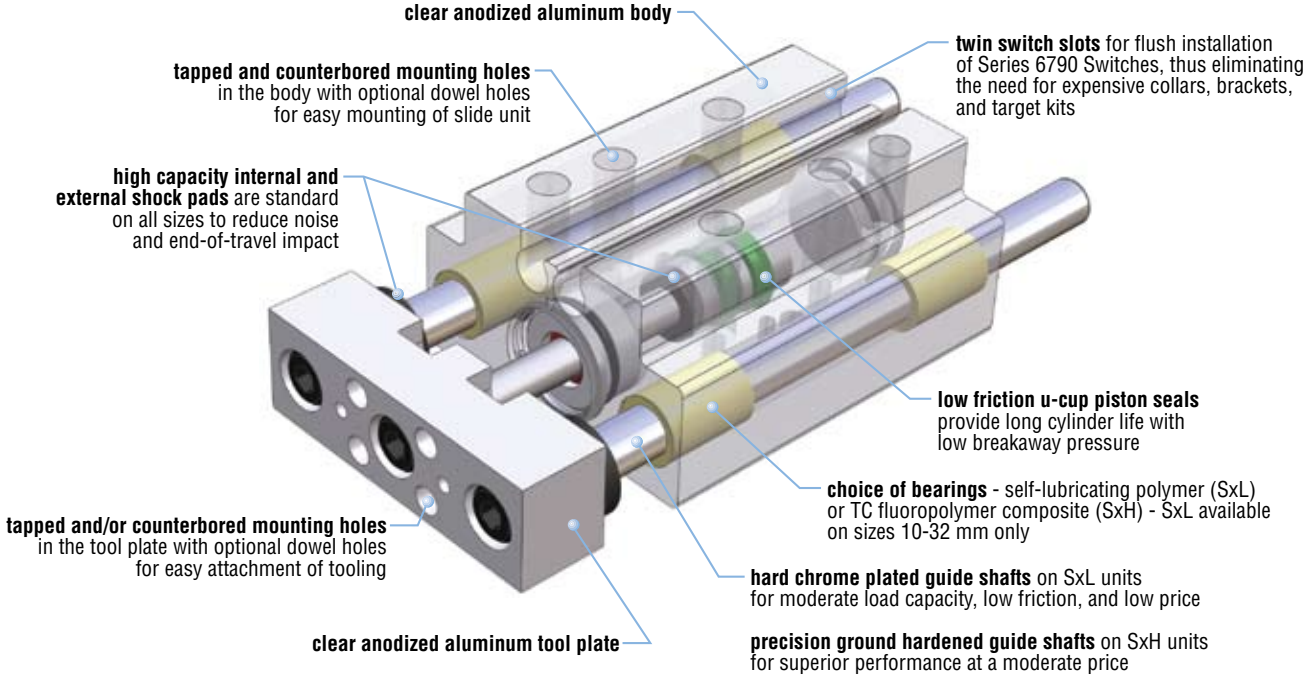
SIZE	A SLOT WIDTH in	A SLOT WIDTH mm	B MAX TOOL DIA in	B MAX TOOL DIA mm	C ROD CLEARANCE DIA in	C ROD CLEARANCE DIA mm	SLOT DEPTH in	SLOT DEPTH mm
12	.062	1.6	.450	11.4	.215	5.5	.030	.8
16	.062	1.6	.600	15.2	.362	9.2	.060	1.5
20	.062	1.6	.817	20.8	.478	12.1	.060	1.5

SxL, SxH

New! 40, 50, & 63 mm bore sizes with long travels

HIGH LOAD CAPABILITY COMPACT SLIDE





Major Benefits

- Choose from two bearing types (2 bearings per shaft, 4 total)
- Nine bore sizes
- No metal to metal contact
- Completely corrosion resistant options provide protection in harsh environments
- All units incorporate twin switch slots for flush switch mounting
- Ships next day

Industry Uses

- Material handling – conveyor
- Assembly machine builders
- Labeling equipment
- Bearing manufacturers
- Automotive
- Semiconductor
- Optical

ORDERING DATA: SERIES SxL/SxH SLIDES

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

PRODUCT
S - Slide

TYPE
L - Polymer bushing (see note 1)
H - Heavy duty precision TC composite bushing

BORE SIZE (mm)
08
10
14
20
25
32
40
50
63

CORROSION RESISTANCE
Q6 - Total corrosion resistant guide shafts
Z1 - Total corrosion resistant unit

MAGNET
M - Magnetic piston for PHD Series 6790 Switches

DOWEL HOLES
(see availability table below)
J3 - Transitional fit
J4 - Clearance fit (imperial only)
J8 - Precision fit (metric only)

S	A	L	1	10	x	1/2	–	Z1	–	AE	–	M	–	J3

SERIES
A - Threaded tool plate
B - Counterbore holes in tool plate

DESIGN NO.
1 - Imperial - ports and mounting holes are imperial
5 - Metric - ports and mounting holes are metric

TRAVEL (see note 4)

UNIT & BORE SIZE	IMPERIAL (in)		METRIC (mm)	
SAL/SBL	STANDARD		STANDARD	
10	1/2, 1, 1-1/2		12, 25, 40	
14	1/2, 1, 1-1/2		12, 25, 40	
20, 25, 32	1, 2, 3		25, 50, 75	
SAH/SBH	STANDARD	LONG	STANDARD	LONG
08	1/2, 1, 1-1/2	–	12, 25, 40	–
10	1/2, 1, 1-1/2	2, 3, 4	12, 25, 40	–
14	1/2, 1, 1-1/2	2, 3, 4, 5, 6	12, 25, 40	–
20, 25, 32	1, 2, 3	4, 5, 6, 7, 8	25, 50, 75	–
40, 50, 63	1, 2, 3	4, 5, 6, 7, 8	50, 75	100

TRAVEL ADJUSTMENT
AE - Extend travel adjustment

SERIES 6790 PROXIMITY SWITCHES

PART NO.	DESCRIPTION
67902-1-02	NPN (Sink) or PNP (Source) DC Reed, 2 m cable
67902-1-05	NPN (Sink) or PNP (Source) DC Reed, 5 m cable
67903-1-02	NPN (Sink) DC Solid State, 2 m cable
67903-1-05	NPN (Sink) DC Solid State, 5 m cable
67904-1-02	PNP (Source) DC Solid State, 2 m cable
67904-1-05	PNP (Source) DC Solid State, 5 m cable
67922-1	NPN (Sink) or PNP (Source) DC Reed, Quick Connect
67929-2	AC Reed, Current Limited, Quick Connect
67923-1	NPN (Sink) DC Solid State, Quick Connect
67924-1	PNP (Source) DC Solid State, Quick Connect
63549-02	2 m Cordset with Quick Connect
63549-05	5 m Cordset with Quick Connect

UNIQUE SLIDES ARE AVAILABLE. PLEASE CONSULT PHD.

NOTES:
1) L - Polymer bushing not available on size 08, 40, 50, & 63 mm bore units.
2) Shock pads are standard on extend and retract for all sizes. Retract shock pads are located on the guide shafts. Extend shock pad is located internally on the piston.
3) -AE option (stop collars) is recommended for high cycle speed applications and high load applications. Extend shock pads are included with the -AE option to remove impact load from the piston rod.
4) ** Long travel units are available standard on imperial units. 100 mm long travel units are available on metric sizes 40, 50, & 63. Contact PHD for longer travel metric units.

DOWEL HOLE AVAILABILITY

DESIGN NO.	ITEM	DOWEL HOLES	J3	J4	J8
1 (IMPERIAL)	HOUSING	(J3 STD)	STD	OPT	–
	SAx TOOL PLATE	NONE	OPT	OPT	–
	SBx TOOL PLATE	(J3 STD)	STD	OPT	–
2 (METRIC)	HOUSING	PD	OPT	–	OPT
	SAx TOOL PLATE	PD	OPT	–	OPT
	SBx TOOL PLATE	PD	OPT	–	OPT

NOTES:
1) SEE DOWEL HOLE DIAMETERS TABLE FOR DIMENSIONAL INFORMATION.
2) STD = Standard OPT = Optional PD = Production Diameter

SPECIFICATIONS	SERIES SxL / SxH
OPERATING PRESSURE	30 to 150 psi [2 to 10 bar]
OPERATING TEMPERATURE	-20° to 180°F [-29° to 82°C]
TRAVEL TOLERANCE	Nominal travel +.080/-.000 [+2 mm/-0 mm]
LUBRICATION	Factory lubricated for rated life
MAINTENANCE	Field repairable

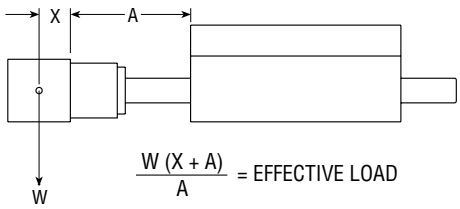
CYLINDER FORCE CALCULATIONS

		IMPERIAL	METRIC
		F = P x A	F = 0.1 x P x A
F	= Cylinder Force	lbs	N
P	= Operating Pressure	psi	bar
A	= Effective Area	in^2	mm^2

SIZE	TRAVEL in	TRAVEL mm	SHAFT DIAMETER in	SHAFT DIAMETER mm	BORE DIAMETER in	BORE DIAMETER mm	EFFECTIVE AREA DIRECTION	EFFECTIVE AREA in^2	EFFECTIVE AREA mm^2	BASE WEIGHT lb	BASE WEIGHT kg	MAX. STATIC LOAD SxL lb	MAX. STATIC LOAD SxL N	MAX. STATIC LOAD SxH lb	MAX. STATIC LOAD SxH N	TYPICAL DYNAMIC LOAD lb	TYPICAL DYNAMIC LOAD N
08	1/2	12	.197	5	.315	8	EXTEND	.078	50.3	.24	.11	—	—	46	205	0 - 1	0 - 4.5
	1	25					RETRACT	.058	37.4	.29	.13	—	—	33	147		
	1 1/2	40								.34	.15	—	—	26	116		
10	1/2	12	.236	6	.394	10	EXTEND	.122	78.7	.28	.13	60	267	82	365	1 - 2	4.5 - 8.9
	1	25								.36	.16	44	196	59	262		
	1 1/2	40								.44	.20	34	151	46	205		
	2	—					RETRACT	.091	58.7	.52	—	—	—	37	—		
	3	—								.68	—	—	—	27	—		
	4	—								.84	—	—	—	21	—		
14	1/2	12	.394	10	.551	14	EXTEND	.238	154	.79	.36	210	934	344	1530	2 - 6	8.9 - 26.7
	1	25								.95	.43	190	845	254	1130		
	1 1/2	40								1.11	.50	150	667	202	898		
	2	—								1.27	—	—	—	165	—		
	3	—					RETRACT	.195	126	1.59	—	—	—	123	—		
	4	—								1.91	—	—	—	98	—		
	5	—								2.23	—	—	—	81	—		
	6	—								2.55	—	—	—	69	—		
20	1	25	.472	12	.787	20	EXTEND	.487	314	1.72	.78	280	1245	378	1681	6 - 12	26.7 - 53.4
	2	50								2.26	1.03	190	845	260	1156		
	3	75								2.80	1.27	150	667	198	881		
	4	—								3.34	—	—	—	158	—		
	5	—					RETRACT	.409	264	3.88	—	—	—	133	—		
	6	—								4.42	—	—	—	114	—		
	7	—								4.96	—	—	—	100	—		
	8	—								5.50	—	—	—	89	—		
25	1	25	.630	16	.984	25	EXTEND	.761	491	2.79	1.27	423	1882	738	3284	10 - 16	44.5 - 71.2
	2	50								3.62	1.64	419	1865	489	2176		
	3	75								4.45	2.02	323	1437	380	1691		
	4	—								5.27	—	—	—	312	—		
	5	—					RETRACT	.639	412	6.10	—	—	—	264	—		
	6	—								6.92	—	—	—	229	—		
	7	—								7.75	—	—	—	202	—		
	8	—								8.58	—	—	—	180	—		
32	1	25	.787	20	1.260	32	EXTEND	1.247	805	3.89	1.76	528	2349	1325	5894	12 - 25	53.4 - 111
	2	50								4.97	2.25	523	2326	950	4226		
	3	75								6.05	2.74	520	2313	750	3336		
	4	—								7.13	—	—	—	605	—		
	5	—					RETRACT	1.071	691	8.21	—	—	—	515	—		
	6	—								9.24	—	—	—	445	—		
	7	—								10.32	—	—	—	393	—		
	8	—								11.40	—	—	—	352	—		
40	1	—	.984	25	1.575	40	EXTEND	1.948	1256.8	6.86	—	—	—	1947	—	16 - 75	71 - 334
	2	50								8.57	3.86	—	—	1740	7740		
	3	75								10.28	4.64	—	—	1374	6112		
	4	100								11.99	5.41	—	—	1136	5053		
	5	—					RETRACT	1.636	1055.5	13.70	—	—	—	968	—		
	6	—								15.41	—	—	—	843	—		
	7	—								17.12	—	—	—	747	—		
	8	—								18.83	—	—	—	671	—		
50	1	—	1.181	30	1.969	50	EXTEND	3.043	1963.2	10.94	—	—	—	2888	—	25 - 100	111 - 445
	2	50								13.43	6.08	—	—	2859	12717		
	3	75								15.92	7.21	—	—	2282	10151		
	4	100								18.41	8.34	—	—	1899	8447		
	5	—					RETRACT	2.556	1649.0	20.90	—	—	—	1626	—		
	6	—								23.39	—	—	—	1422	—		
	7	—								25.88	—	—	—	1263	—		
	8	—								28.37	—	—	—	1137	—		
63	1	—	1.374	34.9	2.480	63	EXTEND	4.832	3117.4	17.26	—	—	—	3823	—	75 - 150	334 - 668
	2	50								20.64	9.34	—	—	3805	16925		
	3	75								24.03	10.87	—	—	3555	15813		
	4	100								27.41	12.41	—	—	2964	13185		
	5	—					RETRACT	4.345	2803.2	30.79	—	—	—	2542	—		
	6	—								34.18	—	—	—	2225	—		
	7	—								37.56	—	—	—	1978	—		
	8	—								40.94	—	—	—	1781	—		

EFFECTIVE LOAD

All of the loads in this catalog are given at the front of the extended tool plate. When the load is attached to the tool plate, use the following formula and chart to calculate the effective load. **This method of finding the effective load must be used for all the load carrying specifications and charts in this catalog.**



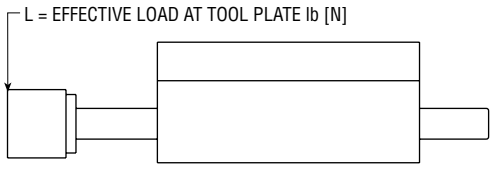
SIZE	TRAVEL in	TRAVEL mm	A in	A mm
08	1/2	12	.937	23.8
	1	25	1.437	36.5
	1-1/2	40	1.937	49.2
10	1/2	12	.937	23.8
	1	25	1.437	36.5
	1-1/2	40	1.937	49.2
	2	—	2.437	—
	3	—	3.437	—
	4	—	4.437	—
14	1/2	12	1.062	27.0
	1	25	1.562	39.7
	1-1/2	40	2.062	52.4
	2	—	2.562	—
	3	—	3.562	—
	4	—	4.562	—
	5	—	5.562	—
	6	—	6.562	—

SIZE	TRAVEL in	TRAVEL mm	A in	A mm
20	1	25	1.875	47.6
	2	50	2.875	73.0
	3	75	3.875	98.4
	4	—	4.875	—
	5	—	5.875	—
	6	—	6.875	—
	7	—	7.875	—
	8	—	8.875	—
25	1	25	2.074	52.7
	2	50	3.074	78.1
	3	75	4.074	103.5
	4	—	5.074	—
	5	—	6.074	—
	6	—	7.074	—
	7	—	8.074	—
	8	—	9.074	—
32	1	25	2.188	55.6
	2	50	3.188	81.0
	3	75	4.188	106.4
	4	—	5.188	—
	5	—	6.188	—
	6	—	7.188	—
	7	—	8.188	—
	8	—	9.188	—

SIZE	TRAVEL in	TRAVEL mm	A in	A mm
40	1	—	2.341	—
	2	50	3.431	86.3
	3	75	4.431	111.3
	4	100	5.431	136.3
	5	—	6.431	—
	6	—	7.431	—
	7	—	8.431	—
	8	—	9.431	—
50	1	—	2.627	—
	2	50	3.627	91.3
	3	75	4.627	116.3
	4	100	5.627	141.3
	5	—	6.627	—
	6	—	7.627	—
	7	—	8.627	—
	8	—	9.627	—
63	1	—	2.687	—
	2	50	3.687	92.8
	3	75	4.687	117.8
	4	100	5.687	142.8
	5	—	6.687	—
	6	—	7.687	—
	7	—	8.687	—
	8	—	9.687	—

BREAKAWAY

Breakaway pressure is affected by several factors including the load at the tool plate, slide travel, and lubrication condition of the unit. The following formulas yield approximate breakaway pressure for the Series SxL/SxH Slides.



APPROXIMATE BREAKAWAY PRESSURE

SIZE	SxL psi	SxL bar	SxH psi	SxH bar
08	—	—	(L x 13.78) + 20	(L x 0.214) + 1.38
10	(L x 7.03) + 20	(L x 0.109) + 1.38	(L x 8.34) + 20	(L x 0.129) + 1.38
14	(L x 2.87) + 20	(L x 0.044) + 1.38	(L x 3.48) + 20	(L x 0.054) + 1.38
20	(L x 1.17) + 20	(L x 0.018) + 1.38	(L x 1.47) + 20	(L x 0.023) + 1.38
25	(L x 0.69) + 20	(L x 0.011) + 1.38	(L x 0.87) + 20	(L x 0.013) + 1.38
32	(L x 0.37) + 20	(L x 0.006) + 1.38	(L x 0.48) + 20	(L x 0.008) + 1.38
40	—	—	(L x 0.31) + 20	(L x 0.0046) + 1.38
50	—	—	(L x 0.19) + 20	(L x 0.0029) + 1.38
63	—	—	(L x 0.10) + 20	(L x 0.0015) + 1.38

SIZING AND APPLICATION ASSISTANCE
See PHD Product Sizing Catalog for specific and complete sizing information.
Online sizing assistance is available at:
www.phdinc.com/apps/sizing

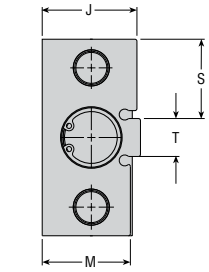
SLIDE SPEEDS

Slide speeds and time required for the slide to extend or retract are dependent upon many application conditions. The table below shows the approximate speed and time for units with no load and with a typical attached load weight as listed to the right of the table. **NOTE:** Flow controls are highly recommended to control impact velocity within maximum allowable kinetic energy as specified in the Sizing Catalog.

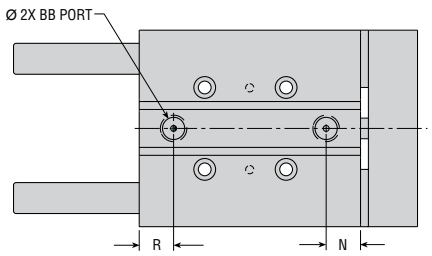
			NO LOAD, MAX VELOCITY						WITH GIVEN LOAD TOTAL, MAX KE WITH -AE OPTION							
			EXTEND			RETRACT			EXTEND			RETRACT			TOTAL MOVING LOAD WEIGHT	
	TRAVEL		TIME	PEAK SPEED		TIME	PEAK SPEED		TIME	IMPACT SPEED		TIME	IMPACT SPEED			
SIZE	in	mm	sec	in/sec	m/sec	sec	in/sec	m/sec	sec	in/sec	m/sec	sec	in/sec	m/sec	lb	N
08	1/2	12	.023	86	2.18	.026	70	1.78	.079	24	0.61	.079	24	0.61	1	4.4
	1	25	.030	105	2.67	.034	93	2.36	.092	24	0.61	.092	24	0.61		
	1-1/2	40	.037	130	3.30	.042	115	2.92	.110	24	0.61	.110	24	0.61		
10	1/2	12	.023	86	2.18	.026	84	2.13	.085	24	0.61	.085	24	0.61	2	8.9
	1	25	.030	105	2.67	.033	100	2.54	.113	24	0.61	.119	24	0.61		
	1-1/2	40	.037	130	3.30	.040	120	3.05	.140	24	0.61	.152	24	0.61		
	2	—	.044	130	3.30	.047	120	3.05	.165	24	0.61	.166	24	0.61		
	3	—	.058	130	3.30	.061	120	3.05	.216	24	0.61	.217	24	0.61		
	4	—	.072	130	3.30	.075	120	3.05	.268	24	0.61	.269	24	0.61		
14	1/2	12	.024	82	2.08	.024	82	2.08	.082	24	0.61	.082	24	0.61	4	17.8
	1	25	.032	98	2.49	.032	98	2.49	.113	24	0.61	.114	24	0.61		
	1-1/2	40	.040	120	3.05	.040	120	3.05	.143	24	0.61	.145	24	0.61		
	2	—	.048	120	3.05	.048	120	3.05	.165	24	0.61	.166	24	0.61		
	3	—	.064	120	3.05	.064	120	3.05	.216	24	0.61	.217	24	0.61		
	4	—	.080	120	3.05	.080	120	3.05	.268	24	0.61	.269	24	0.61		
	5	—	.096	120	3.05	.096	120	3.05	.320	24	0.61	.321	24	0.61		
	6	—	.112	120	3.05	.112	120	3.05	.371	24	0.61	.372	24	0.61		
20	1	25	.040	100	2.54	.040	100	2.54	.139	24	0.61	.143	24	0.61	10	44.5
	2	50	.056	110	2.79	.056	110	2.79	.191	24	0.61	.195	24	0.61		
	3	75	.072	110	2.79	.072	110	2.79	.242	24	0.61	.246	24	0.61		
	4	—	.088	110	2.79	.088	110	2.79	.294	24	0.61	.298	24	0.61		
	5	—	.104	110	2.79	.104	110	2.79	.346	24	0.61	.350	24	0.61		
	6	—	.120	110	2.79	.120	110	2.79	.397	24	0.61	.401	24	0.61		
	7	—	.136	110	2.79	.136	110	2.79	.449	24	0.61	.453	24	0.61		
	8	—	.152	110	2.79	.152	110	2.79	.501	24	0.61	.505	24	0.61		
25	1	25	.044	78	1.98	.047	78	1.98	.132	24	0.61	.137	24	0.61	16	71.2
	2	50	.067	75	1.91	.070	75	1.91	.184	24	0.61	.189	24	0.61		
	3	75	.090	72	1.83	.093	72	1.83	.235	24	0.61	.240	24	0.61		
	4	—	.113	72	1.83	.116	72	1.83	.287	24	0.61	.292	24	0.61		
	5	—	.136	72	1.83	.139	72	1.83	.339	24	0.61	.344	24	0.61		
	6	—	.159	72	1.83	.162	72	1.83	.390	24	0.61	.395	24	0.61		
	7	—	.182	72	1.83	.185	72	1.83	.442	24	0.61	.447	24	0.61		
	8	—	.205	72	1.83	.208	72	1.83	.494	24	0.61	.499	24	0.61		
32	1	25	.051	50	1.27	.057	42	1.07	.126	24	0.61	.132	24	0.61	25	111.2
	2	50	.082	48	1.22	.093	40	1.02	.178	24	0.61	.184	24	0.61		
	3	75	.113	46	1.17	.129	38	0.97	.229	24	0.61	.235	24	0.61		
	4	—	.144	46	1.17	.165	38	0.97	.281	24	0.61	.287	24	0.61		
	5	—	.175	46	1.17	.201	38	0.97	.333	24	0.61	.339	24	0.61		
	6	—	.206	46	1.17	.237	38	0.97	.384	24	0.61	.390	24	0.61		
	7	—	.237	46	1.17	.273	38	0.97	.436	24	0.61	.442	24	0.61		
	8	—	.268	46	1.1	.309	38	0.97	.488	24	0.61	.494	24	0.61		
40	1	—	.064	68	1.73	0.070	61	1.55	.131	24	0.61	0.142	24	0.61	35	156
	2	50	.091	82	2.08	0.100	71	1.80	.183	24	0.61	0.194	24	0.61		
	3	75	.118	99	2.51	0.130	84	2.13	.234	24	0.61	0.245	24	0.61		
	4	100	.145	89	2.26	0.160	74	1.88	.286	24	0.61	0.297	24	0.61		
	5	—	.172	78	1.98	0.190	63	1.60	.338	24	0.61	0.349	24	0.61		
	6	—	.199	68	1.73	0.220	59	1.50	.389	24	0.61	0.400	24	0.61		
	7	—	.226	59	1.50	0.250	54	1.37	.441	24	0.61	0.452	24	0.61		
	8	—	.253	59	1.50	0.280	54	1.37	.493	24	0.61	0.504	24	0.61		
50	1	—	.066	76	1.93	0.072	69	1.75	.198	24	0.61	0.256	24	0.61	47	209
	2	50	.099	74	1.88	0.105	57	1.45	.250	24	0.61	0.308	24	0.61		
	3	75	.132	71	1.80	0.138	57	1.45	.301	24	0.61	0.359	24	0.61		
	4	100	.165	68	1.73	0.171	55	1.40	.353	24	0.61	0.411	24	0.61		
	5	—	.198	65	1.65	0.204	52	1.32	.405	24	0.61	0.463	24	0.61		
	6	—	.231	60	1.52	0.237	50	1.27	.456	24	0.61	0.514	24	0.61		
	7	—	.264	57	1.45	0.270	47	1.19	.508	24	0.61	0.566	24	0.61		
	8	—	.297	54	1.37	0.303	44	1.12	.560	24	0.61	0.618	24	0.61		
63	1	—	.092	62	1.57	0.092	57	1.45	.146	24	0.61	0.169	24	0.61	61	272
	2	50	.134	58	1.47	.140	54	1.37	1.98	24	0.61	0.221	24	0.61		
	3	75	.176	54	1.37	.188	52	1.32	.249	24	0.61	0.272	24	0.61		
	4	100	.218	50	1.27	.236	48	1.22	.301	24	0.61	0.324	24	0.61		
	5	—	.260	48	1.22	.284	48	1.22	.353	24	0.61	0.376	24	0.61		
	6	—	.302	48	1.22	.332	48	1.22	.404	24	0.61	0.427	24	0.61		
	7	—	.344	48	1.22	.380	48	1.22	.456	24	0.61	0.479	24	0.61		
	8	—	.386	48	1.22	.428	48	1.22	.508	24	0.61	0.531	24	0.61		

NOTE: The approximate tabled time and speed is based on:
1) Sizes 08 - 32 mm- line pressure 87 psi, 2) Valve rated at 1.35 CV^2, 3) .28 I.D. tubing, 4) Horizontal operation
2) Sizes 40 & 50 mm- line pressure 87 psi, 2) Value rated at 5.1 CV^2, 3) .281 ID tubing, 4) Horizontal operation
3) Size 63 mm- line pressure 87 psi, 2) Value rated at 5.1 CV^2, 3) .39 ID tubing, 4) Horizontal operation

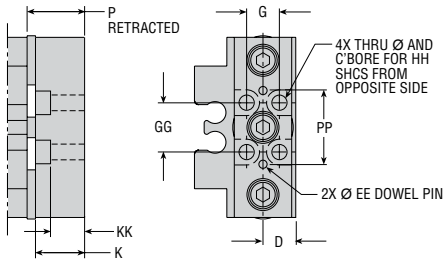
DIMENSIONS: SERIES SxL/SxH SLIDES - STANDARD TRAVELS



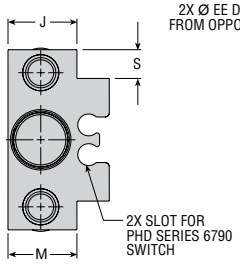
SIZES 14 through 63



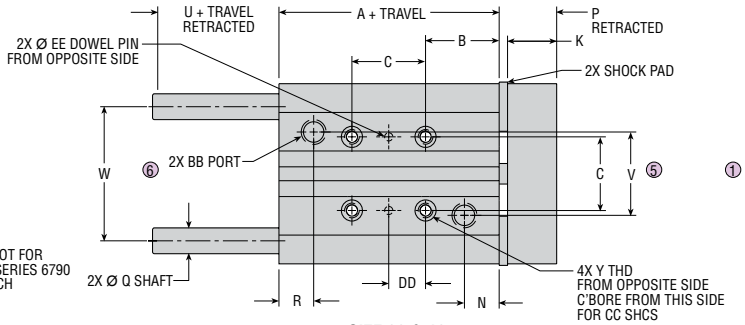
SIZES 14 through 63



SERIES SBx
(TOOL PLATE)



SIZE 08 & 10



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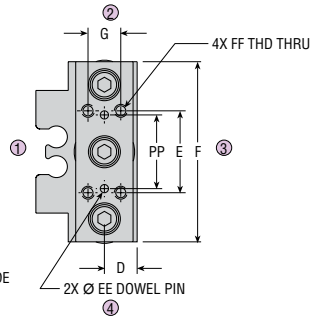
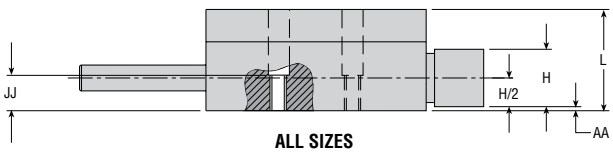


SERIES SAx
(TOOL PLATE)

NOTE: CIRCLED NUMBERS INDICATE POSITION.



ALL SIZES

DOWEL HOLE DIAMETERS

SIZE	EE DOWEL HOLE	PRODUCTION DIAMETER	J3 OPTION TRANSITIONAL	J4 OPTION CLEARANCE FIT	J8 OPTION PRECISION FIT
08	.0625 x .16 DP [2 x 4 DP]	* [+.010 / -.024]	+.0013 / +.0000 [+.033 / +.008]	+.0038 / +.0028 –	– [+.010 / -.000]
10	.0937 x .20 DP [2.5 x 5 DP]	* [+.010 / -.024]	+.0013 / +.0000 [+.033 / +.008]	+.0038 / +.0028 –	– [+.010 / -.000]
14	.1250 x .24 DP [3 x 6 DP]	* [+.010 / -.024]	+.0013 / +.0000 [+.033 / +.008]	+.0038 / +.0028 –	– [+.010 / -.000]
20	.1875 x .35 DP [4 x 9 DP]	* [+.010 / -.024]	+.0013 / +.0000 [+.033 / +.008]	+.0038 / +.0028 –	– [+.012 / -.000]
25	.2500 x .47 DP [6 x 12 DP]	* [+.010 / -.024]	+.0013 / +.0000 [+.033 / +.008]	+.0038 / +.0028 –	– [+.012 / -.000]
32	.2500 x .47 DP [6 x 12 DP]	* [+.010 / -.024]	+.0013 / +.0000 [+.033 / +.008]	+.0038 / +.0028 –	– [+.012 / -.000]
40	.3125 x .63 DP [8 x 16 DP]	* [+.010 / -.024]	+.0013 / +.0000 [+.033 / +.008]	+.0038 / +.0028 –	– [+.015 / -.000]
50	.3125 x .63 DP [8 x 16 DP]	* [+.010 / -.024]	+.0013 / +.0000 [+.033 / +.008]	+.0038 / +.0028 –	– [+.015 / -.000]
63	.375 x .79 DP [10 x 20 DP]	* [+.010 / -.024]	+.0013 / +.0000 [+.033 / +.008]	+.0038 / +.0028 –	– [+.015 / -.000]

1) * ALL IMPERIAL HOUSINGS AND SB TOOL PLATES HAVE J3 DOWEL HOLES AS STANDARD
2) NUMBERS IN [ ] ARE FOR METRIC UNITS DESIGN #5

DOWEL HOLE AVAILABILITY

DESIGN NO.	ITEM	DOWEL HOLES	J3	J4	J8
1 (IMPERIAL)	HOUSING	(J3 STD)	STD	OPT	–
	SAx TOOL PLATE	NONE	OPT	OPT	–
	SBx TOOL PLATE	(J3 STD)	STD	OPT	–
2 (METRIC)	HOUSING	PD	OPT	–	OPT
	SAx TOOL PLATE	PD	OPT	–	OPT
	SBx TOOL PLATE	PD	OPT	–	OPT

NOTES:
1) SEE DOWEL HOLE DIAMETERS TABLE FOR DIMENSIONAL INFORMATION.
2) SEE OPTIONS SECTION FOR J3, J4, & J8 OPTONS.
3) STD = Standard OPT = Optional PD = Production Diameter

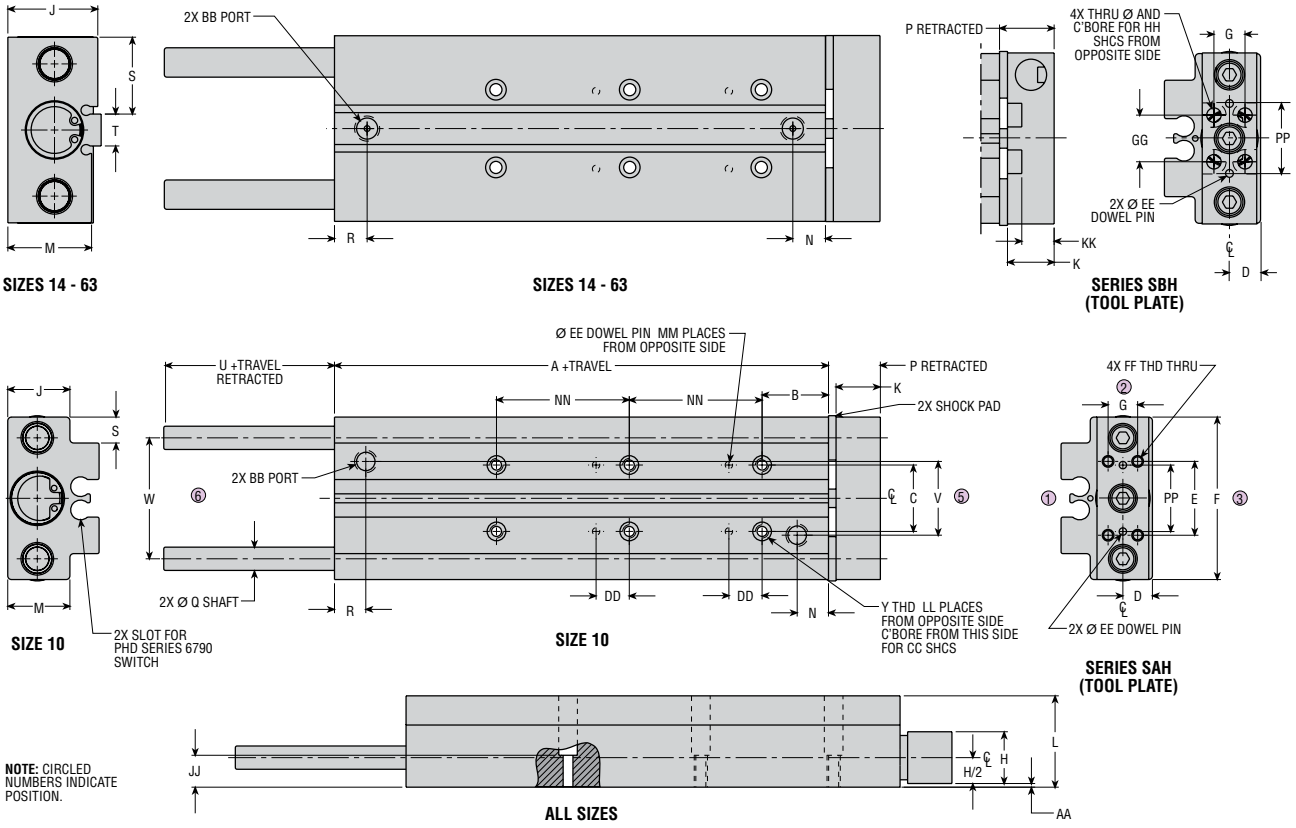
All dimensions are reference only unless specifically toleranced.

DIMENSIONS: SERIES SxL/SxH SLIDES - STANDARD TRAVELS

LETTER	MODEL NUMBER																					
	Sxxx08						Sxxx10						Sxxx14						Sxxx20						Sxxx25					
DIM	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
BORE	8mm						10 mm						14 mm						20 mm						25 mm					
TRAVEL	1/2	[12]	1	[25]	1-1/2	[40]	1/2	[12]	1	[25]	1-1/2	[40]	1/2	[12]	1	[25]	1-1/2	[40]	1	[25]	2	[50]	3	[75]	1	[25]	2	[50]	3	[75]
A			1.181	[30.0]					1.181	[30.0]					1.378	[35.0]					1.875	[48.0]					2.126	[54.0]		
B			.562	[14.0]					.562	[14.0]					.562	[14.0]					.625	[18.0]					0.787	[20.0]		
C			.562	[14.0]					.625	[16.0]					.875	[22.0]					1.250	[30.0]					1.496	[38.0]		
D			.250	[7.0]					.375	[10.0]					.500	[13.0]					.750	[19.0]					0.820	[20.8]		
E			.625	[16.0]					.750	[20.0]					1.000	[26.0]					1.500	[40.0]					1.575	[40.0]		
F			1.375	[35.0]					1.625	[41.5]					2.244	[57.0]					3.000	[76.0]					3.543	[90.0]		
G			.250	[8.0]					.375	[10.0]					.500	[14.0]					.750	[20.0]					0.787	[20.0]		
H			.438	[12.0]					.610	[15.5]					.827	[21.0]					1.220	[31.0]					1.375	[34.9]		
J			.526	[14.0]					.768	[20.0]					.972	[25.0]					1.446	[36.7]					1.682	[42.7]		
K			.375	[10.0]					.375	[10.0]					.500	[14.0]					.750	[20.0]					0.875	[22.2]		
L			.773	[19.8]					.902	[23.4]					1.142	[29.3]					1.500	[38.0]					1.682	[42.7]		
M			.526	[14.0]					.768	[20.0]					.972	[25.0]					1.346	[34.2]					1.682	[42.7]		
N			.265	[6.7]					.282	[7.2]					.342	[8.7]					.525	[13.3]					0.575	[14.6]		
P			.437	[11.5]					.437	[11.5]					.562	[15.5]					.875	[23.0]					1.074	[27.3]		
Q			.197	[5.0]					.236	[6.0]					.394	[10.0]					.472	[12.0]					0.630	[16.0]		
R			.265	[6.7]					.220	[5.6]					.342	[8.9]					.525	[13.3]					0.575	[14.6]		
S			.220	[5.6]					.327	[8.3]					.990	[25.1]					1.240	[31.5]					1.457	[37.0]		
T			N/A						N/A						.263	[6.7]					.519	[13.2]					0.629	[16.0]		
U	.447	[12.8]	.447	[12.2]	.597	[11.4]	.447	[12.8]	.447	[12.2]	.597	[11.4]	.558	[15.5]	.558	[14.9]	.708	[14.1]	.620	[17.4]	.620	[18.2]	.620	[19.1]	.885	[23.3]	0.885	[24.1]	.885	[24.9]
V			.624	[15.8]					.670	[17.0]					N/A						N/A						N/A			
W			1.024	[26.0]					1.181	[30.0]					1.614	[41.0]					2.126	[54.0]					2.598	[66.0]		
Y	#4-40 x .27 DP		[M3 x .5 x 7 DP]				#6-32 x .39 DP		[M4 x .7 x 10 DP]				#10-24 x .50 DP		[M5 x .8 x 12 DP]				1/4-20 x .63 DP		[M6 x 1 x 16 DP]				5/16-18 x .75 DP		[M8 x 1.25 x 20 DP]			
AA			.031	[1.0]					.070	[2.3]					.087	[2.5]					.140	[3.5]					0.132	[3.4]		
BB			#10-32	[M5]					#10-32	[M5]					#10-32	[M5]					1/8 NPT	[G1/8 BSPP]					1/8 NPT	[G1/8 BSPP]		
CC			#2	[M2]					#4	[M3]					#6	[M4]					#10	[M5]					1/4	[M6]		
DD			.281	[7.0]					.312	[8.0]					.438	[11.0]					.625	[15.0]					0.748	[19.0]		
EE	SEE TABLE						SEE TABLE						SEE TABLE						SEE TABLE						SEE TABLE					
FF			#3-48	[M2.5 x .45]					#4-40	[M3 x .5]					#6-32	[M4 x .7]					#10-24	[M5 x .8]					1/4-20	[M6 x 1]		
GG			.375	[10.0]					.500	[10.0]					.750	[18.0]					1.000	[24.0]					1.118	[28.4]		
HH			#3	[M2]					#4	[M3]					#6	[M4]					#10	[M5]					1/4	[M6]		
JJ			.270	[7.5]					.512	[13.5]					.769	[19.5]					1.104	[28.0]					1.421	[36.1]		
KK			.260	[7.4]					.250	[6.6]					.270	[8.2]					.534	[14.5]					0.614	[15.6]		
PP			.562	[14.0]					.625	[16.0]					.875	[22.0]					1.250	[30.0]					1.496	[38.0]		

LETTER	MODEL NUMBER																					
	Sxxx32						Sxxx40						Sxxx50						Sxxx63					
DIM	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
BORE	32 mm						40 mm						50 mm						63 mm					
TRAVEL	1	[25]	2	[50]	3	[75]	1	—	2	[50]	3	[75]	1	—	2	[50]	3	[75]	1	—	2	[50]	3	[75]
A			2.126	[54.0]					2.402	[61.0]					2.701	[68.6]					3.445	[87.5]		
B			.813	[22.0]					.630	[16.0]					.512	[13.0]					.670	[17.0]		
C			1.688	[42.0]					2.1850	[55.5]					2.7559	[70.0]					3.2087	[81.5]		
D			1.000	[25.0]					1.063	[27.0]					1.319	[33.5]					1.575	[40.0]		
E			2.000	[52.0]					2.362	[60.0]					2.953	[75.0]					3.543	[90.0]		
F			3.937	[100.0]					5.512	[140.0]					6.496	[165.0]					7.640	[194.1]		
G			1.000	[26.0]					1.260	[32.0]					1.575	[40.0]					1.969	[50.0]		
H			1.732	[44.0]					1.890	[48.0]					2.402	[61.0]					2.913	[74.0]		
J			1.946	[49.0]					2.073	[52.7]					2.600	[66.0]					3.130	[79.5]		
K			1.000	[26.0]					1.181	[30.0]					1.378	[35.0]					1.437	[36.5]		
L			1.986	[50.0]					2.253	[57.2]					2.696	[68.5]					3.385	[86.0]		
M			1.791	[45.1]					2.073	[52.7]					2.600	[66.0]					3.130	[79.5]		
N			.575	[14.6]					.728	[18.5]					0.797	[20.2]					.984	[25.0]		
P			1.197	[31.0]					1.431	[36.3]					1.628	[41.4]					1.687	[42.8]		
Q			.787	[20.0]					.984	[25.0]					1.181	[30.0]					1.375	[35.0]		
R			.575	[14.6]					.650	[16.5]					0.690	[17.5]					.984	[25.0]		
S			1.529	[38.8]					2.340	[59.4]					2.810	[71.4]					3.290	[83.6]		
T			.879	[22.3]					.840	[21.3]					0.870	[22.1]					1.060	[26.9]		
U	.827	[21.8]	.827	[22.6]	.827	[23.4]	1.124	—	1.124	[30.2]	1.124	[31.0]	1.167	—	1.167	[31.2]	1.167	[32.0]	1.282	—	1.282	[34.2]	1.282	[35.0]
V			N/A						N/A						N/A						N/A			
W			2.875	[73.0]					3.818	[97.0]					4.606	[117.0]					5.394	[137.0]		
Y	5/16-18 x .88 DP		[M8 x 1.25 x 20 DP]				3/8-16 x .84 DP		[M10 x 1.5 x 20 DP]				3/8-16 x .94		[M10 x 1.5 x 25 DP]				1/2-13 x 1.05 DP		[M12 x 1.75 x 26.5 DP]			
AA			.134	[3.0]					.118	[3.0]					.118	[3.0]					.119	[3.0]		
BB			1/8 NPT	[G1/8 BSPP]					1/8 NPT	[1/8 BSPP]					1/8 NPT	[1/8 BSPP]					1/4 NPT	[1/4 BSPP]		
CC			1/4	[M6]					5/16	[M8]					5/16	[M8]					3/8	[M10]		
DD			.844	[21.0]					1.0925	[27.75]					1.3780	[35.0]					1.6044	[40.75]		
EE	SEE TABLE						SEE TABLE						SEE TABLE						SEE TABLE					
FF			1/4-20	[M6 x 1]					5/16-18	[M8 x 1.25]					3/8-16	[M10 x 1.5]					1/2-13	[M12 x 1.75]		
GG			1.500	[38.0]					1.969	[50.0]					2.362	[60.0]					2.756	[70.0]		
HH			1/4	[M6]					5/16	[M8]					3/8	[M10]					1/2	[M12]		
JJ			1.520	[38.2]					1.625	[40.0]					2.000	[50.0]					2.500	[65.0]		
KK			.645	[17.0]					.844	[21.4]					0.977	[24.3]					0.912	[23.9]		
PP			1.688	[42.0]					2.165	[55.0]					2.559	[65.0]					3.150	[80.0]		

NOTE: UNITS IN [ ] ARE IN mm



NOTE: CIRCLED NUMBERS INDICATE POSITION.

TABLE 2 - DOWEL HOLE DIAMETERS

MODEL	EE DOWEL HOLE	PRODUCTION DIAMETER	J3 OPTION TRANSITIONAL	J4 OPTION CLEARANCE FIT	J8 OPTION PRECISION FIT
08	.0625 x .16 DP	*	+.0013 / +.0000	+.0038 / +.0028	—
10	.0937 x .20 DP	*	+.0013 / +.0000	+.0038 / +.0028	—
14	.1250 x .24 DP	*	+.0013 / +.0000	+.0038 / +.0028	—
20	.1875 x .35 DP	*	+.0013 / +.0000	+.0038 / +.0028	—
25	.2500 x .47 DP	*	+.0013 / +.0000	+.0038 / +.0028	—
32	.2500 x .47 DP	*	+.0013 / +.0000	+.0038 / +.0028	—
40	.3125 x .63 DP	*	+.0013 / +.0000	+.0038 / +.0028	—
	[8 x 16 DP]	[+.010 / -.024]	+.033 / +.008	—	+.015 / -.000
50	.3125 x .63 DP	*	+.0013 / +.0000	+.0038 / +.0028	—
	[8 x 16 DP]	[+.010 / -.024]	+.033 / +.008	—	+.015 / -.000
63	.375 x .79 DP	*	+.0013 / +.0000	+.0038 / +.0028	—
	[10 x 20 DP]	[+.010 / -.024]	+.033 / +.008	—	+.015 / -.000

NOTES:
1) * ALL IMPERIAL HOUSINGS AND SB TOOL PLATES HAVE J3 DOWEL HOLES AS STANDARD
2) NUMBERS IN [ ] ARE FOR METRIC UNITS DESIGN #5

DOWEL HOLE AVAILABILITY

DESIGN NO.	ITEM	DOWEL HOLES	J3	J4	J8
1 (IMPERIAL)	HOUSING	(J3 STD)	STD	OPT	–
	SAx TOOL PLATE	NONE	OPT	OPT	–
	SBx TOOL PLATE	(J3 STD)	STD	OPT	–
2 (METRIC)	HOUSING	PD	OPT	–	OPT
	SAx TOOL PLATE	PD	OPT	–	OPT
	SBx TOOL PLATE	PD	OPT	–	OPT

NOTES:
1) SEE DOWEL HOLE DIAMETERS TABLE FOR DIMENSIONAL INFORMATION.
2) STD = Standard OPT = Optional

All dimensions are reference only unless specifically toleranced.

LETTER DIM	MODEL NUMBER										
	SxxH10	SxHx14	SxHx20	SxHx25	SxHx32	SxH140	SxH540	SxH150	SxH550	SxH163	SxH563
		in	in	in	in	in	mm	in	mm	in	mm
BORE	10 mm	14 mm	20 mm	25 mm	32 mm	40 mm		50 mm		63 mm	
A	1.181	1.378	1.875	2.126	2.126	2.402	61.0	2.701	68.6	3.445	87.5
B	.562	.562	.625	.787	.813	.630	16.0	.512	13.0	.670	17.0
C	.625	.875	1.250	1.496	1.688	2.1850	55.5	2.7559	70.0	3.2087	81.5
D	.375	.500	.750	.820	1.000	1.063	27.0	1.319	33.5	1.575	40.0
E	.750	1.000	1.500	1.575	2.000	2.362	60.0	2.953	75.0	3.543	90.0
F	1.625	2.244	3.000	3.543	3.937	5.512	140.0	6.496	165.0	7.640	194.1
G	.375	.500	.750	.787	1.000	1.260	32.0	1.575	40.0	1.969	50.0
H	.610	.827	1.220	1.375	1.732	1.890	48.0	2.402	61.0	2.913	74.0
J	.768	.972	1.446	1.682	1.946	2.073	52.7	2.600	66.0	3.130	79.5
K	.375	.500	.750	.875	1.000	1.181	30.0	1.378	35.0	1.437	36.5
L	.902	1.142	1.500	1.682	1.986	2.253	57.2	2.696	68.5	3.385	86.0
M	.768	.972	1.346	1.682	1.791	2.073	52.7	2.600	66.0	3.130	79.5
N	.282	.342	.525	.575	.575	.728	18.5	.797	20.2	.984	25.0
P	.437	.562	.875	1.074	1.197	1.431	36.3	1.628	41.4	1.687	42.8
Q	.236	.394	.472	.630	.787	.984	25.0	1.181	30.0	1.375	35.0
R	.220	.342	.525	.575	.575	.650	16.5	.690	17.5	.984	25.0
S	.327	.990	1.240	1.457	1.529	2.340	59.4	2.810	71.4	3.290	83.6
T	—	.263	.519	.629	.879	.840	21.3	.870	22.1	1.060	26.9
U	.447	.558	.733	.885	.827	1.125	31.8	1.167	32.8	1.282	35.8
V	.670	—	—	—	—	—	—	—	—	—	—
W	1.181	1.614	2.126	2.598	2.875	3.818	97.0	4.606	117.0	5.394	137.0
Y	#6-32 x .39 DP	#10-24 x .50 DP	1/4-20 x .63 DP	5/16-18 x .75 DP	5/16-18 x .88 DP	3/8-16 x .84 DP	M10 x 1.5 x 20 DP	3/8-16 x .94 DP	M10 x 1.5 x 25 DP	1/2-13 x 1.05 DP	M12 x 1.75 x 26.5 DP
AA	.070	.087	.140	.132	.134	.118	3.0	.118	3.0	.119	3.0
BB	#10-32	#10-32	1/8 NPT	1/8 NPT	1/8 NPT	1/8 NPT	1/8 BSPP	1/8 NPT	1/8 BSPP	1/4 NPT	1/4 BSPP
CC	#4	#6	#10	1/4	1/4	5/16	M8	5/16	M8	3/8	M10
DD	.312	.438	.625	.748	.844	1.0925	27.75	1.3780	35.0	1.6044	40.75
EE	SEE TABLE 1	SEE TABLE 1	SEE TABLE 1	SEE TABLE 1	SEE TABLE 1	SEE TABLE 1	SEE TABLE 1	SEE TABLE 1	SEE TABLE 1	SEE TABLE 1	SEE TABLE 1
FF	#4-40	#6-32	#10-24	1/4-20	1/4-20	5/16-18	M8 x 1.25	3/8-16	M10 x 1.5	1/2-13	M12 x 1.75
GG	.500	.750	1.000	1.118	1.500	1.969	50.0	2.362	60.0	2.756	70.0
HH	#4	#6	#10	1/4	1/4	5/16	M8	3/8	M10	1/2	M12
JJ	.512	.769	1.104	1.421	1.520	1.625	40.0	2.000	50.0	2.500	65.0
KK	.250	.270	.534	0.614	.645	.844	21.4	.977	24.3	.912	23.9
LL	SEE TABLE 2	SEE TABLE 2	SEE TABLE 2	SEE TABLE 2	SEE TABLE 2	SEE TABLE 2	SEE TABLE 2	SEE TABLE 2	SEE TABLE 2	SEE TABLE 2	SEE TABLE 2
MM	SEE TABLE 1	SEE TABLE 1	SEE TABLE 1	SEE TABLE 1	SEE TABLE 1	SEE TABLE 1	SEE TABLE 1	SEE TABLE 1	SEE TABLE 1	SEE TABLE 1	SEE TABLE 1
NN	1.250	1.750	2.500	2.992	3.375	3.347	85.0	3.898	99.0	4.213	107.0
PP	.625	.875	1.250	.1496	1.688	2.165	55.0	2.559	65.0	3.150	80.0

* LONG TRAVEL METRIC SLIDES AVAILABLE AS STANDARD AS 100 mm TRAVEL. CONSULT PHD FOR ADDITIONAL TRAVEL LENGTHS

TABLE 1 - STROKE RELATED DIMENSIONS

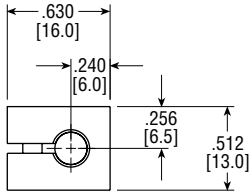
BORE	10 mm		14 mm		20 mm		25 & 32 mm		40, 50 & 63 mm	
LETTER DIM TRAVEL	LL	MM	LL	MM	LL	MM	LL	MM	LL	MM
2.0 in	4	2	4	2	—	—	—	—	—	—
3.0 in	4	2	4	2	—	—	—	—	—	—
100 mm	—	—	—	—	—	—	—	—	4	2
4.0 in	6	4	6	4	4	2	4	2	4	2
5.0 in	—	—	6	4	6	4	4	2	4	2
6.0 in	—	—	6	4	6	4	4	2	4	2
7.0 in	—	—	—	—	6	4	6	4	6	4
8.0 in	—	—	—	—	6	4	6	4	6	4

NOTES:
1) SEE TABLE ON PREVIOUS PAGE FOR DOWEL HOLE OPTION AVAILABILITY.
2) SEE OPTIONS SECTION FOR J3, J4, & J8 OPTIONS.

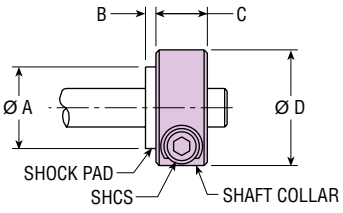
AE TRAVEL ADJUSTMENT ON EXTEND

This option provides both travel adjustment stop collars and shock pads on extension only. The travel adjustment stop collars provide infinite adjustment while the shock pads provide excellent noise reduction and energy absorption capability.

NOTE: AE travel adjustments are available as a kit. To specify, give the full unit description -H9031. Each travel adjustment kit contains 2 steel shaft collars, 2 shock pads, and 2 SHCS.



SIZE 08 ONLY



UNIT SIZE	LETTER DIMENSION [mm]			
	A	B	C	D
8	.375 [9.5]	.064 [1.6]	— —	— —
10	.500 [12.7]	.064 [1.6]	.315 [8.0]	.709 [18.0]
14	.591 [15.0]	.064 [1.6]	.433 [11.0]	.875 [22.2]
20	.865 [22.0]	.125 [3.2]	.511 [13.0]	1.125 [28.6]
25	.945 [24.0]	.199 [5.0]	.511 [13.0]	1.375 [34.9]
32	1.125 [28.6]	.199 [5.0]	.590 [15.0]	1.500 [38.1]
40	1.500 [38.1]	.250 [6.4]	.708 [18.0]	2.026 [51.5]
50	1.750 [44.5]	.250 [6.4]	.749 [19.0]	2.345 [59.6]
63	2.120 [53.8]	.250 [6.4]	.866 [22.0]	2.750 [69.9]

TRAVEL ADJUSTMENT KIT

UNIT SIZE	KIT NUMBER		COLLAR SCREWS
	STANDARD	Z1 OPTION	MAX TORQUE
8	73439-1	73439-2	22 in/lb [2.5 Nm]
10	73440-1	73440-2	22 in/lb [2.5 Nm]
14	73441-1	73441-2	50 in/lb [5.6 Nm]
20	73442-1	73442-1	100 in/lb [11.3 Nm]
25	74822-1	74822-2	100 in/lb [11.3 Nm]
32	73443-1	73443-2	150 in/lb [16.9 Nm]
40	79636-1	79636-2	350 in/lb [39.5 Nm]
50	79637-1	79637-2	350 in/lb [39.5 Nm]
63	79638-1	79638-2	700 in/lb [79.1 Nm]

J3 TRANSITIONAL FIT DOWEL PIN HOLES

This option provides transitional fit dowel pin holes in the tool plate and housing, providing a compromise fit between clearance and interference. Transitional fits are used where accuracy of location is important, but a small amount of clearance in order to simplify the installation of dowel pins is permissible.

J4 CLEARANCE FIT DOWEL PIN HOLES

Specifying this option provides clearance fit dowel pin holes in the tool plate and housing. Clearance fits are used when extra clearance is needed due to inaccuracies of attached tooling. Available on imperial units only.

J8 PRECISION FIT DOWEL PIN HOLES

Specifying this option provides H7 tolerance precision fit dowel pin holes in the tool plate and housing. Precision fits are used where accuracy of location is of prime importance and for parts requiring rigidity and alignment. Available on metric units only.

Q6 TOTAL CORROSION RESISTANT GUIDE SHAFTS

This option provides stainless steel hard chrome guide shafts on the Series SxL Slides and corrosion resistant coating on the Series SxH Slides for use in applications where moisture may corrode untreated, hardened and ground shafts.

NOTE: For sizes and locations, see dimension pages.

Z1 TOTAL CORROSION RESISTANT UNIT

This option includes Q6 guide shafts and provides stainless steel or electroless nickel plating on all other externally exposed ferrous parts. This optional plating can be used for protecting the slide from severe or corrosive environments.

M MAGNET FOR PHD SERIES 6790 MINIATURE REED AND SOLID STATE SWITCHES

This option equips the unit with a magnetic piston for use with PHD's Series 6790 Switch. The switch housing is completely contained by the slide housing and provides a very compact switch design. The switches mount easily to the slide housing using two small grooves located on the top of the unit and are locked into place with a set screw. See Switches and Sensors section for additional switch information and complete specifications.

PART NO.	DESCRIPTION
67902-1-02	NPN (Sink) or PNP (Source) DC Reed, 2 m cable
67902-1-05	NPN (Sink) or PNP (Source) DC Reed, 5 m cable
67903-1-02	NPN (Sink) DC Solid State, 2 m cable
67903-1-05	NPN (Sink) DC Solid State, 5 m cable
67904-1-02	PNP (Source) DC Solid State, 2 m cable
67904-1-05	PNP (Source) DC Solid State, 5 m cable
67922-1	NPN (Sink) or PNP (Source) DC Reed, Quick Connect
67929-2	AC Reed, Current Limited, Quick Connect
67923-1	NPN (Sink) DC Solid State, Quick Connect
67924-1	PNP (Source) DC Solid State, Quick Connect
63549-02	2 m Cordset with Quick Connect
63549-05	5 m Cordset with Quick Connect

NOTES:

1) Switch set screw torque to 16 in-oz [.11 Nm] max.
2) See Switches and Sensors section for additional switch information and complete specification.

SD, SE

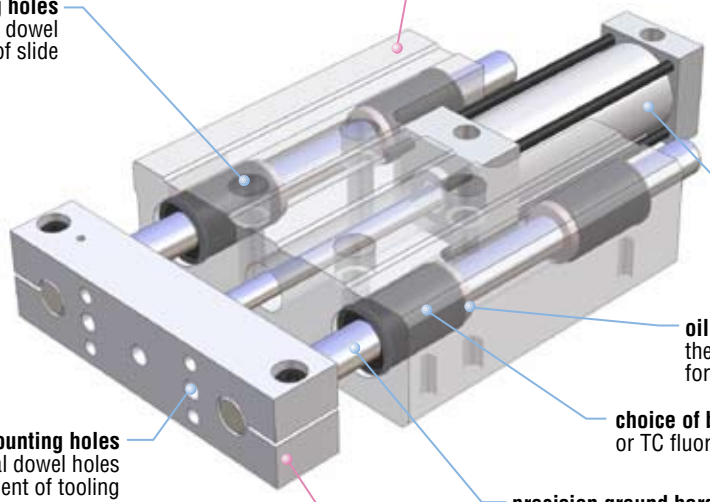
VERSATILE UNIT WITH OVER 45 STANDARD OPTIONS

The SD version is compact and ideal for short travel in horizontal or vertical application, where slide length and weight are critical.

SERIES SD

The SE version has a greater distance between bushings for longer slide travels and greater shaft stability.

SERIES SE



clear anodized aluminum body

counterbored mounting holes in the body with optional dowel holes for easy mounting of slide

PHD Series AV cylinder for long life with a wide range of control and switch accessories

oil wicks internally lubricate the guide shafts and bushings for maximum life

choice of bearings - linear bushing (SxB) or TC fluoropolymer composite (SxC, SxD)

threaded and counterbored mounting holes in the tool plate with optional dowel holes for easy attachment of tooling

precision ground hardened guide shafts on all units for superior performance at a moderate price (SxC, SxD)

oversize guide shafts are available with TC for maximum rigidity and minimum deflection

clear anodized aluminum tool plate

Major Benefits

- Offered in short or long body
- Can be ordered with standard or oversize shafts
- Standard dowel pin holes for ease of mounting
- Several switch options
- 5 bore sizes
- Versatile unit with over 45 standard options

Industry Uses

- Assembly machine builders
- Automotive
- Labeling equipment
- Packaging
- Optical
- Medical
- General purpose slide

BASIC MODEL

TO ORDER SPECIFY:
Product, Series, Type, Three Position, Slide Size, Slide Travel, Mid-Position Travel, Tool Plate Extension, and Options.

PRODUCT
S - Slide

SERIES
D - Short Body
E - Long Body

THREE POSITION UNIT
(specify only if needed)

TOOL PLATE EXTENSION
Additional distance between tool plate and bearing block in 1" increments. Leave blank if no additional extension is required.
(specify only if needed)

S E B E 25 x 2-1/4 x 1-1/8 x 1

SLIDES WITH *TC* COMPOSITE BUSHINGS

TYPE	SLIDE SIZE	SHAFT SIZE DIA.	CYLINDER BORE	EFF. AREA (EXTENSION)
C	22	3/8"	3/4"	.44
D	22	1/2" (oversize)	3/4"	.44
C	23	1/2"	1"	.78
D	23	5/8" (oversize)	1"	.78
C	24	5/8"	1-1/8"	.99
D	24	3/4" (oversize)	1-1/8"	.99
C	25	3/4"	1-3/8"	1.48
D	25	1" (oversize)	1-3/8"	1.48
C	26	1"	2"	3.14
D	26	1-3/8" (oversize)	2"	3.14

SLIDES WITH LINEAR BALL BUSHINGS

TYPE	SLIDE SIZE	SHAFT SIZE DIA.	CYLINDER BORE	EFF. AREA (EXTENSION)
B	22	3/8"	3/4"	.44
B	23	1/2"	1"	.78
B	24	5/8"	1-1/8"	.99
B	25	3/4"	1-3/8"	1.48
B	26	1"	2"	3.14

SLIDE TRAVEL (in)

SIZE SERIES D
22 - 1/4 to 12
23 - 1/4 to 14
24 - 1/4 to 18
25 - 1/4 to 18
26 - 1/4 to 22

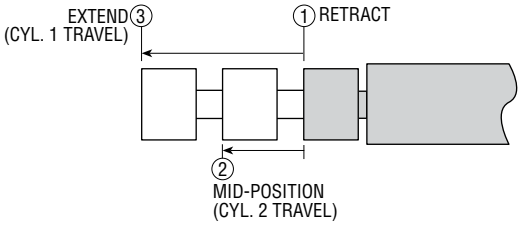
SIZE SERIES E
22 - 1/4 to 16
23 - 1/4 to 18
24 - 1/4 to 24
25 - 1/4 to 24
26 - 1/4 to 28

Available in 1/4" increments. Consult factory for longer travel lengths.

3 POSITION SLIDES
Total slide travel from retract position 1 to extend position 3.

MID-POSITION TRAVEL
Specify for 3 position units.
Travel from retract position 1 to mid-position 2.

3 POSITION DETAIL



Options may affect unit length. See unit dimension and options pages for adders.

ADDITIONAL OPTIONS

SHOCK ABSORBER OPTIONS

GM - Provisions for Shock Absorber mounting on extension*
GN - Provisions for Shock Absorber mounting on retraction*
GO - Provisions for Shock Absorber mounting on extension and retraction*
G2 - Shock Absorber and 8 mm Proximity Switch Ready on extension and retraction*
G3 - Shock Absorber and 8 mm Proximity Switch Ready on extension*
G4 - Shock Absorber and 8 mm Proximity Switch Ready on retraction*
G12 - Shock Absorber and 12 mm Proximity Switch Ready on extension and retraction*
G13 - Shock Absorber and 12 mm Proximity Switch Ready on extension*
G14 - Shock Absorber and 12 mm Proximity Switch Ready on retraction*
BK - HushStop® on extension for use with appropriate shock absorber option -Gx
BL - HushStop® on retraction for use with appropriate shock absorber option -Gx
BS - Shock Pads on extension for use with option -GM, -GO, -G2, -G3, -G12, or -G13 only*
BT - Shock Pads on retraction for use with option -GN, -GO, -G2, -G4, -G12, or -G14 only*

– PB – AR – GM – BS

OPTIONS

PB - Port Controls® on extension and retraction*
DB - Adjustable Cushions on extension and retraction*
U7 - Ports and control needles in position 3 (180° from standard)
E - Solid State Magnetic Piston
M - Reed Switch Magnetic Piston
BR - Shock Pads on retraction*
BJ - HushStop® on retraction*
GV - Side mounting holes in position 2
H1 - Slide only, no cylinder
H4 - Replacement cylinder only (see note 7)
H47 - Rodlok® unit preassembled (see note 7)
J1 - Close fit dowel pin holes in the tool plate
J2 - Normal fit dowel pin holes in the tool plate
J6 - Normal fit dowel pin holes in the body. Close fit dowel pin holes are standard in the body.
L10 - Oversize ports (sizes 25 & 26 only)
Q1 - Corrosion resistant guide shafts
V1 - Fluoro-Elastomer Seals
Z1 - Electroless nickel plate on all external ferrous parts excluding rod ends

GENERAL SLIDE OPTIONS

SHOCK PADS STANDARD	SHOCK PADS HUSHSTOP®	
AR	AT	- Travel Adjustment and Shock Pads on retraction*
AE	AS	- Travel Adjustment and Shock Pads on extension*
GG	G22	- Travel Adjustment and Shock Pads on extension with provisions for Proximity Switch mounting in both directions*
GH	G23	- Travel Adjustment and Shock Pads on retraction with provisions for Proximity Switch mounting on retract only*
GI	G24	- Travel Adjustment and Shock Pads with provisions for Proximity Switch mounting in both directions*

NOTES:

1) Shock absorbers must be ordered separately. See option pages. Shock mounting brackets must be ordered separately for -GM, -GN, and -GO option.
2) Provisions for shock absorber mounting options include shock stops mounted on the shaft, a stop collar on the opposite shaft, and threaded holes in the slide body for mounting the shock bracket.
3) For stop and travel adjustment kits see option pages or chart below.
4) BJ, -BR and -GG options not available with tool plate extension.
5) Proximity switches and brackets must be ordered separately for -GG, -GH, -GI, -GM, -GN, or -GO options. See option pages and the Switches and Sensors section.
6) For HushStop® options (AS, AT, BJ, BK, BL, G22, G23, & G24) stop locations may vary due to compression of softer shock pad.
7) Rodlok® must be ordered separately when a replacement cylinder -H4 is ordered with an -H47 unit.
8) *Caution: Unit dimensions are affected by these options. You must allow for these changes. See option drawings for complete details. Shock pads come standard with the travel adjustment options and do not need to be specified separately when travel adjustment is ordered.

SERIES 1750 SWITCH MOUNTING KIT

SERIES	UNIT SIZE	COMPACT SWITCH BRACKET NO.
SD & SE	22	17000-31-5
	23	17000-32-5
	24	17000-33-5
	25	17000-34-5
	26	58050-02

STOP & TRAVEL ADJUSTMENT KITS

	SHAFT	22	23	24	25	26
TRAVEL ADJUSTMENT (STANDARD) -AR OR -AE	STANDARD	59737-01	59737-03	59737-05	59737-07	59737-09
	OVERSIZED	59737-02	59737-04	59737-06	59737-08	59737-10
TRAVEL ADJUSTMENT (HushStop®) -AR OR -AE	STANDARD	67653-01	67653-03	67653-05	67653-07	67653-09
	OVERSIZED	67653-02	67653-04	67653-06	67653-08	67653-10
PROXIMITY & TRAVEL ADJUSTMENT (STANDARD) -GG OR -GH	STANDARD	59745-01	59745-03	59745-05	59745-07	59745-09
	OVERSIZED	59745-02	59745-04	59745-06	59745-08	59745-10
PROXIMITY & TRAVEL ADJUSTMENT (HushStop®) -GG OR -GH	STANDARD	67651-01	67651-03	67651-05	67651-07	67651-09
	OVERSIZED	67651-02	67651-04	67651-06	67651-08	67651-10
SHOCK ABSORBER STOP -GM OR -GN	STANDARD	59746-01	59746-03	59746-05	59746-07	59746-09
	OVERSIZED	59746-02	59746-04	59746-06	59746-08	59746-10
SHOCK MOUNTING KIT	—	54108-11	54108-11	54109-11	54109-11	54110-11

Kit contains all components for standard non-Z1 units for one direction only.

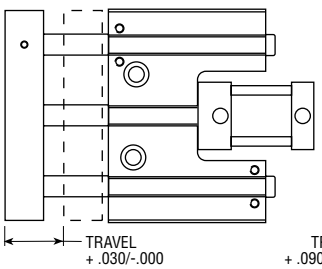
SPECIFICATIONS	SERIES SD/SE
OPERATING PRESSURE	20 psi min to 150 psi max [1.4 bar min to 10 bar max] air
OPERATING TEMPERATURE	-20° to + 180°F [-29° to + 82°C]
TRAVEL TOLERANCE	Nominal travel, +.030/- .000 in [+ .76/- 0.0 mm]
TOOL PLATE EXTENSION	+ .090/-.000 [+2.3/-0.0 mm]
3-POSITION	Mid-location ± .030 [0.76 mm]
REPEATABILITY	± .001" [± .025 mm] of original position
VELOCITY	
W/OUT PORT CONTROLS	50 in/sec [1.3 m/sec] max., zero load at 100 psi [6.9 bar]
WITH OPTION PB	16 in/sec [.4 m/sec] max., zero load at 100 psi [6.9 bar]
LUBRICATION	Factory lubricated for life
MAINTENANCE	Field repairable

SIZE	TYPE	SHAFT DIAMETER in	SHAFT DIAMETER mm	BORE DIAMETER in	BORE DIAMETER mm	EFFECTIVE AREA DIRECTION	EFFECTIVE AREA in²	EFFECTIVE AREA mm²	SERIES SD BASE WEIGHT lb	SERIES SD BASE WEIGHT kg	SERIES SE BASE WEIGHT lb	SERIES SE BASE WEIGHT kg	TRAVEL WEIGHT ADDER lb/in	TRAVEL WEIGHT ADDER kg/mm	TYPICAL DYNAMIC LOAD lb	TYPICAL DYNAMIC LOAD N
	B	.375	9.5			EXTEND	.44	285	1.59	.72	2.38	1.08	.10	.002		
22	C	.375	9.5	.750	19.1	RETRACT	.39	254	1.59	.72	2.38	1.08	.10	.002	8	36
	D	.500	12.7						1.66	.75	2.55	1.16	.15	.003		
	B	.500	12.7			EXTEND	.79	506	3.25	1.47	4.6	2.10	.18	.003		
23	C	.500	12.7	1.000	25.4	RETRACT	.71	457	3.25	1.47	4.6	2.10	.18	.003	15	67
	D	.625	15.9						3.27	1.48	4.8	2.17	.25	.004		
	B	.625	15.9			EXTEND	1.00	642	4.70	2.13	6.4	2.88	.28	.005		
24	C	.625	15.9	1.125	28.6	RETRACT	.88	570	4.70	2.13	6.4	2.88	.28	.005	25	111
	D	.750	19.1						4.75	2.15	6.5	2.95	.35	.006		
	B	.750	19.1			EXTEND	1.49	958	8.57	3.89	11.7	5.31	.42	.007		
25	C	.750	19.1	1.375	34.9	RETRACT	1.29	832	8.57	3.89	11.7	5.31	.42	.007	35	156
	D	1.000	25.4						8.74	3.96	12.3	5.58	.62	.011		
	B	1.000	25.4			EXTEND	3.14	2026	16.57	7.52	23.7	10.73	.70	.012		
26	C	1.000	25.4	2.000	50.8	RETRACT	2.84	1829	16.57	7.52	23.7	10.73	.70	.012	50	223
	D	1.375	34.9						17.55	7.96	25.8	11.72	1.07	.019		

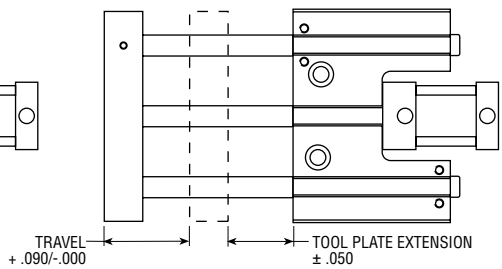
NOTE: Thrust capacity, allowable mass and dynamic moment capacity must be considered when selecting a slide. Refer to sizing software or the product technical manual for complete sizing and selection information.

TOLERANCES

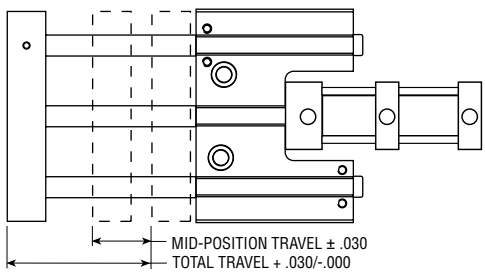
STANDARD UNIT



UNIT WITH TOOL PLATE EXTENSION



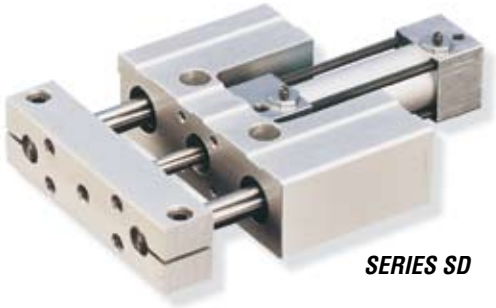
3 POSITION UNIT



CYLINDER FORCE CALCULATIONS

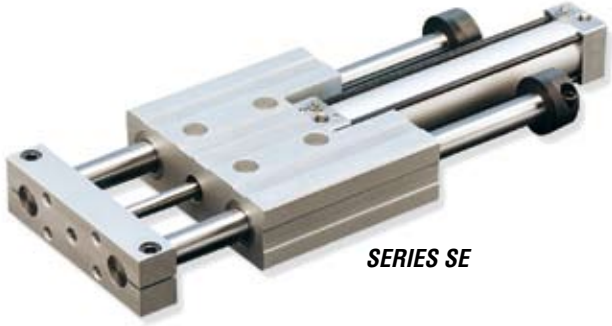
		IMPERIAL F = P x A	METRIC F = 0.1 x P x A
F	= Cylinder Force	lbs	N
P	= Operating Pressure	psi	bar
A	= Effective Area	in²	mm²
	(Extend or Retract)		

SIZING AND APPLICATION ASSISTANCE
See PHD Product Sizing Catalog for specific and complete sizing information. Online sizing assistance is available at: ***www.phdinc.com/apps/sizing***



SERIES SD

SD version is compact and ideal for short travel in horizontal or vertical application, where slide length and weight are critical.

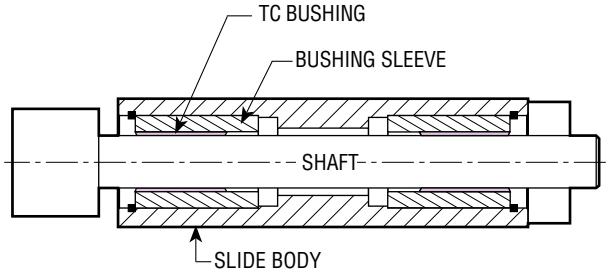


SERIES SE

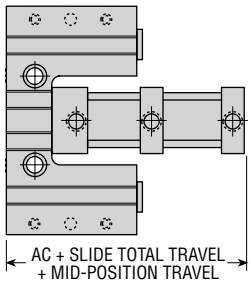
SE version has a greater distance between bushings for longer slide travels and greater shaft stability.

THE TC BUSHING ADVANTAGE

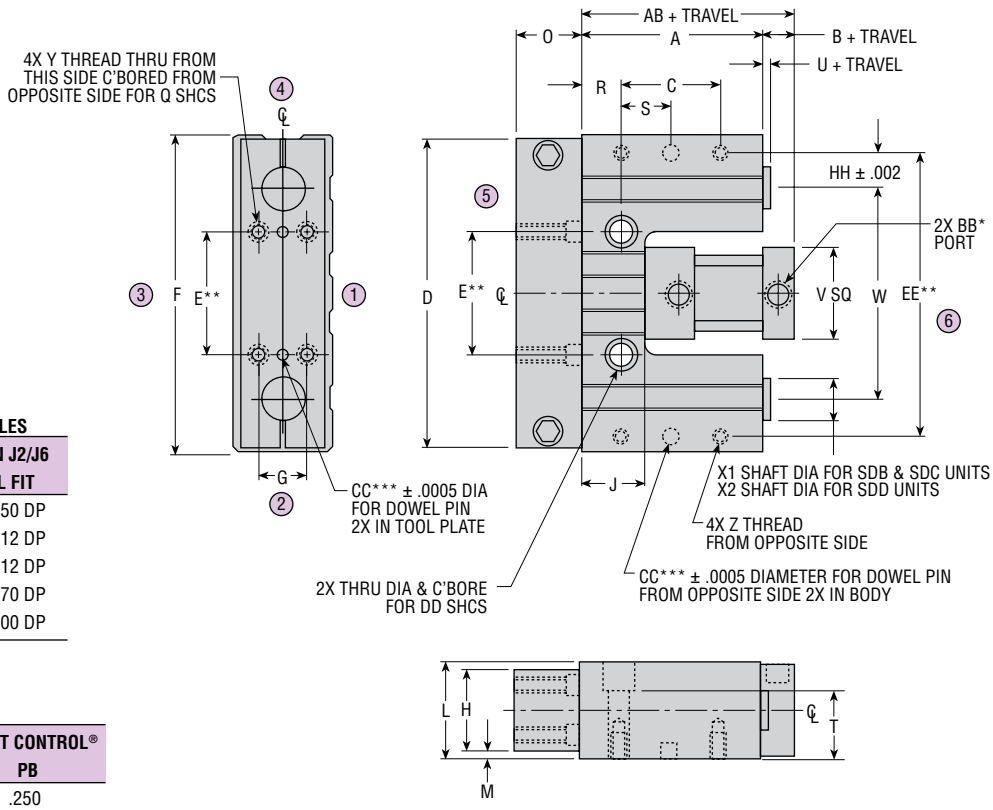
- PHD's ***TC*** fluoropolymer composite bushing has a thin profile allowing the use of large diameter shafts without enlarging the slide body.
- ***TC*** bushings have internal lubrication and are virtually impervious to contamination.
- Field applications and testing have proven slide life comparable to that of traditional linear ball bushings.
- Slide value is increased due to the decreased deflection of the larger shafts and the cost advantages of PHD's ***TC*** bushing.



DIMENSIONS: SERIES SD SLIDES



3 POSITION DETAIL



OPTIONAL CC* DOWEL PIN HOLES**

SLIDE MODEL	OPTION J1/J5 CLOSE FIT	OPTION J2/J6 NORMAL FIT
Sxx22	.1884 x .250 DP	.1913 x .250 DP
Sxx23	.2509 x .312 DP	.2520 x .312 DP
Sxx24	.2509 x .312 DP	.2520 x .312 DP
Sxx25	.3759 x .470 DP	.3770 x .470 DP
Sxx26	.3759 x .500 DP	.3770 x .500 DP

3 POSITION TRAVEL OPTION

SLIDE MODEL	AC	*FOR EACH CUSHION	*PORT CONTROL® PB
SDxE22	5.220	.500	.250
SDxE23	5.425	.500	.250
SDxE24	5.945	.500	.250
SDxE25	7.157	.875	—
SDxE26	8.932	—	—

OPTION ADDERS

SIZE	PB	DB	BR/BJ	AR/AT	AE/AS	GG/GN/G22	GH/GM/G23	GI/GO/G24
22	.25	1.00	.25	.75	.75	.75	.75	1.50
23	.25	1.00	.25	.75	.75	.75	.75	1.50
24	.25	1.00	.25	.75	.75	.75	.75	1.50
25	0	1.750	.25	.75	.75	.75	.75	1.50
26	0	0	.25	.875	.875	.875	.875	1.75

NOTES:

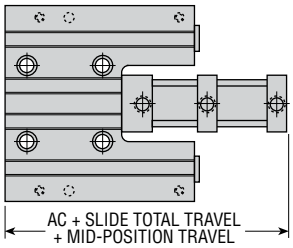
1) FOR OPTIONS PB AND DB, ADD TO CYLINDER'S LENGTH (AFFECTS DIMENSIONS B, AB, AC)
2) FOR OPTIONS BR, BJ, AR, AT, GN, G23 AND GH, ADD BETWEEN DIMENSIONS O AND AC, O AND AB
3) FOR OPTIONS GM, AE, AS, AND GG, G22 ADD TO DIMENSION U
4) FOR OPTIONS GO AND GI, ADD HALF BETWEEN DIMENSIONS O AND AC, O AND AB, AND HALF TO DIMENSION U
5) SEE OPTION PAGES FOR DETAILED OPTION INFORMATION
6) STROKE IS + .030/– .000
7) ALL DIMENSIONS ARE CENTERED ON DESIGNATED CENTERLINE OF THE UNIT UNLESS OTHERWISE SPECIFIED
8) PORT LOCATION FOR SDx26 IS NOT ON CENTERLINE
9) *PORT IS #10-32 WITH OPTION -PB ON SIZE 22
10) **TOLERANCE IS ± .0008 BETWEEN CLOSE FIT DOWEL PIN HOLES. TOLERANCE IS ± .001 BETWEEN NORMAL FIT DOWEL PIN HOLES
11) ***CLOSE FIT DOWEL PINS ARE STANDARD IN HOUSING
12) CIRCLED NUMBERS INDICATE POSITION

SIZE	BORE SIZE	LETTER DIMENSION A	B	C	D	E**	F	G	H	J	L	M	O	Q	R	S	T
22	3/4	2.390	.680	1.375	3.800	1.625	3.880	.580	1.000	.790	1.200	.100	.700	#10 x .215 DP	.500	.500	.825
23	1	2.880	.385	1.500	4.720	1.875	4.820	.750	1.250	.980	1.500	.125	.950	#10 x .215 DP	.625	.750	1.045
24	1-1/8	3.390	.375	1.750	5.400	2.000	5.500	.900	1.500	1.480	1.700	.100	.950	1/4 x .275 DP	.750	.875	1.260
25	1-3/8	3.650	.970	1.750	6.450	2.375	6.550	1.300	2.000	1.500	2.200	.100	1.200	5/16 x .338 DP	.875	.875	1.542
26	2	5.000	.615	3.000	8.375	3.125	8.500	1.625	2.500	1.700	2.750	.125	1.450	3/8 x .400 DP	1.000	1.500	2.050

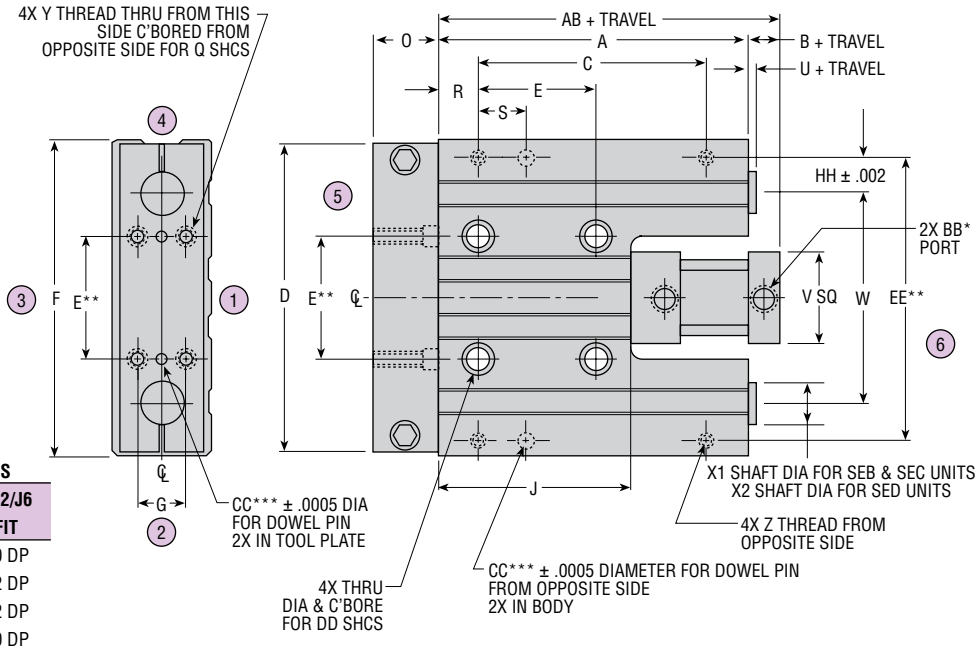
SIZE	U	V	W	X1	X2	Y	Z	AB	BB	CC***	DD	EE**	HH
22	.160	1.000	2.625	.375	.500	1/4-20	#10-24 x .37 DP	3.070	1/8 NPT*	.1884 x .25 DP	1/4	3.4370	.406
23	.045	1.375	3.250	.500	.625	1/4-20	1/4-20 x .40 DP	3.260	1/8 NPT	.2509 x .31 DP	5/16	4.3300	.540
24	.035	1.500	3.625	.625	.750	5/16-18	1/4-20 x .50 DP	3.760	1/8 NPT	.2509 x .31 DP	3/8	5.0000	.688
25	.025	1.875	4.250	.750	1.000	3/8-16	3/8-16 x .69 DP	4.620	1/8 NPT	.3759 x .47 DP	3/8	5.8750	.812
26	.175	2.500	5.750	1.000	1.375	1/2-13	3/8-16 x .75 DP	5.615	1/4 NPT	.3759 x .50 DP	1/2	7.7500	1.000

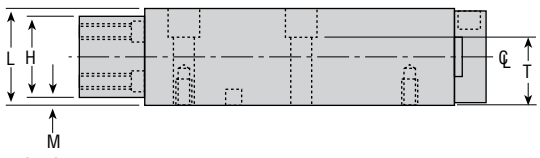
All dimensions are reference only unless specifically toleranced.

DIMENSIONS: SERIES SE SLIDES



3 POSITION DETAIL





OPTIONAL CC* DOWEL PIN HOLES**

SLIDE MODEL	OPTION J1/J5 CLOSE FIT	OPTION J2/J6 NORMAL FIT
Sxx22	.1884 x .250 DP	.1913 x .250 DP
Sxx23	.2509 x .312 DP	.2520 x .312 DP
Sxx24	.2509 x .312 DP	.2520 x .312 DP
Sxx25	.3759 x .470 DP	.3770 x .470 DP
Sxx26	.3759 x .500 DP	.3770 x .500 DP

3 POSITION TRAVEL OPTION

SLIDE MODEL	AC	*FOR EACH CUSHION	*PORT CONTROL® PB
SExE22	7.005	.500	.250
SExE23	7.445	.500	.250
SExE24	7.695	.500	.250
SExE25	9.407	.875	—
SExE26	11.932	—	—

OPTION ADDERS

SIZE	PB	DB	BR/BJ	AR/AT	AE/AS	GG/GN/G22	GH/GM/G23	GI/GO/G24
22	.25	1.00	.25	.75	.75	.75	.75	1.50
23	.25	1.00	.25	.75	.75	.75	.75	1.50
24	.25	1.00	.25	.75	.75	.75	.75	1.50
25	0	1.750	.25	.75	.75	.75	.75	1.50
26	0	0	.25	.875	.875	.875	.875	1.75

NOTES:

1) FOR OPTIONS PB AND DB, ADD TO CYLINDER'S LENGTH (AFFECTS DIMENSIONS B, AB, AC)
2) FOR OPTIONS BR, BJ, AR, AT, GN, AND GH, G23 ADD BETWEEN DIMENSIONS O AND AC, O AND AB
3) FOR OPTIONS GM, AE, AS, AND GG, G22 ADD TO DIMENSION U
4) FOR OPTIONS GO AND GI, ADD HALF BETWEEN DIMENSIONS O AND AC, O AND AB, AND HALF TO DIMENSION U
5) SEE OPTION PAGES FOR DETAILED OPTION INFORMATION
6) STROKE IS + .030/– .000
7) ALL DIMENSIONS ARE CENTERED ON DESIGNATED CENTERLINE OF THE UNIT UNLESS OTHERWISE SPECIFIED
8) PORT LOCATION FOR SEx26 IS NOT ON CENTERLINE
9) *PORT IS #10-32 WITH OPTION -PB ON SIZE 22
10) **TOLERANCE IS ± .0008 BETWEEN CLOSE FIT DOWEL PIN HOLES, TOLERANCE IS ± .001 BETWEEN NORMAL FIT DOWEL PIN HOLES
11) ***CLOSE FIT DOWEL PINS ARE STANDARD IN HOUSING
12) CIRCLED NUMBERS INDICATE POSITION

SIZE	BORE SIZE	LETTER DIMENSION A	B	C	D	E**	F	G	H	J	L	M	O	Q	R	S	T
22	3/4	4.140	.680	3.125	3.800	1.625	3.880	.580	1.000	2.540	1.200	.100	.700	#10 x .215 DP	.500	.500	.825
23	1	4.770	.495	3.500	4.720	1.875	4.820	.750	1.250	2.980	1.500	.125	.950	#10 x .215 DP	.625	.750	1.045
24	1-1/8	5.020	.495	3.500	5.400	2.000	5.500	.900	1.500	3.230	1.700	.100	.950	1/4 x .275 DP	.750	.875	1.260
25	1-3/8	5.770	1.105	4.000	6.450	2.375	6.550	1.300	2.000	3.750	2.200	.100	1.200	5/16 x .338 DP	.875	.875	1.542
26	2	8.000	.615	6.000	8.375	3.125	8.500	1.625	2.500	4.700	2.750	.125	1.450	3/8 x .400 DP	1.000	1.500	2.050

SIZE	U	V	W	X1	X2	Y	Z	AB	BB	CC***	DD	EE**	HH
22	.160	1.000	2.625	.375	.500	1/4-20	#10-24 x .37 DP	4.820	1/8 NPT*	.1884 x .25 DP	1/4	3.4370	.406
23	.155	1.375	3.250	.500	.625	1/4-20	1/4-20 x .40 DP	5.260	1/8 NPT	.2509 x .31 DP	5/16	4.3300	.540
24	.155	1.500	3.625	.625	.750	5/16-18	1/4-20 x .50 DP	5.510	1/8 NPT	.2509 x .31 DP	3/8	5.0000	.688
25	.155	1.875	4.250	.750	1.000	3/8-16	3/8-16 x .69 DP	6.870	1/8 NPT	.3759 x .47 DP	3/8	5.8750	.812
26	.175	2.500	5.750	1.000	1.375	1/2-13	3/8-16 x .75 DP	8.615	1/4 NPT	.3759 x .50 DP	1/2	7.7500	1.000

PB PORT CONTROL®

The exclusive PHD Port Control®, based on the "meter-out" principle, features an adjustable needle and check seal. Both are built into the cylinder head and cap and are used to control the speed of the slide over its entire travel.

The self-locking needle has micrometer threads and is adjustable under pressure. It determines the orifice size which controls the exhaust volume only of the cylinder proper. The check seal is closed while fluid is exhausting from the cylinder, but opens to permit full flow of incoming fluids. The PHD Port Control® provides the optimum in speed control for slides. All adjustments are made from the top surface of the slide. It saves space and eliminates the cost of installation and fittings for external flow control valves.

NOTE: Port Controls add 1/4" to the cylinder length (affects dimensions AB, AC, and B) on sizes 22, 23, and 24.

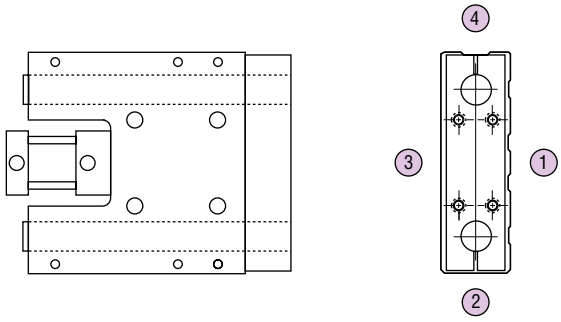
MAXIMUM SLIDE VELOCITY
SD & SE SLIDES

50 in/sec without Port Controls®
16 in/sec with Port Controls®

The above figures are based on a working pressure of 100 psi and a no load horizontal condition.

U7 PORTS AND CONTROL NEEDLE IN POSITION 3

This option provides for the ports, Port Control®, and cushions to be in position 3, or underside of the unit (180° from standard).

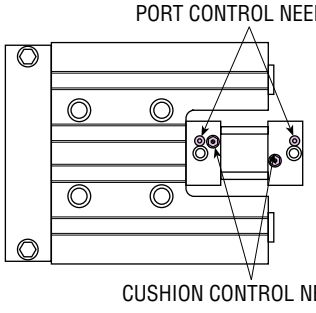


DB ADJUSTABLE CUSHIONS

PHD Cushions are designed for smooth deceleration at each end of travel. When the cushion is activated, the remaining volume in the cylinder must exhaust past an adjustable needle which controls the amount of deceleration. The wide adjustment range makes the cushion ideal for end of travel shock reduction. Cushion needles are located on the same side as the Port Control® needles for easy access and adjustment.

NOTE: Cushions add to the cylinder length (affects dimensions AB, AC, and B) add 1.000" on sizes 22, 23, and 24; and 1.750" on size 25.

PORT CONTROL® & CUSHION ADJUSTMENT POSITIONS



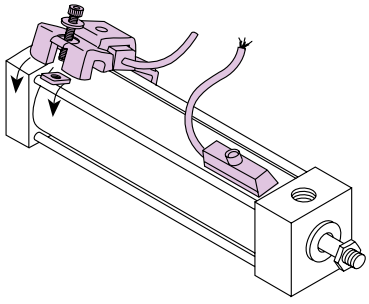
Effective cushion length 1/2" on size 22 through 24 and 3/4" on size 25.

E MAGNET FOR PHD SOLID STATE SWITCHES

This option equips the cylinder with a magnetic band on the piston for use with PHD 1750 Solid State Switches.

M MAGNET FOR PHD REED SWITCHES

This option equips the cylinder with a magnetic band on the piston for use with PHD 1750 Reed Switches.



These cylinder-mounted switches are an easy and convenient way of interfacing the slide to various programmable controllers or logic systems. See page 2-54 for specific Solid State and Reed Switch information. **SWITCHES MUST BE ORDERED SEPARATELY.**

All dimensions are reference only unless specifically toleranced.

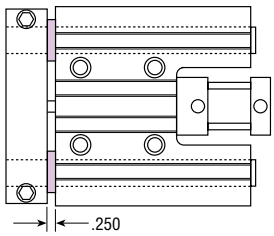
L10 OVERSIZED PORTS
(available on sizes 25 & 26 only)

This option provides an oversized port on the head and cap of the cylinder for size 25 and 26. This will then allow ports to match appropriate sized NFPA cylinder standards.

Size 25 ports become 1/4 NPT instead of 1/8 NPT. Size 26 ports become 3/8 NPT instead of 1/4 NPT. Ports will remain in standard port locations.

BR SHOCK PADS ON RETRACTION

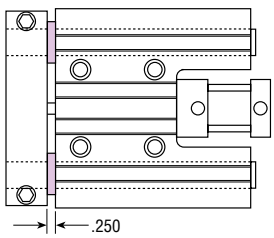
This option provides polyurethane shock pads on retraction only, eliminating metal-to-metal contact as the tool plate reaches the slide body. This option greatly reduces noise and shock upon slide retraction. Not available with tool plate extension.



ADD TO BASIC SLIDE DIMENSIONS

BJ HushStop® SHOCK PADS ON RETRACTION

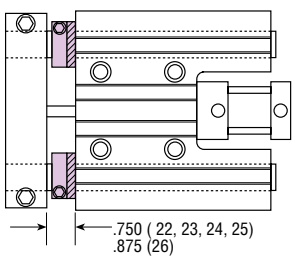
This option provides composite shock pads on retraction only, eliminating metal-to-metal contact as the tool plate reaches the slide body. This option, quieter than the BR option, greatly reduces noise and shock upon slide retraction. Not available with tool plate extension. Due to the composite shock pads, stop locations may vary. For close tolerance stop locations, use BR option.



ADD TO BASIC SLIDE DIMENSIONS

AR TRAVEL ADJUSTMENT AND SHOCK PADS ON RETRACTION

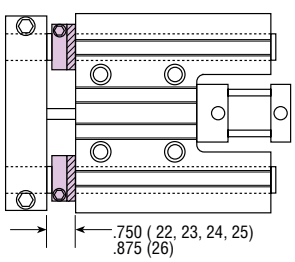
This option provides both travel adjustment stop collars and polyurethane shock pads on retraction only. The travel adjustment stop collars provide infinite adjustment while the shock pads eliminate metal-to-metal contact, thereby quieting the unit.



ADD TO BASIC SLIDE DIMENSIONS

AT TRAVEL ADJUSTMENT AND HushStop® SHOCK PADS ON RETRACTION

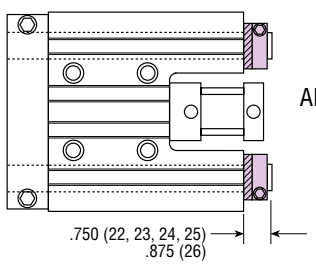
This option, quieter than the AR option, provides both travel adjustment stop collars and composite shock pads on retraction only. The travel adjustment stop collars provide infinite adjustment while the shock pads eliminate metal-to-metal contact, thereby quieting the unit. Due to the composite shock pads, stop locations may vary. For close tolerance stop locations, use the AR option.



ADD TO BASIC SLIDE DIMENSIONS

AE TRAVEL ADJUSTMENT AND SHOCK PADS ON EXTENSION

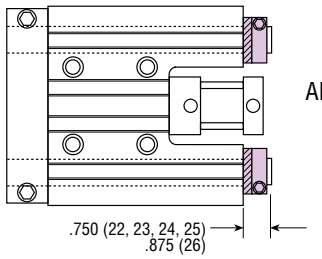
This option provides both travel adjustment stop collars and polyurethane shock pads on extension only. The travel adjustment stop collars provide infinite adjustment while the shock pads eliminate metal-to-metal contact, thereby quieting the unit.



ADD TO BASIC SLIDE DIMENSIONS

AS TRAVEL ADJUSTMENT AND HushStop® SHOCK PADS ON EXTENSION

This option, quieter than the AE option, provides both travel adjustment stop collars and composite shock pads on extension only. The travel adjustment stop collars provide infinite adjustment while the shock pads eliminate metal-to-metal contact, thereby quieting the unit. Due to the composite shock pads, stop locations may vary. For close tolerance stop locations, use the AE option.



ADD TO BASIC SLIDE DIMENSIONS

STOP & TRAVEL ADJUSTMENT KITS

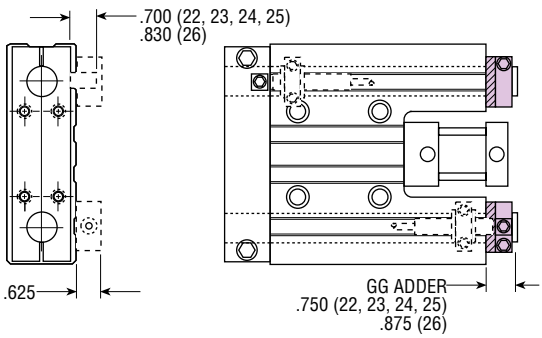
KIT TYPE	SHAFT	22	23	24	25	26
STANDARD TRAVEL ADJUSTMENT (-AR OR -AE)	STANDARD	59737-01	59737-03	59737-05	59737-07	59737-09
	OVERSIZED	59737-02	59737-04	59737-06	59737-08	59737-10
HushStop® TRAVEL ADJUSTMENT (-AT OR -AS)	STANDARD	67653-01	67653-03	67653-05	67653-07	67653-09
	OVERSIZED	67653-02	67653-04	67653-06	67653-08	67653-10
STANDARD PROXIMITY & TRAVEL ADJUSTMENT (-GG OR -GH)	STANDARD	59745-01	59745-03	59745-05	59745-07	59745-09
	OVERSIZED	59745-02	59745-04	59745-06	59745-08	59745-10
HushStop® PROXIMITY & TRAVEL ADJUSTMENT (-G22 OR -G23)	STANDARD	67651-01	67651-03	67651-05	67651-07	67651-09
	OVERSIZED	67651-02	67651-04	67651-06	67651-08	67651-10
SHOCK ABSORBER STOP (-GM OR -GN)	STANDARD	59746-01	59746-03	59746-05	59746-07	59746-09
	OVERSIZED	59746-02	59746-04	59746-06	59746-08	59746-10

Kit contains all components for standard non-Z1 units for one direction only.

GG TRAVEL ADJUSTMENT AND SHOCK PADS ON EXTENSION

WITH PROVISIONS FOR PROXIMITY SWITCH MOUNTING IN BOTH DIRECTIONS

This option provides both travel adjustment and polyurethane shock pads on extension; and provisions for mounting of proximity switch targets and brackets on both ends. **Switches and bracket kits must be ordered separately.** See page 2-54 for bracket/target kits and for switch ordering information. Not available with tool plate extension. With tool plate extension use GH option.



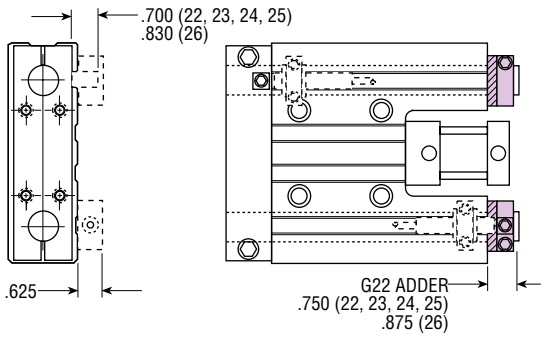
ADD TO BASIC SLIDE DIMENSIONS

G22 TRAVEL ADJUSTMENT AND HushStop® SHOCK PADS ON EXTENSION

WITH PROVISIONS FOR PROXIMITY SWITCH MOUNTING IN BOTH DIRECTIONS

This option, quieter than the GG option, provides both travel adjustment and composite shock pads on extension; and provisions for mounting of proximity switch targets and brackets on both ends. **Switches and bracket kits must be ordered separately.** See page 2-54 for bracket/target kits and for switch ordering information.

Due to the composite shock pads, stop locations may vary. For close tolerance stop locations, use the GG option.

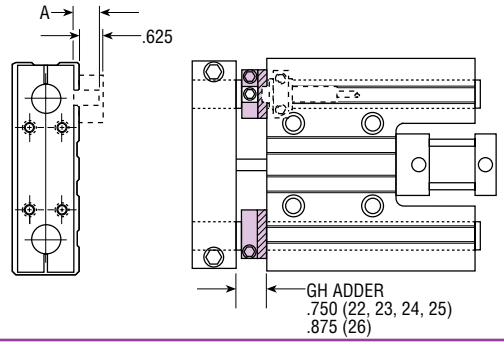


ADD TO BASIC SLIDE DIMENSIONS

All dimensions are reference only unless specifically toleranced.

GH TRAVEL ADJUSTMENT AND SHOCK PADS ON RETRACTION
WITH PROVISIONS FOR PROXIMITY SWITCH MOUNTING ON RETRACTION

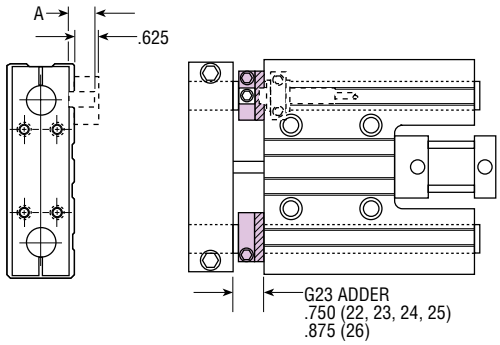
This option provides both travel adjustment and polyurethane shock pads on retraction and provisions for mounting of proximity switch targets and brackets in the retraction direction only. **Switches and bracket kits must be ordered separately.** See page 2-54 for bracket/target kits and for switch ordering information.



G23 TRAVEL ADJUSTMENT AND HushStop® SHOCK PADS ON RETRACTION
WITH PROVISIONS FOR PROXIMITY SWITCH MOUNTING ON RETRACTION

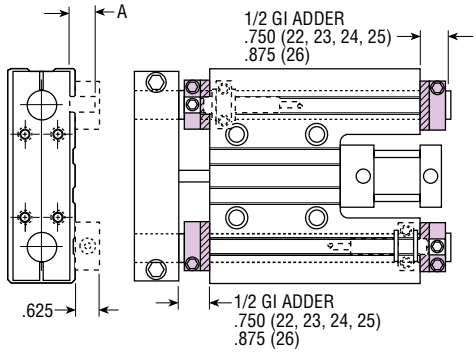
This option, quieter than the GH option, provides both travel adjustment and composite shock pads on retraction and provisions for mounting of proximity switch targets and brackets in the retraction direction only. **Switches and bracket kits must be ordered separately.** See page 2-54 for bracket/target kits and for switch ordering information.

Due to the composite shock pads, stop locations may vary. For close tolerance stop locations, use the GH option.



GI TRAVEL ADJUSTMENTS, SHOCK PADS, AND PROVISIONS FOR PROXIMITY SWITCHES IN BOTH DIRECTIONS

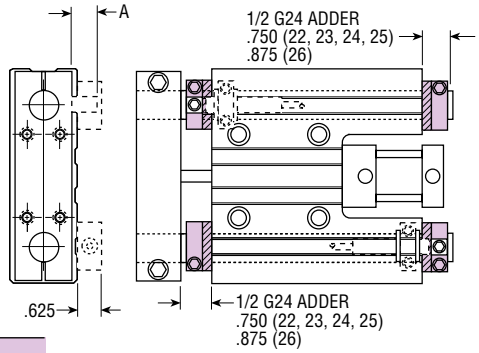
This option provides both travel adjustment and polyurethane shock pads in both directions and provisions for mounting of proximity switch targets and brackets on both ends. **Switches and bracket kits must be ordered separately.** See page 2-54 for bracket/target kits and for switch ordering information.



G24 TRAVEL ADJUSTMENTS, HushStop® SHOCK PADS, AND PROVISIONS FOR PROXIMITY SWITCHES IN BOTH DIRECTIONS

This option,quieter than the GI option, provides both travel adjustment and composite shock pads in both directions and provisions for mounting of proximity switch targets and brackets on both ends. **Switches and bracket kits must be ordered separately.** See page 2-54 for bracket/target kits and for switch ordering information.

Due to the composite shock pads, stop locations may vary. For close tolerance stop locations, use the GI option.



SLIDE SIZE	A	
	8 mm PROX	12 mm PROX
22	.700	1.500
23	.700	1.500
24	.700	1.000
25	.700	1.000
26	.830	1.125

ADD TO BASIC SLIDE DIMENSIONS

All dimensions are reference only unless specifically toleranced.

Q1 CORROSION RESISTANT GUIDE SHAFTS

Extremely hard corrosion-resistant coating on the guide shafts for use in applications where moisture may corrode hardened ground shafts. End faces of the shafts remain uncoated. Consult PHD for fully coated shafts.

V1 FLUORO-ELASTOMER SEALS

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

Z1 ELECTROLESS NICKEL PLATING

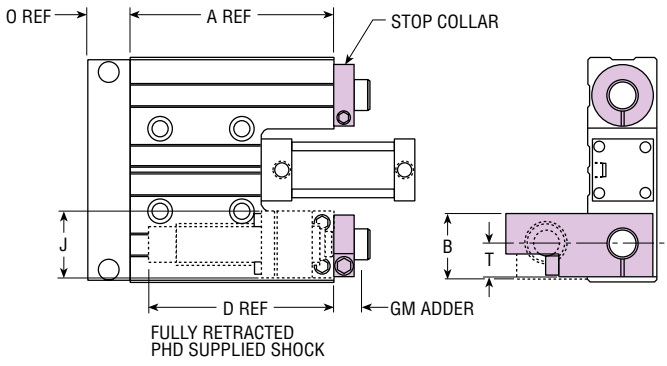
This option provides electroless nickel plating on all externally exposed ferrous parts except the guide shafts and cylinder rod end. This optional plating can be used for protecting the slide from severe or corrosive environments. The guide shafts can be made corrosion-resistant by specifying the -Q1 shaft option.

NOTE: Shock absorbers are not plated with -Z1 option.

GM PROVISIONS FOR SHOCK ABSORBER MOUNTING ON EXTENSION

This option provides for mounting a bracket for a shock absorber in the extend direction. This includes mounting holes in the slide body, a shock stop on one shaft, and a stop collar on the other shaft. **The shock absorber and shock mounting kit must be ordered separately.** This arrangement allows the shock absorber to double as a travel adjustment in the extension direction.

See page 2-54 for shock mounting kit and shock absorber ordering information. Shock stop and mounting bracket are supplied ready for proximity switch bracket and target mounting.



ADD TO BASIC SLIDE DIMENSIONS

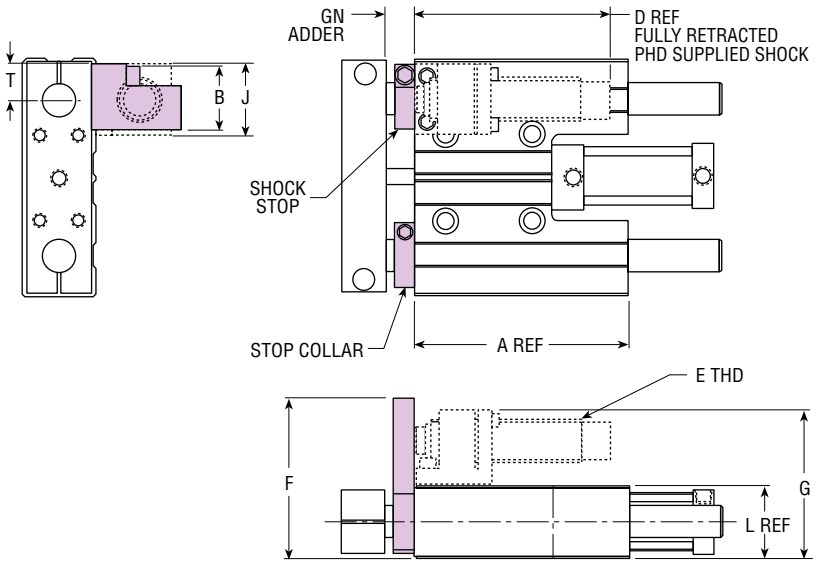
SIZE	A REF. SD	A REF. SE	B	GM ADDER	D	E THREAD	F	G	J	L REF.	O REF.	T
22	2.390	4.140	1.000	.750	4.00	3/4-16 UNF	2.575	2.450	1.125	1.200	.700	.563
23	2.875	4.765	1.250	.750	4.00	3/4-16 UNF	2.875	2.750	1.125	1.500	.950	.695
24	3.390	5.015	1.500	.750	4.75	1-12 UNF	3.575	3.450	1.650	1.700	.950	.815
25	3.650	5.765	2.000	.750	4.75	1-12 UNF	4.075	3.950	1.650	2.200	1.200	1.050
26	5.000	8.000	2.500	.875	4.75	1-12 UNF	4.875	4.750	2.000	2.750	1.450	1.325

All dimensions are reference only unless specifically toleranced.

GN PROVISIONS FOR SHOCK ABSORBER MOUNTING ON RETRACTION

This option provides for mounting a bracket for a shock absorber in the retract direction. This includes mounting holes in the slide body, a shock stop on one shaft, and a stop collar on the other shaft. **The shock absorber and shock mounting kit must be ordered separately.** This arrangement allows the shock absorber to double as a travel adjustment in the retraction direction.

See page 2-54 for shock mounting kit and shock absorber ordering information. Shock stop and mounting bracket are supplied ready for proximity switch bracket and target mounting.



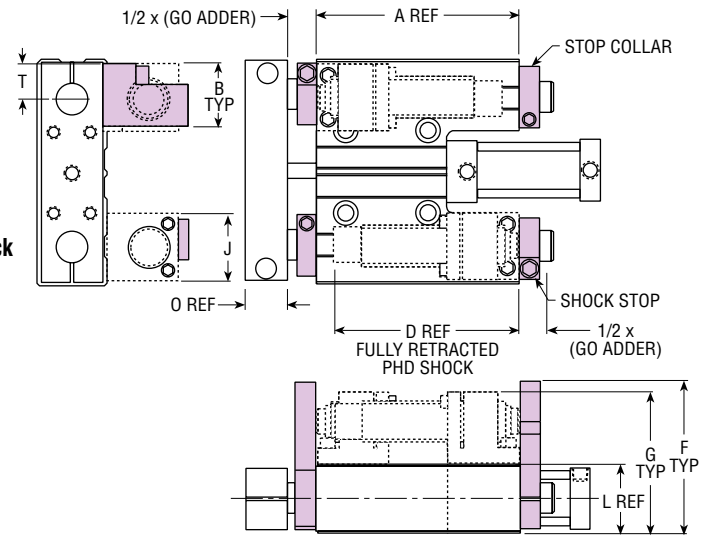
ADD TO BASIC SLIDE DIMENSIONS

SIZE	A REF. SD	A REF. SE	B	GN ADDER	D	E THREAD	F	G	J	L REF.	T
22	2.390	4.140	1.000	.750	4.00	3/4-16 UNF	2.575	2.450	1.125	1.200	.563
23	2.875	4.765	1.250	.750	4.00	3/4-16 UNF	2.875	2.750	1.125	1.500	.695
24	3.390	5.015	1.500	.750	4.75	1-12 UNF	3.575	3.450	1.650	1.700	.815
25	3.650	5.765	2.000	.750	4.75	1-12 UNF	4.075	3.950	1.650	2.200	1.050
26	5.000	8.000	2.500	.875	4.75	1-12 UNF	4.875	4.750	2.000	2.750	1.325

GO PROVISIONS FOR SHOCK ABSORBER MOUNTING ON EXTENSION AND RETRACTION

This option provides for mounting brackets for shock absorbers in both the extend and retract direction. This includes two sets of mounting holes in the slide body, shock stops mounted on the shafts in each direction, and stop collars mounted on the opposite shafts. **The shock absorbers and shock mounting kits must be ordered separately.** This arrangement allows the shock absorbers to double as travel adjustments in both directions.

See page 2-54 for shock mounting kit and shock absorber ordering information. Shock stops and brackets are supplied ready for proximity switch bracket and target mounting.



ADD TO BASIC SLIDE DIMENSIONS

SIZE	A REF. SD	A REF. SE	B	GO ADDER	D	E THREAD	F	G	J	L REF.	O REF.	T
22	2.390	4.140	1.000	1.500	4.000	3/4-16 UNF	2.575	2.450	1.125	1.200	.700	.563
23	2.875	4.765	1.250	1.500	4.000	3/4-16 UNF	2.875	2.750	1.125	1.500	.950	.695
24	3.390	5.015	1.500	1.500	4.750	1-12 UNF	3.575	3.450	1.650	1.700	.950	.815
25	3.650	5.765	2.000	1.500	4.750	1-12 UNF	4.075	3.950	1.650	2.200	1.200	1.050
26	5.000	8.000	2.500	1.750	4.750	1-12 UNF	4.875	4.750	2.000	2.750	1.450	1.325

All dimensions are reference only unless specifically toleranced.

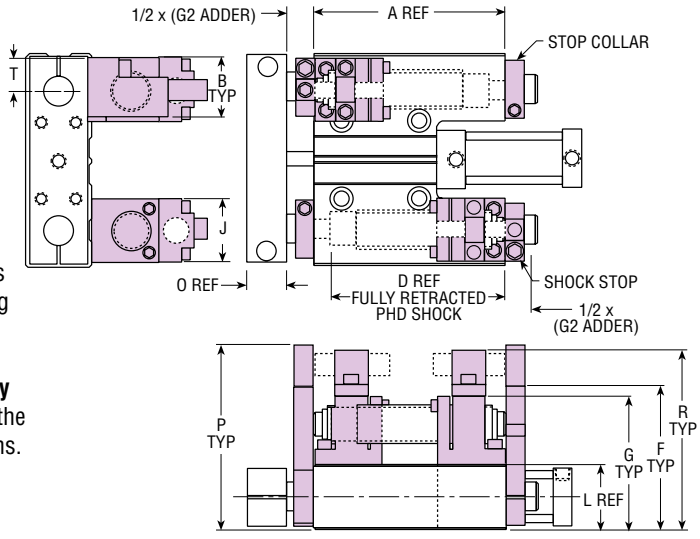
G2 G12

SHOCK ABSORBER AND PROXIMITY SWITCH READY ON EXTENSION AND RETRACTION

This option provides mounting brackets for shock absorbers and proximity switches in both directions. This includes mounting brackets for both shock absorbers and proximity switches, proximity targets, and mounting hardware with stop collars and stops mounted on the shafts. **The shock absorbers and proximity switches must be ordered separately.** This arrangement allows the shock absorbers to double as travel adjustments in both directions.

See page 2-54 for shock absorbers and proximity switches.

G2 = 8 mm proximity switch
G12 = 12 mm proximity switch



ADD TO BASIC SLIDE DIMENSIONS

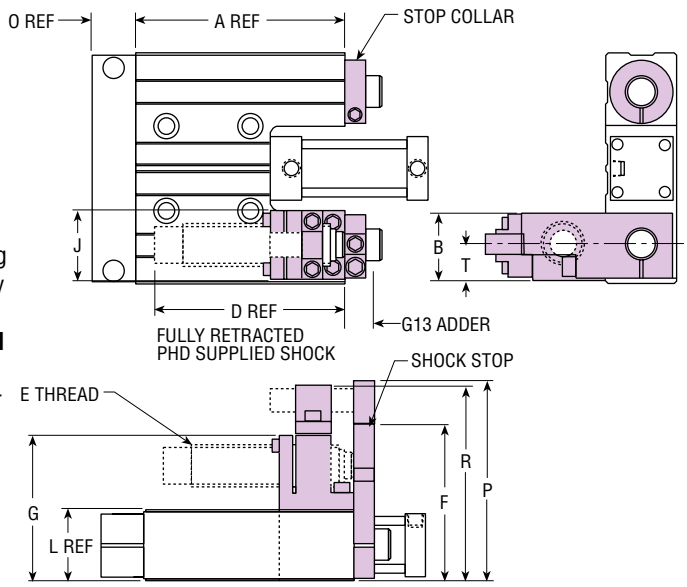
SIZE	A REF. SD	A REF. SE	B	G2/G12 ADDER	D	E THREAD	F	G	J	L REF.	O REF.	P 8 mm	P 12 mm	R 8 mm	R 12 mm	T
22	2.390	4.140	1.000	1.500	4.000	3/4-16 UNF	2.575	2.450	1.125	1.200	.700	3.275	4.075	3.075	3.700	.563
23	2.875	4.765	1.250	1.500	4.000	3/4-16 UNF	2.875	2.750	1.125	1.500	.950	3.575	4.375	3.375	4.000	.695
24	3.390	5.015	1.500	1.500	4.750	1-12 UNF	3.575	3.450	1.650	1.700	.950	4.275	4.575	4.075	4.330	.815
25	3.650	5.765	2.000	1.500	4.750	1-12 UNF	4.075	3.950	1.650	2.200	1.200	4.775	5.075	4.575	4.830	1.050
26	5.000	8.000	2.500	1.750	4.750	1-12 UNF	4.875	4.750	2.000	2.750	1.450	5.705	6.000	5.375	5.625	1.325

G3 G13

SHOCK ABSORBER & PROXIMITY SWITCH READY ON EXTENSION

This option provides mounting brackets for a shock absorber and proximity switch on the extension only. This includes mounting brackets for both shock absorber and proximity switch, a proximity target and mounting hardware, with a stop collar and stop on the shafts. **The shock absorber and proximity switch must be ordered separately.** This arrangement allows the shock absorber to double as a travel adjustment in the extension direction. See page 2-52 for shock absorbers and proximity switches.

G3 = 8 mm Proximity Switch
G13 = 12 mm Proximity Switch



ADD TO BASIC SLIDE DIMENSIONS

SIZE	A REF. SD	A REF. SE	B	G3/G13 ADDER	D	E THREAD	F	G	J	L REF.	O REF.	P 8 mm	P 12 mm	R 8 mm	R 12 mm	T
22	2.390	4.140	1.125	.750	4.00	3/4-16 UNF	2.575	2.450	1.125	1.200	.700	3.275	4.075	3.075	3.700	.563
23	2.875	4.765	1.250	.750	4.00	3/4-16 UNF	2.875	2.750	1.125	1.500	.950	3.575	4.375	3.375	4.000	.695
24	3.390	5.015	1.500	.750	4.75	1-12 UNF	3.575	3.450	1.650	1.700	.950	4.275	4.575	4.075	4.330	.815
25	3.650	5.765	2.000	.750	4.75	1-12 UNF	4.075	3.950	1.650	2.200	1.200	4.775	5.075	4.575	4.830	1.050
26	5.000	8.000	2.500	.875	4.75	1-12 UNF	4.875	4.750	2.000	2.750	1.450	5.705	6.000	5.375	5.625	1.325

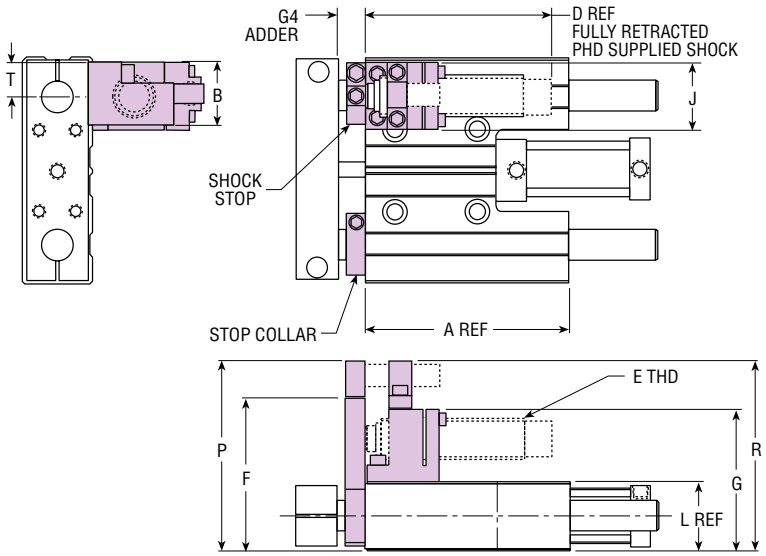
All dimensions are reference only unless specifically toleranced.

G4 G14

SHOCK ABSORBER & PROXIMITY SWITCH READY ON RETRACTION

This option provides mounting brackets for a shock absorber and proximity switch on the retraction only. This includes mounting brackets for both shock absorber and proximity switch, shaft, a proximity target and mounting hardware, with a stop collar and stop on the other shafts. **The shock absorber and proximity switch must be ordered separately.** This arrangement allows the shock absorber to double as a travel adjustment in the retract direction. See page 2-54 for shock absorbers and proximity switches.

G4 = 8 mm Proximity Switch
G14 = 12 mm Proximity Switch



ADD TO BASIC SLIDE DIMENSIONS

SIZE	A REF. SD	A REF. SE	B	G4/G14 ADDER	D	EL THREAD	F	G	J	REF.	P 8 mm	P 12 mm	R 8 mm	R 12 mm	T
22	2.390	4.140	1.125	.750	4.00	3/4-16 UNF	2.575	2.450	1.125	1.200	3.275	4.075	3.075	3.700	.563
23	2.875	4.765	1.250	.750	4.00	3/4-16 UNF	2.875	2.750	1.125	1.500	3.575	4.375	3.375	4.000	.695
24	3.390	5.015	1.500	.750	4.75	1-12 UNF	3.575	3.450	1.650	1.700	4.275	4.575	4.075	4.330	.815
25	3.650	5.765	2.000	.750	4.75	1-12 UNF	4.075	3.950	1.650	2.200	4.775	5.075	4.575	4.830	1.050
26	5.000	8.000	2.500	.875	4.75	1-12 UNF	4.875	4.750	2.000	2.750	5.705	6.000	5.375	5.625	1.325

SHOCK KITS

Each shock mounting kit contains one shock bracket with all necessary hardware for mounting one shock absorber in either direction. Slide unit must be ordered as provisions for shock absorber. **Shock absorbers must be ordered separately.** See PHD Product Sizing Catalog for kit numbers.

SHOCK ABSORBERS

Shock absorbers are ordered separately and should be properly matched to the slide application. See PHD Product Sizing Catalog for proper shock absorber selection and shock numbers.

BS

SHOCK PADS ON EXTENSION

The -BS option adds shock pads on extension to the -GM, -GO, -G2, -G3, -G12, or -G13 shock absorber option. The shock pads are assembled between the shock stop (stop collar) and the slide body. The purpose of this option is to complement the shock absorber by eliminating metal to metal contact at the end of slide extension. Shock pads do not affect length adders for shock absorber options.

BT

SHOCK PADS ON RETRACTION

The -BT option adds shock pads on retraction to the -GN, -GO, -G2, -G4, -G12, or -G14 shock absorber option. The shock pads are assembled between the shock stop (stop collar) and the slide body. The purpose of this option is to complement the shock absorber by eliminating metal to metal contact at the end of slide retraction. Shock pads do not affect length adders for shock absorber options.

BK

HushStop® SHOCK PADS ON EXTENSION

The -BK option adds composite shock pads on extension to the -GM, -GO, -G2, -G3, -G12, or -G13 shock absorber option. The shock pads are assembled between the shock stop (stop collar) and the slide body. The purpose of this option, quieter than the -BS option, is to complement the shock absorber by eliminating metal to metal contact at the end of slide extension. Shock pads do not affect length adders for shock absorber options.

Due to the composite shock pads, stop locations may vary. For close tolerance stop locations, use the -BS option.

BL

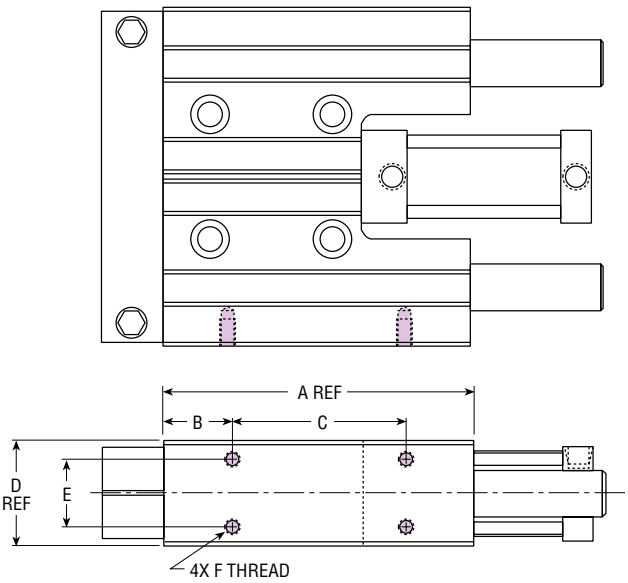
HushStop® SHOCK PADS ON RETRACTION

The -BL option adds composite shock pads on retraction to the -GN, -GO, -G2, -G4, -G12, or -G14 shock absorber option. The shock pads are assembled between the shock stop (stop collar) and the slide body. The purpose of this option, quieter than the -BT option, is to complement the shock absorber by eliminating metal to metal contact at the end of slide retraction. Shock pads do not affect length adders for shock absorber options.

Due to the composite shock pads, stop locations may vary. For close tolerance stop locations, use the -BT option.

GV SIDE MOUNTING HOLES IN POSITION 2

This option provides an additional mounting pattern on one side of the slide body. This pattern is ideal if the slide is to be mounted on edge for applications where a narrow profile is required.



NOTE: MTG HOLES CENTERED ON CENTERLINE OF UNIT

OPTION ADDERS

MODEL	A	B	C	D	E	F THREAD
SDx22	2.390	.750	.625	1.200	.750	10-24 x .375 DP
SEx22	4.140	.750	2.375	1.200	.750	10-24 x .375 DP
SDx23	2.875	.937	.875	1.500	1.062	1/4-20 x .375 DP
SEx23	4.765	.937	2.875	1.500	1.062	1/4-20 x .375 DP
SDx24	3.390	1.063	1.125	1.700	1.125	1/4-20 x .430 DP
SEx24	5.015	1.063	2.875	1.700	1.125	1/4-20 x .430 DP
SDx25	3.650	1.313	.875	2.200	1.500	3/8-16 x .650 DP
SEx25	5.765	1.313	3.125	2.200	1.500	3/8-16 x .650 DP
SDx26	5.000	1.500	2.000	2.750	2.000	3/8-16 x .750 DP
SEx26	8.000	1.500	5.000	2.750	2.000	3/8-16 x .750 DP

H47 RODLOK® SLIDE & RODLOK®

PHD's Rodlok® is ideal for locking the tool plate while in a static/stationary position. When the pressure is removed from the port of the Rodlok®, the mechanism will grip the piston rod of the cylinder and prevent it from moving. The loads are held indefinitely without power. Rodlok® performance is application and environment sensitive (cleanliness of rod or Rodlok® will also affect performance). THE RODLOK® IS NOT DESIGNED TO BE USED AS A PERSONNEL SAFETY DEVICE.

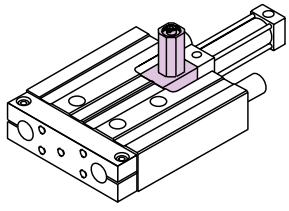
SIZE	STATIC LOCKING FORCE* lb	N
22	40	180
23	56	250
24	79	350
25	135	600
26	338	1500

NOTE: *Locking force given in table is the actual locking force with a dry clean rod and does not include any safety factor.

OPERATING PRESSURE

The operating pressure for the locking device is different than the operating pressure for the slide to which it is attached. The locking device of the Rodlok is designed with an operating pressure range of 60 psi [4 bar] minimum to 150 psi [10 bar] maximum. The Series SD/SE Slide with a Rodlok attached has an operating pressure range of 45 psi [3 bar] minimum to 150 psi [10 bar] maximum.

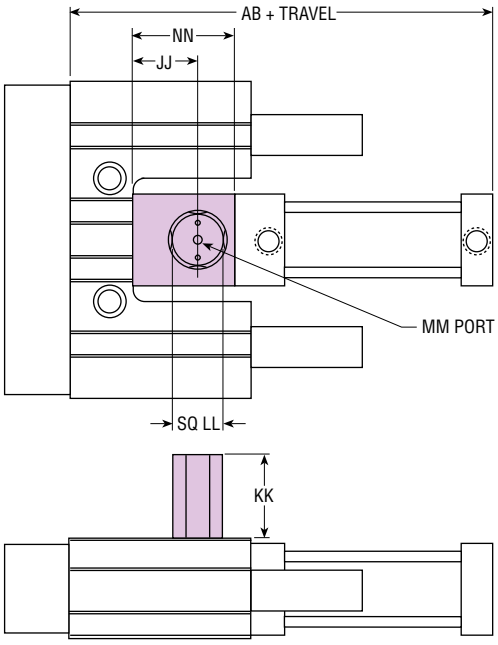
NOTE: When ordering a replacement cylinder (-H4), Rodlok® must be ordered separately.



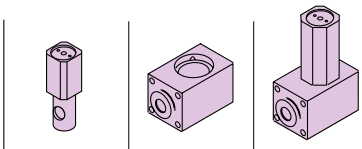
BORE in	DEVICE WEIGHT lb	ADAPTOR WEIGHT lb	TOTAL WEIGHT lb
SDx22	0.10	0.10	0.22
SEx22	0.10	0.10	0.22
SD/SEx23	0.14	0.18	0.35
SD/SEx24	0.14	0.22	0.41
SD/SEx25	0.20	0.40	0.70
SD/SEx26	0.58	0.70	1.54

NOTE: Total weight includes rod adder for -H46/-H47 cylinder.

All dimensions are reference only unless specifically toleranced.



REPLACEMENT RODLOK® KITS



MODEL NO.	LOCKING DEVICE KIT	ADAPTOR KIT*	COMPLETE RODLOK®*
SDx22	64476	63931-06	63935-06
SEx22	64476	63931-07	63935-07
SD/SEx23	64477	63931-08	63935-08
SD/SEx24	64478	63931-09	63935-09
SD/SEx25	64479	63931-10	63935-10
SD/SEx26	64480	63931-05	63935-05

NOTES:
1) *Kits ship with cylinder mounting hardware.
2) Part numbers listed above are intended for replacement purposes only and are to be used specifically on slides with the -H47 option.

The Rodlok® locking device and adaptor can be purchased separately as kits. See chart above. The locking device and adaptor are not available with a corrosion resistant (-Z1 option) finish.

LETTER DIM.	MODEL NUMBER									
	SDxx22	SExx22	SDxx23	SExx23	SDxx24	SExx24	SDxx25	SExx25	SDxx26	SExx26
KK	1.309	1.309	1.336	1.336	1.236	1.236	1.459	1.459	1.912	1.912
LL	.728	.728	.787	.787	.787	.787	.886	.886	1.279	1.279
MM	10-32	10-32	10-32	10-32	10-32	10-32	10-32	10-32	1/8 NPT	1/8 NPT
NN	1.50	1.50	1.50	1.50	1.50	1.50	1.750	1.750	3.000	3.000
JJ	.875	.875	.875	.875	.875	.875	.750	.750	1.299	1.299
AB	4.570	6.320	4.760	6.760	5.250	7.010	6.370	8.620	8.615	11.615

SWITCHES & BRACKETS

(FOR USE WITH -E OR -M OPTIONS)

BRACKETS

SLIDE SIZE	COMPACT SWITCH BRACKET NO.
22	17000-31-5
23	17000-32-5
24	17000-33-5
25	17000-34-5
26	58050-02

See Switches and Sensors section for switch details.

PROXIMITY SWITCHES

OPTION	TYPE	PART NO.	DESCRIPTION
-E	HALL	17503-2-06	Sink Type 10-30 VDC
		17504-2-06	Source Type 10-30 VDC
		17523-2	Sink Type 10-30 VDC, Quick Connect
		17524-2	Source Type 10-30 VDC, Quick Connect
-M	REED	17502-2-06	Sink or Source Type 10-30 VDC
		17509-3-06	AC Type 110-120 VAC with Current Limit
		17522-2	Sink or Source Type 10-30 VDC, Quick Connect
		17529-3	AC Type 110-120 VAC, Quick Connect with Current Limit

STRAIN RELIEF KITS

Compact switch bracket for sizes 22, 23, 24, and 25 have built in strain reliefs. Compact Switch Strain Relief Kit for size 26 is 18412. Consult PHD for availability of other PHD Switches and Brackets.

PROXIMITY SWITCH BRACKET & TARGET KITS (FOR USE WITH PROPER -Gxxx OPTION)

Each kit contains a bracket, target, and hardware for mounting one threaded proximity switch on an SD or SE Slide. Switches must be ordered separately. See Switches and Sensors section for detailed switch information. ***Slides must be ordered with provisions for proximity switches in order for these bracket and target kits to function. See individual proximity & switch ready options for switch dimensions.***

PROXIMITY SWITCH BRACKET AND TARGET KITS

SLIDE SIZE	SWITCH SIZE	
	8 mm	12 mm
22	53101-01-1	63998-01-1
23	53101-01-1	63998-01-1
24	53101-02-1	63998-02-1
25	53101-02-1	63998-02-1
26	53101-03-1	63998-03-1

Kit contains all components for standard non-Z1 unit for one direction only.

PROXIMITY SWITCHES

PART NO.	DESCRIPTION
51422-005-02	8 mm Inductive Proximity Switch NPN with 2 meter Cable
51422-006-02	8 mm Inductive Proximity Switch PNP with 2 meter Cable
15561-001	12 mm Inductive Proximity Switch NPN with 3 meter cable
15561-002	12 mm Inductive Proximity Switch PNP with 3 meter cable
15561-003	12 mm Inductive Proximity Switch AC 35-250 VAC with 3 meter cable

See Switches and Sensors section for switch details.

SHOCK ABSORBERS

See individual shock ready options for shock absorber dimensions.

SLIDE SIZE	PHD SHOCK ABSORBER NUMBER*
22	57057-02-x
23	57057-02-x
24	57057-03-x
25	57057-03-x
26	57057-03-x

* See PHD product sizing software or Sizing Catalog for proper shock selection.

SLIDE SIZE	PHD SHOCK MOUNTING KIT
22	54108-11
23	54108-11
24	54109-11
25	54109-11
26	54110-11

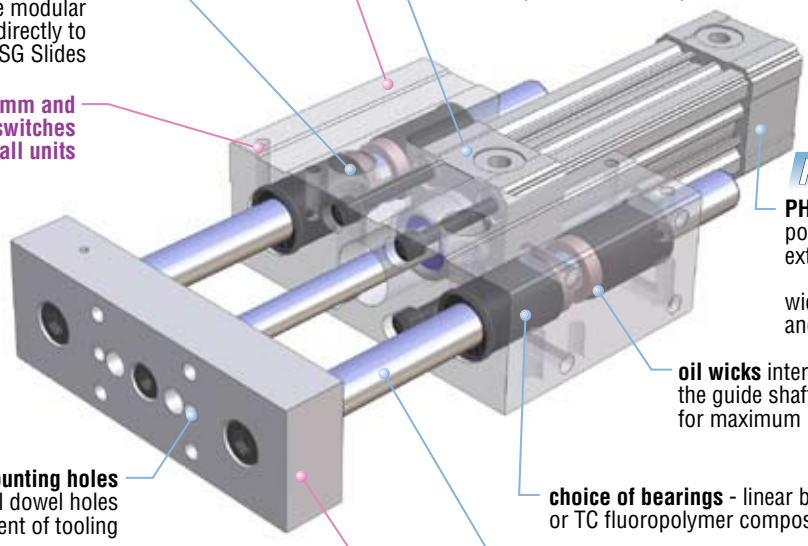
Kit contains components for standard non -Z1 units for one direction only.

SK, SL

VERSATILE METRIC SLIDE WITH OVER 30 STANDARD OPTIONS

The SK version is compact and ideal for short travel in horizontal or vertical application, where slide length and weight are critical.

The SL version has a greater distance between bushings for longer slide travels and greater shaft stability.



Major Benefits

- Offered in short or long body
- Can be ordered with standard or oversize shafts
- Standard dowel pin holes for ease of mounting
- Several switch options
- 5 bore sizes
- Versatile unit with over 30 standard options
- Now with improved seal and bearing support

Industry Uses

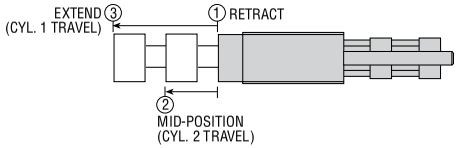
- Assembly machine builders
- Automotive
- Labeling equipment
- Packaging
- Optical
- Medical
- General purpose slide

ORDERING DATA: SERIES SK & SL SLIDES

With Cylinder Example: SKB83x100-M-AR-GM-BS
Without Cylinder Example: SKB83x100-H12-AR-GM-BS

TO ORDER SPECIFY:
Product, Series, Type, Three Position Unit, Slide Size, Slide Travel, Mid-Position Travel, Tool Plate Extension, and Options.

3 POSITION DETAIL



SLIDE TRAVEL [mm]

SIZE	SERIES SK	SERIES SL
1	25 to 300	25 to 300
2	25 to 300	25 to 300
3	25 to 300	25 to 450
4	50 to 450	50 to 600
5	50 to 450	50 to 600
6	50 to 550	50 to 700

Available in 5 mm increments. Minimum travel required for all SK or SL Slides for use with ISO cylinders is:
Size 1 25 mm Size 4 50 mm
Size 2 25 mm Size 5 50 mm
Size 3 25 mm Size 6 50 mm

WITH CYLINDER OPTIONS
DB - Cushion controls both directions (standard locations are 1 & 5) See note 5.
DE - Cushion control extend only (standard in location 1)
DR - Cushion control retract only (standard in location 5)
E - Series 1750 Solid State Magnetic Piston (for size 1 only)
H47 - Rodlok® cylinder with locking device adaptor (not available on size 1)
L9 - Imperial ports (metric ports standard) (see catalog for port sizes)
M - Magnetic Piston for Series 1750 Reed Switches on size 1 and Series 6250 Reed Switches on all other sizes (2 through 6)
PB - Port controls both directions (standard locations are 1 & 5) See note 5. (not available on size 1) (see catalog for port sizes)
PE - Port controls extend only (standard in location 1) (not available on size 1)
PR - Port control retract only (standard in location 5) (not available on size 1)
UBxx- Ports location (standard locations are 1 & 5) (not available on 3-pos. unit)

WITHOUT CYLINDER OPTION
This option is required for slide with user supplied ISO Cylinder.
H11- Slide for VDMA/ISO cylinders (sizes 4, 5, and 6 only)
H12- Slide for 6432 ISO cylinder (sizes 1, 2, and 3 only)

PRODUCT
S - Slide

THREE POSITION UNIT
(specify only if needed)

DESIGN NO.
8

S K B E 8 3 x 100 x 50 x 25 – DB – M – AR – GM – BS

SERIES
K - Short Body
L - Long Body

SLIDES WITH LINEAR BALL BUSHINGS

TYPE	SLIDE SIZE	BORE SIZE DIA. [mm]	SHAFT SIZE DIA. [mm]
B	1	19	8
B	2	20	10
B	3	25	12
B	4	32	16
B	5	40	20
B	6	50	25

SLIDES WITH TC COMPOSITE BUSHINGS

TYPE	SLIDE SIZE	BORE SIZE DIA. [mm]	SHAFT SIZE DIA. [mm]
C	1	19	8
D	1	19	10 (oversize)
C	2	20	10
D	2	20	12 (oversize)
C	3	25	12
D	3	25	16 (oversize)
C	4	32	16
D	4	32	20 (oversize)
C	5	40	20
D	5	40	25 (oversize)
C	6	50	25
D	6	50	30 (oversize)
E	6	50	35 (oversize)

MID-POSITION TRAVEL
Specify for 3 position units. Travel from retract position 1 to mid-position 2.

TOOL PLATE EXTENSION
Additional distance between tool plate and bearing body in 1 mm increments. Leave blank if additional extension is not required. Minimum tool plate extension for all SK slides only with ISO cylinders is 50 mm (if tool extension is required).

SLIDE OPTIONS
AE - Travel Adjustment and Shock Pads on extension*
AR - Travel Adjustment and Shock Pads on retraction*
BR - Shock Pads on retraction*
BS - Shock Pads on extension for use with option -GM or -GO only*
BT - Shock Pads on retraction for use with option -GN or -GO only*
GG - Travel Adjustment and Shock Pads on extension with provisions for Proximity Switch mounting in both directions*
GH - Travel Adjustment and Shock Pads on retraction with provisions for Proximity Switch mounting on retract only*
GI - Travel Adjustment and Shock Pads with provisions for Proximity Switch mounting in both directions*
GM - Provisions for Shock Absorber mounting on extension**
GN - Provisions for Shock Absorber mounting on retraction**
GO - Provisions for Shock Absorber mounting on extension and retraction**
J3 - Transitional fit dowel holes (in both tool plate and housing)
J8 - Precision fit dowel holes (in both tool plate and housing)
Q1 - Corrosion resistant guide shafts (ends unplated)

⚠ **Options may affect unit length. See unit dimension and options pages for adders.**

NOTES:
1) -BR and -GG options not available with tool plate extension.
2) * Shock pads come standard with the travel adjustment options and do not need to be specified separately when travel adjustment is ordered.
3) **Shock absorber ready options include shock absorber stop brackets mounted on the shaft and a stop collar on the opposite shaft.
4) Shock absorbers, proximity switches, and all mounting kits must be ordered separately.
5) Cushion and port controls are available on -DB and -PB options only (locations 1 & 5) on 3-position units.

ENGINEERING DATA: SERIES SK & SL SLIDES

SPECIFICATIONS	SERIES SK/SL
OPERATING PRESSURE	20 psi min to 150 psi max [1.4 bar min to 10 bar max] air
OPERATING TEMPERATURE	-20° to +180°F [-29° to +82°C]
TRAVEL TOLERANCE	Nominal travel +.098/.000 [+2.5/-0 mm]*
3 POSITION	Mid location ±.039 [±1 mm]*
REPEATABILITY	±0.001 [±.025 mm] of original position
VELOCITY	80 in/sec [2 m/sec] max., zero load at 87 psi [6 bar]
LUBRICATION	Factory lubricated for rated life
MAINTENANCE	Field repairable

SIZE	TYPE	SHAFT DIAMETER in	SHAFT DIAMETER mm	BORE DIAMETER in	BORE DIAMETER mm	EFFECTIVE AREA DIRECTION	EFFECTIVE AREA in²	EFFECTIVE AREA mm²	SERIES SK BASE WEIGHT lb	SERIES SK BASE WEIGHT kg	SERIES SL BASE WEIGHT lb	SERIES SL BASE WEIGHT kg	TRAVEL WEIGHT ADDER lb/in	TRAVEL WEIGHT ADDER kg/mm	TYPICAL DYNAMIC LOAD lb	TYPICAL DYNAMIC LOAD N
1	B	.315	8	.750	19.1	EXTEND	.44	285	1.76	.80	2.32	1.05	.10	.002	6.7	32
	C	.315	8			RETRACT	.37	236	1.76	.80	2.32	1.05	.10	.002		
	D	.394	10						1.90	.86	2.45	1.11	.12	.002		
2	B	.394	10	.787	20	EXTEND	.49	314	3.35	1.52	4.23	1.92	.17	.003	7.8	36
	C	.394	10			RETRACT	.41	264	3.35	1.52	4.23	1.92	.17	.003		
	D	.472	12						3.53	1.60	3.53	1.60	.20	.004		
3	B	.472	12	.984	25	EXTEND	.76	491	4.12	1.87	5.38	2.44	.20	.004	13.4	62
	C	.472	12			RETRACT	.64	412	4.12	1.87	5.38	2.44	.20	.004		
	D	.630	16						4.52	2.05	5.93	2.69	.28	.005		
4	B	.630	16	1.260	32	EXTEND	1.25	804	6.73	3.05	8.16	3.70	.39	.007	20.2	89
	C	.630	16			RETRACT	1.07	691	6.73	3.05	8.16	3.70	.39	.007		
	D	.787	20						7.39	3.35	9.02	4.09	.56	.010		
5	B	.787	20	1.575	40	EXTEND	1.95	1257	10.56	4.79	12.86	5.83	.56	.010	33.7	151
	C	.787	20			RETRACT	1.64	1056	10.56	4.79	12.86	5.83	.56	.010		
	D	.984	25						11.60	5.26	14.09	6.39	.73	.013		
6	B	.984	25	1.969	50	EXTEND	3.04	1963	19.01	8.62	23.84	10.81	.73	.013	56	250
	C	.984	25						19.01	8.62	23.84	10.81	.73	.013		
	D	1.181	30			RETRACT	2.56	1649	20.59	9.34	25.78	11.69	.90	.016		
	E	1.378	35						22.25	10.09	27.87	12.64	1.12	.020		

NOTE: Thrust capacity, allowable mass and dynamic moment capacity must be considered when selecting a slide. Refer to sizing software or the product technical manual for complete sizing and selection information.

SIZE	ISO CYLINDER SPECIFICATIONS (OPTION -H11 OR -H12)
1	Ø 16 mm per ISO/6432 Standard
2	Ø 20 mm per ISO/6432 Standard
3	Ø 25 mm per ISO/6432 Standard
4	Ø 32 mm per VDMA 24562/ISO 6431
5	Ø 40 mm per VDMA 24562/ISO 6431
6	Ø 50 mm per VDMA 24562/ISO 6431

ISO CYLINDER NOTES (-H11 or -H12 option):

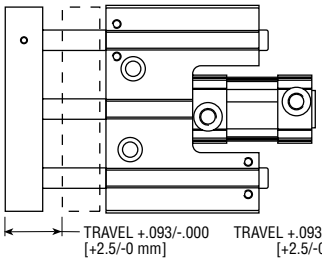
1) Cylinder supplied by user.
2) Cylinder rod extensions are not required. Slide units have a rod adaptor coupling standard for each specific unit at the correct length (-H11, -H12).
3) For repeatability, consult the cylinder manufacturer.
4) Minimum travel required for all Series SK or SL Slides with ISO cylinders is:

Size				
1	25 mm	4	50 mm	
2	25 mm	5	50 mm	
3	25 mm	6	50 mm	

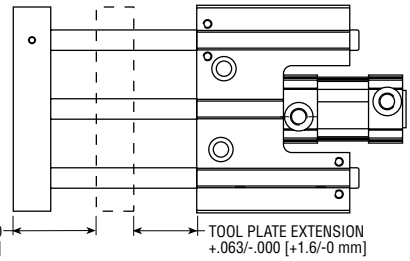
5) Slide travel will be .019 to .039 [.5 to 1 mm] less than the ISO cylinder stroke on -H11 or -H12 units when properly adjusted.

TOLERANCES*

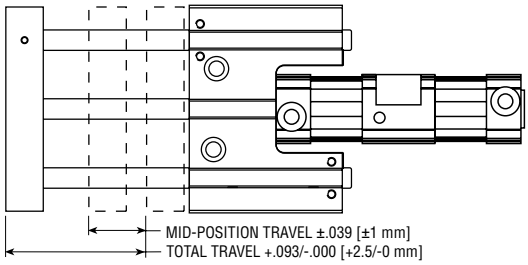
STANDARD UNIT



UNIT WITH TOOL PLATE EXTENSION



3 POSITION UNIT

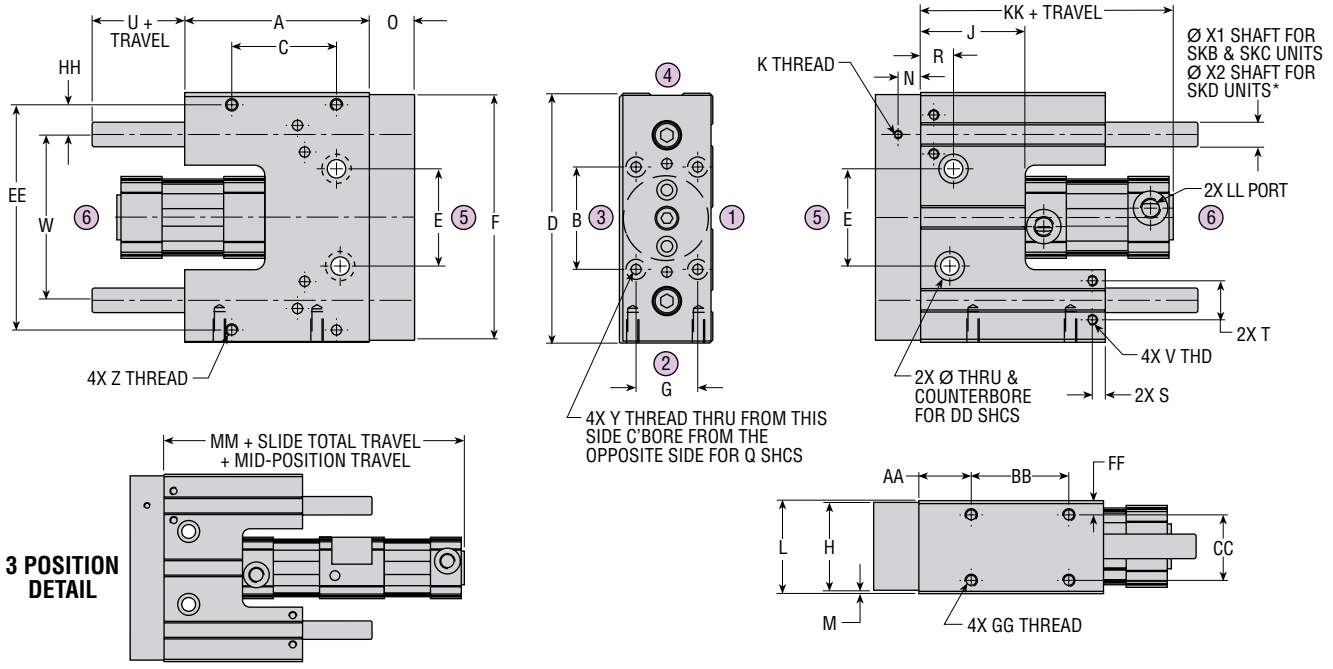


NOTE: *All travel tolerance values measured at 60 ± 4 psi [4 ± .27 bar] due to impact seal design in cylinder.

SIZING AND APPLICATION ASSISTANCE

See PHD Product Sizing Catalog for specific and complete sizing information.
Online sizing assistance is available at: ***www.phdinc.com/apps/sizing***

DIMENSIONS: SERIES SK SLIDES



LETTER DIM.	SIZE 1	2	3	4	5	6
BORE	19	20	25	32	40	50
A	65	82.5	90	100	115	150
B	39	38.5	50	47.5	58	65
C	39	51	51	70	63	100
D	90	107	122	143	173	215
E	38.5	50	47.5	58	65	80
F	88	105	120	141	171	213
G	16.5	23	30	32	36	45
H	29	38	43	48	60	70
J	40	45	51	48	55	66
K	M4 x 0.7 x 6.5 mm DP	M4 x 0.7 x 10 mm DP	M4 x 0.7 x 6.5 mm DP	M4 x 0.7 x 11 mm DP	M4 x 0.7 x 11 mm DP	M4 x 0.7 x 11 mm DP
L	31	40	45.5	50.5	62	73
M	1	1	1	1	1	1.5
N	5	5	11	5.8	5.8	5.8
O	23.5	24	22	25	30	35
Q	M3	M4	M5	M6	M8	M10
R	20	23	16	22	22.5	25.5
S	6.4	11	6.4	8.1	9.5	12.4
T	15.4	19.1	19.1	27.0	27.0	34.9
U	39	39	45	45	45	51
V	M4 x 0.7 x 8 mm DP	M5 x 0.8 x 9.5 mm DP	M5 x 0.8 x 9.5 mm DP	M6 x 1.0 x 15 mm DP	M6 x 1.0 x 15 mm DP	M8 x 1.25 x 16 mm DP
W	61.5	76	81	97	117	143
X1*	8	10	12	16	20	25
X2	10	12	16	20	25	30
Y	M4 x 0.7	M5 x 0.8	M6 x 1.0	M8 x 1.25	M10 x 1.5	M12 x 1.75
Z	M4 x 0.7 x 7 mm DP	M5 x 0.8 x 9 mm DP	M6 x 1.0 x 10 mm DP	M8 x 1.25 x 16 mm DP	M10 x 1.5 x 19 mm DP	M12 x 1.75 x 20 mm DP
AA	14	12	25.5	31.5	33	44.5
BB	38.5	50	47.5	58	65	65
CC	23	30	32	36	45	50
DD	M5	M6	M8	M10	M12	M12
EE	80	95	110	128	154	197
FF	4	5	6.5	7	8.5	11.5
GG	M4 x 0.7 x 8 mm DP	M5 x 0.8 x 12 mm DP	M6 x 1.0 x 15 mm DP	M8 x 1.25 x 16 mm DP	M10 x 1.5 x 20 mm DP	M12 x 1.75 x 20 mm DP
HH	9	9.5	14.5	15.5	18.5	27
KK	103	116	125	148	166	178
LL	1/8 BSPP	G 1/8 BSPP	G 1/8 BSPP	G 1/8 BSPP	G 1/4 BSPP	G 1/4 BSPP
MM	158	206	218	260.0	289	324

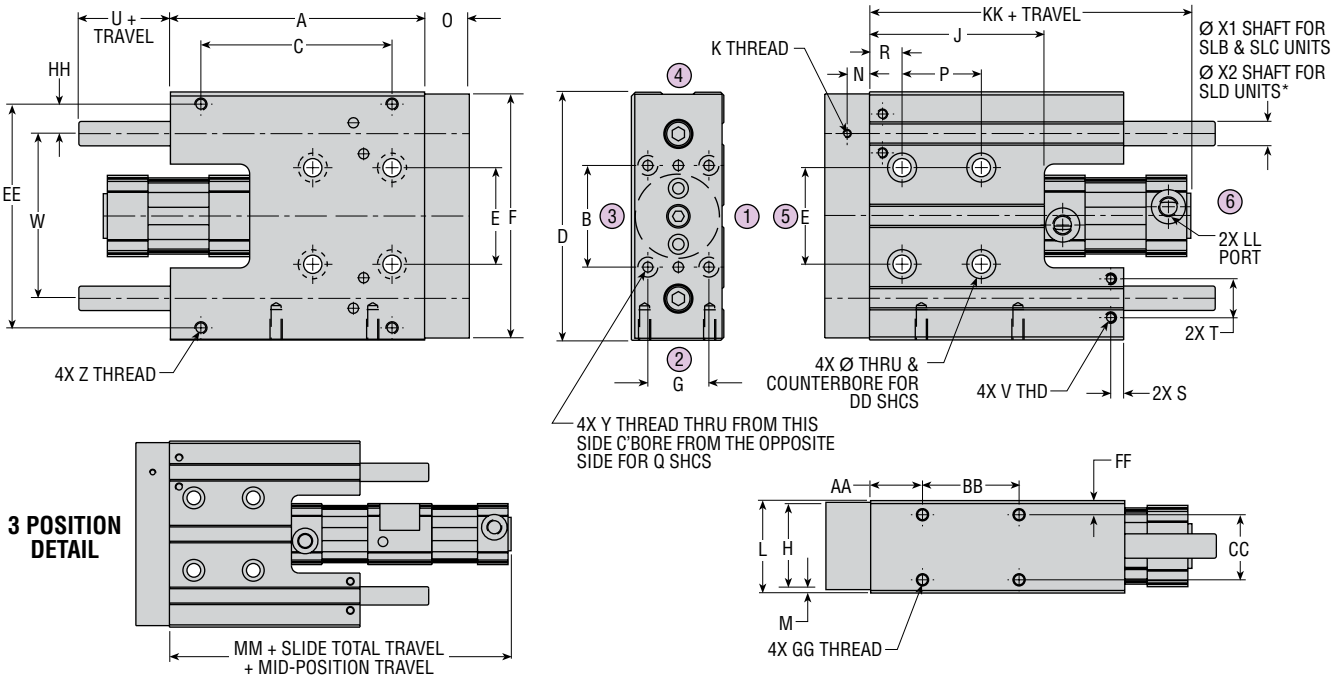
SIZE	OPTION ADDERS (See Notes 9 & 10) BR	AR, GH, GI, GN, GO	H47	DE, DR	DB
1	6	19	—	12.7	25.4
2	6	19	40	—	—
3	6	22	44	—	—
4	6	22	48	—	—
5	6	22	55	—	—
6	6	25	70	—	—

NOTES:

1) DIMENSIONS MAY BE AFFECTED BY OPTIONS. FOR OPTION DIMENSIONS SEE OPTION PAGES.
2) ALL DIMENSIONS ARE CENTERED ON THE CENTERLINE OF THE SLIDE UNLESS OTHERWISE SPECIFIED
3) * FOR SIZE 6 ONLY WITH SKE DOUBLE OVERSIZE SHAFT = 35 mm
4) FOR PORT AND NEEDLE LOCATIONS, SEE OPTION PAGES.
5) ALL UNITS, EXCEPT PORT WITH PORT CONTROL ON SAME SIDE, COMPLY WITH DIN 3852 PART 2 PORT SPECIFICATIONS FOR SHORT STUD AND LARGE SEALING SURFACE.
6) DIMENSIONS ARE IN mm
7) NUMBERS ENCLOSED BY A CIRCLE INDICATE POSITION
8) FOR DOWEL HOLE LOCATIONS, SEE PAGE 2-70.
9) FOR OPTIONS BR, AR, GH, GI, GN AND GO, ADD BETWEEN DIMENSIONS O AND A, O AND KK, AND O AND MM.
10) FOR OPTIONS H47, DE, DR AND DB, ADD TO KK AND MM DIMENSIONS.

All dimensions are reference only unless specifically toleranced.

DIMENSIONS: SERIES SL SLIDES



LETTER DIM.	SIZE 1	2	3	4	5	6
BORE	19	20	25	32	40	50
A	90	110	125	130	145	200
B	39	38.5	50	47.5	58	65
C	64	78.5	94	96	105	150
D	90	107	122	143	173	215
E	38.5	50	47.5	58	65	80
F	88	105	120	141	171	213
G	16.5	23	30	32	36	45
H	29	38	43	48	60	70
J	67	77	86	85	95	116
K	M4 x 0.7 x 6.5 mm DP	M4 x 0.7 x 10 mm DP	M4 x 0.7 x 6.5 mm DP	M4 x 0.7 x 11 mm DP	M4 x 0.7 x 11 mm DP	M4 x 0.7 x 11 mm DP
L	31	40	45.5	50.5	62	73
M	1	1	1	1	1	1.5
N	5	5	11	5.8	5.8	5.8
O	23.5	24	22	25	30	35
P	34.5	35	39	36	40.5	55
Q	M3	M4	M5	M6	M8	M10
R	20	23	16	22	22.5	25.5
S	6.4	11	6.4	8.1	9.5	12.4
T	15.4	19.1	19.1	27.0	27.0	34.9
U	39	39	45	45	45	51
V	M4 x 0.7 x 8 mm DP	M5 x 0.8 x 9.5 mm DP	M5 x 0.8 x 9.5 mm DP	M6 x 1.0 x 15 mm DP	M6 x 1.0 x 15 mm DP	M8 x 1.25 x 16 mm DP
W	61.5	76	81	97	117	143
X1*	8	10	12	16	20	25
X2	10	12	16	20	25	30
Y	M4 x 0.7	M5 x 0.8	M6 x 1.0	M8 x 1.25	M10 x 1.5	M12 x 1.75
Z	M4 x 0.7 x 7 mm DP	M5 x 0.8 x 9 mm DP	M6 x 1.0 x 10 mm DP	M8 x 1.25 x 16 mm DP	M10 x 1.5 x 19 mm DP	M12 x 1.75 x 20 mm DP
AA	14	12	25.5	31.5	33	44.5
BB	38.5	50	47.5	58	65	65
CC	23	30	32	36	45	50
DD	M5	M6	M8	M10	M12	M12
EE	80	95	110	128	154	197
FF	4	5	6.5	7	8.5	11.5
GG	M4 x 0.7 x 8 mm DP	M5 x 0.8 x 12 mm DP	M6 x 1.0 x 15 mm DP	M8 x 1.25 x 16 mm DP	M10 x 1.5 x 20 mm DP	M12 x 1.75 x 20 mm DP
HH	9	9.5	14.5	15.5	18.5	27
KK	130	148	160	185	206	228
LL	1/8 BSPP	G 1/8 BSPP	G 1/8 BSPP	G 1/8 BSPP	G 1/4 BSPP	G 1/4 BSPP
MM	185	238	253	297	329	374

SIZE	OPTION ADDERS (See Notes 9 & 10) BR	AR, GH, GI, GN, GO	H47	DE, DR	DB
1	6	19	—	12.7	25.4
2	6	19	40	—	—
3	6	22	44	—	—
4	6	22	48	—	—
5	6	22	55	—	—
6	6	25	70	—	—

NOTES:

1) DIMENSIONS MAY BE AFFECTED BY OPTIONS. FOR OPTION DIMENSIONS SEE OPTION PAGES.
2) ALL DIMENSIONS ARE CENTERED ON THE CENTERLINE OF THE SLIDE UNLESS OTHERWISE SPECIFIED
3) * FOR SIZE 6 ONLY WITH SLE DOUBLE OVERSIZE SHAFT = 35 mm
4) FOR PORT AND NEEDLE LOCATIONS, SEE OPTION PAGES.
5) ALL UNITS, EXCEPT PORT WITH PORT CONTROL ON SAME SIDE, COMPLY WITH DIN 3852 PART 2 PORT SPECIFICATIONS FOR SHORT STUD AND LARGE SEALING SURFACE.
6) DIMENSIONS ARE IN mm
7) NUMBERS ENCLOSED BY A CIRCLE INDICATE POSITION
8) FOR DOWEL HOLE LOCATIONS, SEE PAGE 2-70.
9) FOR OPTIONS BR, AR, GH, GI, GN AND GO, ADD BETWEEN DIMENSIONS O AND A, O AND KK, AND O AND MM.
10) FOR OPTIONS H47, DE, DR AND DB, ADD TO KK AND MM DIMENSIONS.

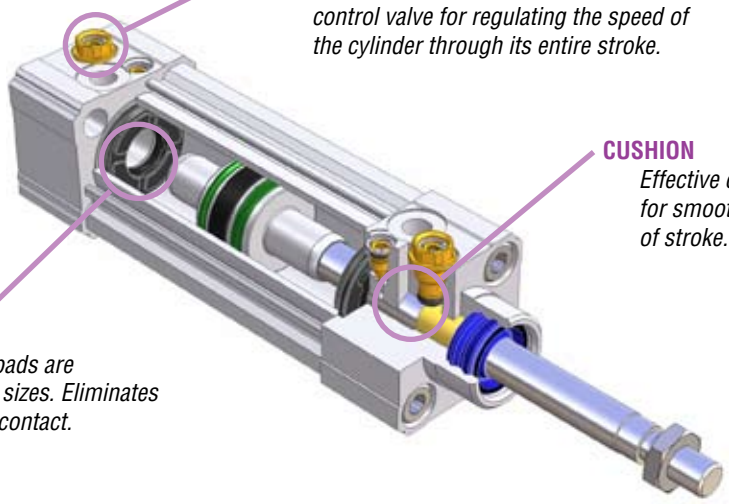
The cylinder features...

The HUSHCONTROL® Advantage

Only PHD Series CV Cylinders are offered with the Hushcontrol® Advantage. Hushcontrol® is achieved when optional cushions and Port Controls® are ordered with the standard shock pads. This combination provides:

- Superior speed and deceleration control of piston rod and attached loads.
- Significantly lowers noise levels even at high cycle speeds.

PORT CONTROL®
PHD's Port Control is a built-in flow control valve for regulating the speed of the cylinder through its entire stroke.



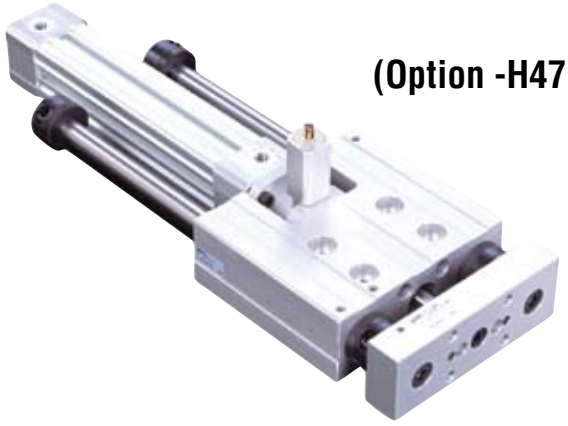
CUSHION
Effective cushion up to 30.2 mm for smooth deceleration at end of stroke.

SHOCK PAD
Built-in shock pads are standard on all sizes. Eliminates metal to metal contact.

(Option -PB,-DB)

Rodlok®

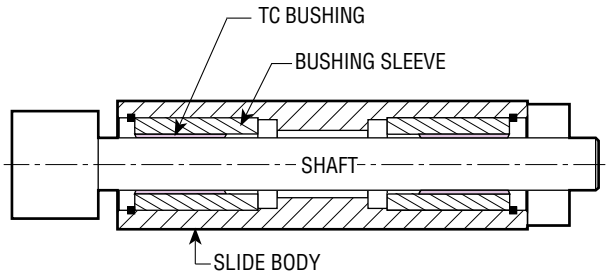
Optional Rodlok® securely holds a static piston rod in place at any point of stroke desired. Ideal for applications where rod drift is unacceptable due to system leakage, line rupture, or power loss.



(Option -H47)

THE TC BUSHING ADVANTAGE

- PHD's ***TC*** fluoropolymer composite bushings are available for standard diameter guide shafts or the optional oversize shafts.
- ***TC*** bushings have internal lubrication and are virtually impervious to contamination.
- Field applications and testing have proven slide life to be comparable with that of units with traditional ball bushings.
- Together with cost benefits, slide performance with ***TC*** bushings is enhanced by reduced deflection of the large diameter shafts.



DB CUSHION CONTROL IN BOTH DIRECTIONS

(standard location 1 & 5)

DE CUSHION CONTROL ON EXTEND ONLY

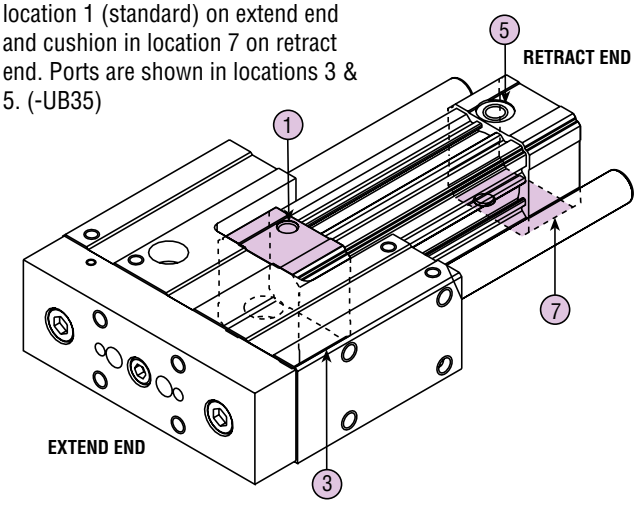
(standard location 1) (N/A on 3-position units)

DR CUSHION CONTROL ON RETRACT ONLY

(standard location 5) (N/A on 3-position units)

PHD cushions are designed for smooth deceleration at the ends of cylinder stroke. When the cushion is activated, the remaining volume in the cylinder must exhaust past an adjustable needle valve which controls the amount of deceleration. The effective cushion length for each bore size is shown in the table below. To specify alternative cushion control locations on the head or cap, see the option code below right.

Unit shown is -DB17, cushion in location 1 (standard) on extend end and cushion in location 7 on retract end. Ports are shown in locations 3 & 5. (-UB35)

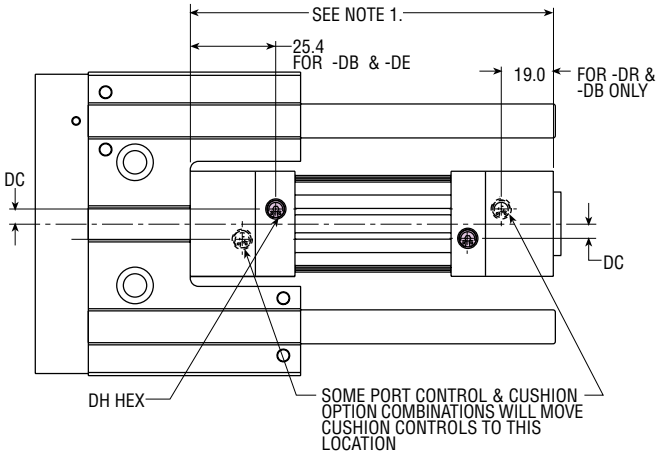


CUSHION CONTROL OPTIONS

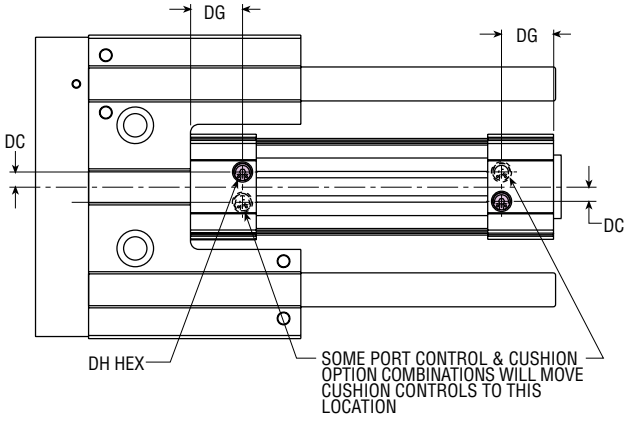
-D x x x

- Cushion Control Locations: B - Both ends; E - Extend end only; R - Retract end only
- Retract Location (5, 7) **Omit if -DEx**
- Extend Location (1, 3) **Omit if -DRx**

SIZE 1



SIZES 2-6



LETTER DIMENSION	SIZE 1 mm	2 mm	3 mm	4 mm	5 mm	6 mm
DC	4	4.8	5.7	7.0	10.0	9.0
DG	—	14.8	14.2	24.5	27.5	26.5
DH	—	2.5	2.5	2.5	2.5	2.5
EFFECTIVE CUSHION LENGTH*	20	11.2	11.9	15.2	20.5	22.1

NOTES:

1) For -DE & -DR, add 12.7 mm to standard length and for -DB, add 25.4 to standard length on size 81 only.
2) *-AE and -AR options may decrease effective cushion length depending on position of stop collars.

FOR SIZES 2 - 6 (not available on size 1)

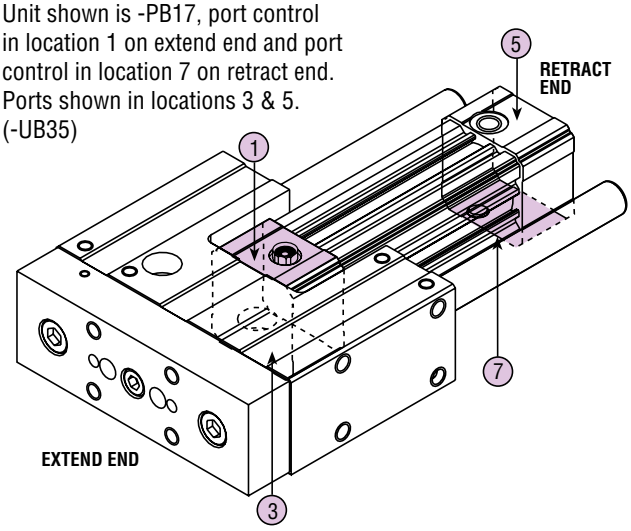
PB **PORT CONTROLS® ON BOTH ENDS**
(standard location 1 & 5)

PE **PORT CONTROLS® ON EXTEND ONLY** (standard location 1) (N/A on 3-position units)

PR **PORT CONTROLS® ON RETRACT ONLY**
(standard location 5) (N/A on 3-position units)

PHD's Port Control® is a built-in flow control for regulating the speed of the slide through its entire stroke. The Port Control operates on the "meter-out" principle and features an adjustable needle in a cartridge with a check seal. The self-locking needle has micrometer threads and is adjustable under pressure. The needle determines the orifice size which controls the exhaust flow rate of the actuator. The check seal expands while air is exhausting from the actuator, forcing the air to exhaust past the adjustable needle. The check seal collapses to allow a free flow of incoming air. The PHD Port Control saves space and eliminates the cost of fittings and installation for external flow control valves. Refer to the option code to specify port control locations.

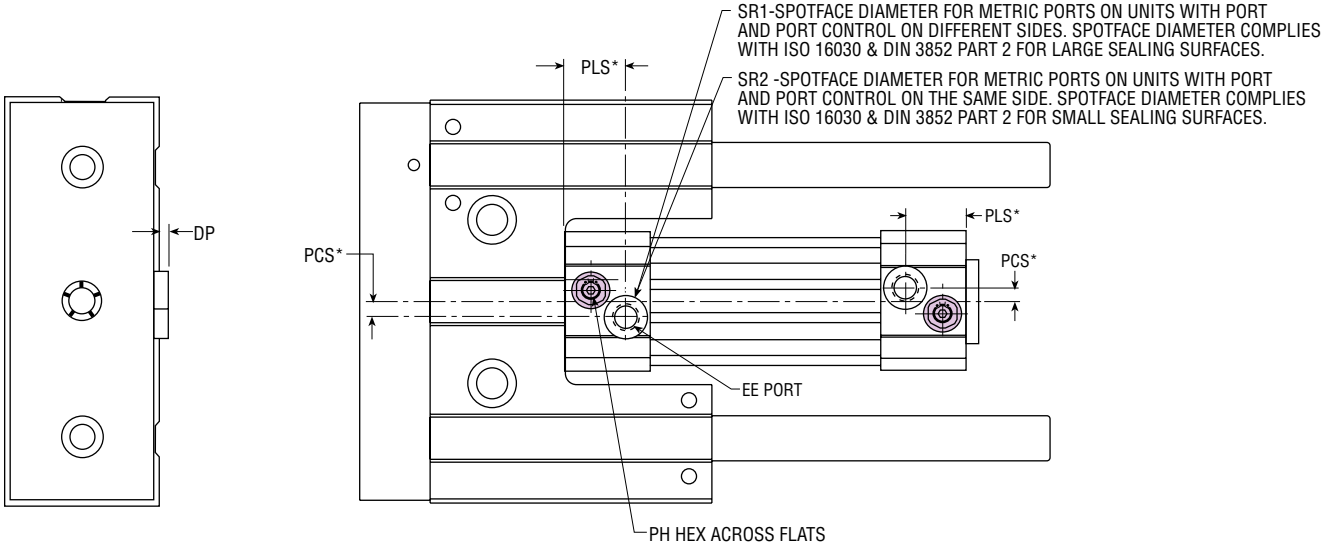
Unit shown is -PB17, port control in location 1 on extend end and port control in location 7 on retract end. Ports shown in locations 3 & 5. (-UB35)



PORT CONTROL OPTIONS

-P X X X

- Port Control Locations: B - Both ends; E - Extend end only; R - Retract end only
- Retract Location (5, 7) **Omit if -PEx**
- Extend Location (1, 3) **Omit if -PRx**



LETTER DIM.	SIZE 2 mm	3 mm	4 mm	5 mm	6 mm
EE*	M5	M5	G 1/8	G 1/4	G 1/4
PCS*	7.0	7.0	5.0	6.0	6.0
PH	2.5	2.5	2.5	2.5	2.5
PLS*	14.5	14.5	22.0	23.5	23.0
SR1	16.5	16.5	19.0	25.0	25.0
SR2	9.0	9.0	16.5	19.0	19.0
DP	1.7	0.7	3.8	3.1	0.6

*Dimensions shown are for units with port and port control in the same location. For units with other port and port control combinations, standard port location dimensions apply. Ports may be located on either side of the slide centerline depending on port control and cushion option combinations.

All dimensions are reference only unless specifically toleranced.

FOR SIZE 1 ONLY

E MAGNET FOR PHD SERIES 1750 SOLID STATE SWITCHES

This option equips the cylinder with a magnetic band on the piston for use with PHD 1750 Hall Effect Switches.

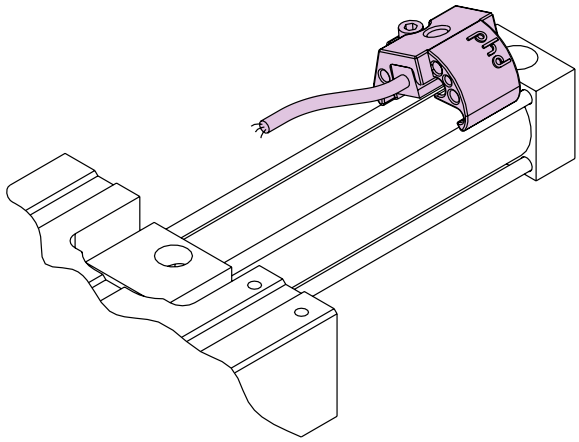
M MAGNET FOR PHD SERIES 1750 REED SWITCHES

This option equips the cylinder with a magnetic band on the piston for use with PHD Series 1750 Reed Switches.

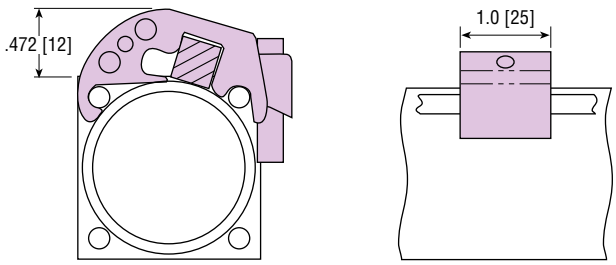
Cylinder-mounted switches are an easy and convenient way of interfacing the slide to various programmable controllers or logic systems. See the Switch section for specific Solid State and Reed Switch information.

OPTION	PART NO.	DESCRIPTION
-E HALL	17503-2-06	Sink Type 10-30 VDC
	17504-2-06	Source Type 10-30 VDC
	17523-2	Sink Type 10-30 VDC, Quick Connect
	17524-2	Source Type 10-30 VDC, Quick Connect
-M REED	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

Kit contains all components for standard non-Z1 units for one direction only.



SERIES 1750 COMPACT PROXIMITY SWITCH BRACKET



Unit size 81 uses switch bracket part no. 17000-31-5.

FOR SIZES 2 - 6

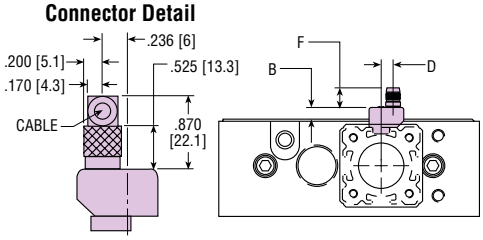
M MAGNET FOR PHD SERIES 6250 REED AND SOLID STATE SWITCHES

This option equips the cylinder with a magnetic band on the piston for use with PHD Reed and Solid State Switches listed below. These switches mount easily to the cylinder using "T" slots in the body. See the Switch section for complete switch information.

PART NO.	DESCRIPTION	COLOR
62505-1-02	NPN (Sink) DC Solid State, 2 m cable	Brown
62506-1-02	PNP (Source) DC Solid State, 2 m cable	Tan
62515-1	NPN (Sink) DC Solid State, Quick Connect	Brown
62516-1	PNP (Source) DC Solid State, Quick Connect	Tan

PART NO.	DESCRIPTION	COLOR
62507-1-02	AC/DC Reed, 2 m cable	Silver
62517-1	AC/DC Reed, Quick Connect	Silver

Connector Detail



LETTER DIM.	SIZE 2	3	4	5	6
B	.236 [6.0]	.236 [6.0]	.236 [6.0]	.276 [7.0]	.197 [5.0]
D	.228 [5.8]	.228 [5.8]	.228 [5.8]	.228 [5.8]	.228 [5.8]
F	.374 [9.5]	.374 [9.5]	.374 [9.5]	.374 [9.5]	.374 [9.5]

Numbers in [ ] are for metric units and are in mm.

FOR SIZES 2 - 6 (not available on size 1)

H47 RODLOK® SLIDE & RODLOK®

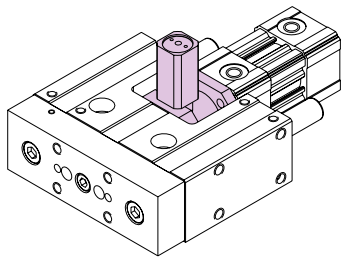
PHD's Rodlok® is ideal for locking the tool plate while in a static/stationary position. When the pressure is removed from the port of the Rodlok®, the mechanism will grip the piston rod of the cylinder and prevent it from moving. The loads are held indefinitely without power. Rodlok® performance is application and environment sensitive (Cleanliness of rod or Rodlok® will also affect performance). THE RODLOK® IS NOT DESIGNED TO BE USED AS A PERSONNEL SAFETY DEVICE.

SIZE	STATIC LOCKING FORCE* (N)
2	350
3	400
4	600
5	1000
6	1500

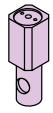
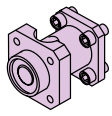
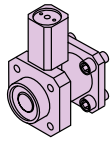
NOTE: *Locking force indicated above is the actual locking force with a dry clean rod and does not include any safety factor.

OPERATING PRESSURE

The operating pressure for the locking device is different than the operating pressure for the slide to which it is attached. The locking device of the Rodlok is designed with an operating pressure range of 4 bar minimum to 10 bar maximum. The Series SK/SL Slide with a Rodlok attached has an operating pressure range of 3 bar minimum to 10 bar maximum.



RODLOK® KITS

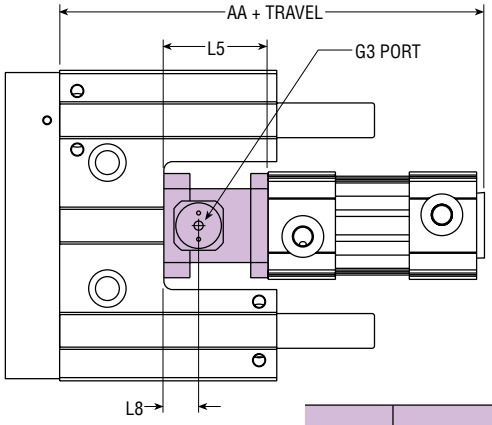




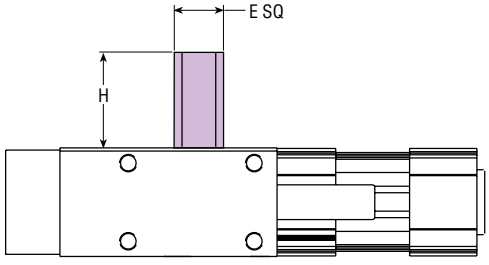
SIZE	LOCKING DEVICE KIT	ADAPTOR KIT*	COMPLETE RODLOK®*
2	63459-07-1	63460-07-1	63461-07-1
3	63459-08-1	63460-08-1	63461-08-1
4	63459-01-1	63460-01-1	63461-01-1
5	63459-02-1	63460-02-1	63461-02-1
6	63459-03-1	63460-03-1	63461-03-1

NOTES:
1) *Kits ship with cylinder mounting hardware.
2) Part numbers listed above are intended for replacement purposes only and are to be used specifically on slides with the -H47 option.

SIZE	DEVICE WEIGHT lb	DEVICE WEIGHT kg	ADAPTOR WEIGHT lb	ADAPTOR WEIGHT kg	TOTAL WEIGHT lb	TOTAL WEIGHT kg
2	0.14	0.06	0.14	0.06	0.31	0.14
3	0.14	0.06	0.16	0.07	0.36	0.16
4	0.20	0.09	0.28	0.13	0.57	0.26
5	0.30	0.14	0.44	0.20	0.93	0.42
6	0.54	0.24	0.84	0.38	1.76	0.80

NOTE: Total weight includes rod adder for -H46/-H47 cylinder.





The Rodlok locking device and adaptor can be purchased separately as kits. See chart above. The locking device and adaptor are not available with a corrosion resistant (-Z1 option) finish.

LETTER DIM.	SIZE 2 mm	3 mm	4 mm	5 mm	6 mm
H	40.2	37.2	45.5	44.0	56.0
E	20.5	20.5	25.0	27.5	32.5
G3	M5	M5	G 1/8	G 1/8	G 1/8
L5	40	44	48	55	70
L8	13	13	16	19.5	21
AA	156	169	196	221	248

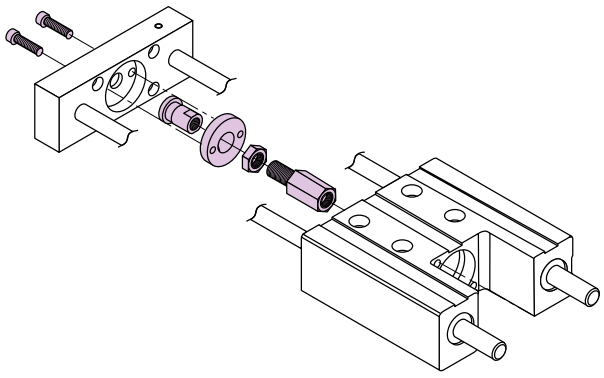
All dimensions are reference only unless specifically toleranced.

H11 SLIDE ONLY (WITHOUT CYLINDER) SIZES 84, 85, & 86

for VDMA/ISO Cylinders 32, 40, & 50 mm Bores

H12 SLIDE ONLY (WITHOUT CYLINDER) SIZES 81, 82, & 83

for ISO 6432 Cylinders 16, 20, & 25 mm Bores



These options provide the slide mechanism only without a cylinder. Included with options -H11 and -H12 is all the hardware required for mounting standard ISO cylinders to the slide. A self-aligning rod coupling and rod length adapter are also provided, making it easy to attach the appropriate ISO cylinder. (No extra rod extension required.)

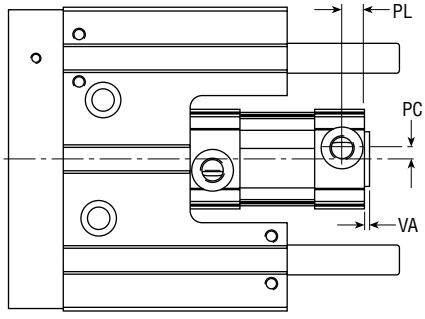
L9 NPT PORTS

This option provides NPT ports on metric units instead of the standard BSPP ports. The NPT ports are located in the same location as the BSPP ports.

SIZE	OPTIONAL NPT PORT	STANDARD BSPP PORT
1	1/8	G 1/8
2	1/8*	G 1/8*
3	1/8*	G 1/8*
4	1/8	G 1/8
5	1/4	G 1/4
6	1/4	G 1/4

*When port controls are specified on the same face as ports, the standard metric port is M5 and the -L9 option provides a 10-32 port.

STANDARD PORT LOCATIONS



SIZE	PC	PL	VA
2	4.2	9.0	2
3	4.5	9.0	2
4	5.0	16.0	4
5	6.0	18.5	4
6	6.0	18.5	4

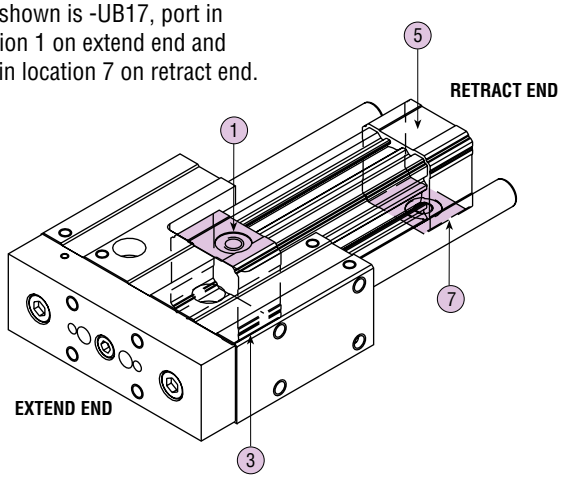
For size 1, ports are on centerline of cylinder.

UB ALTERNATE PORT LOCATION

(N/A on 3-position units)

With this option, alternate port locations can be specified, providing increased flexibility and user convenience. See option code below to specify port locations.

Unit shown is -UB17, port in location 1 on extend end and port in location 7 on retract end.



PORT LOCATION OPTIONS

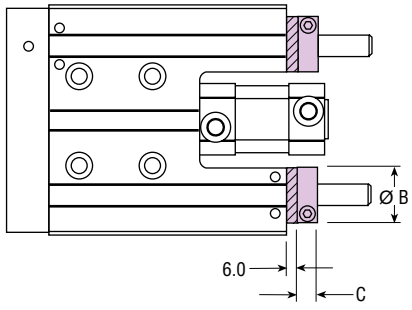
-UB x x

Extend Location (Head) (1,3)	Retract Location (Cap) (5,7)

AE TRAVEL ADJUSTMENT AND SHOCK PADS ON EXTENSION

Two travel adjustment stop collars with polyurethane shock pads are used for adjustment of slide extension. The travel adjustment stop collars allow precise adjustment while the shock pads eliminate metal-to-metal contact, thereby reducing noise.

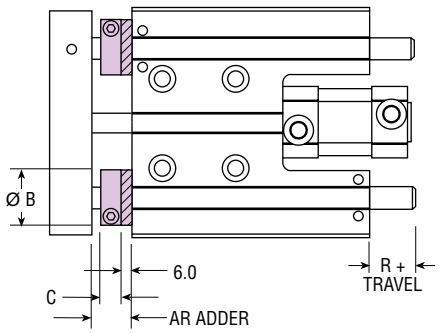
	LETTER DIMENSION					
	Ø B			C		
SIZE	SxB, SxC	SxD	SxE	SxB, SxC	SxD	SxE
1	22.0	25.0	—	9.0	10.0	—
2	25.0	28.0	—	10.0	11.0	—
3	28.0	35.0	—	11.0	13.0	—
4	35.0	42.0	—	13.0	15.0	—
5	42.0	48.0	—	15.0	15.0	—
6	48.0	54.0	63.0	15.0	15.0	19.0



AR TRAVEL ADJUSTMENT AND SHOCK PADS ON RETRACTION

This option provides two travel adjustment collars with polyurethane shock pads for retraction only. The travel adjustment stop collars allow precise adjustment while the shock pads eliminate metal-to-metal contact.

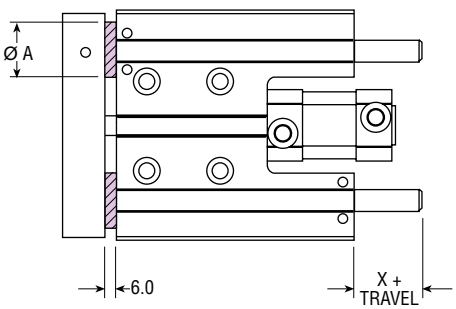
	LETTER DIMENSION											
	Ø B			C			AR ADDER			R		
SIZE	SxB, SxC	SxD	SxE	SxB, SxC	SxD	SxE	SxB, SxC	SxD	SxE	SxB, SxC	SxD	SxE
1	22.0	25.0	—	9.0	10.0	—	19.0	19.0	—	20.0	20.0	—
2	25.0	28.0	—	10.0	11.0	—	19.0	19.0	—	20.0	20.0	—
3	28.0	35.0	—	11.0	13.0	—	22.0	22.0	—	23.0	23.0	—
4	35.0	42.0	—	13.0	15.0	—	22.0	22.0	—	23.0	23.0	—
5	42.0	48.0	—	15.0	15.0	—	22.0	22.0	—	23.0	23.0	—
6	48.0	54.0	63.0	15.0	15.0	19.0	25.0	25.0	25.0	26.0	26.0	26.0



BR SHOCK PADS ON RETRACTION

This option provides polyurethane shock pads on retraction only, eliminating metal-to-metal contact as the tool plate reaches the slide body. This option greatly reduces noise and shock upon slide retraction. Not available with tool plate extension.

	LETTER DIMENSION			
	Ø A			X
SIZE	SxB, SxC	SxD	SxE	
1	22.0	22.0	—	33.0
2	22.0	28.5	—	33.0
3	28.5	35.0	—	39.0
4	35.0	41.0	—	39.0
5	41.0	47.5	—	39.0
6	47.5	51.0	51.0	45.0



BS SHOCK PADS ON EXTENSION

The -BS option adds shock pads on extension to either the -GM or -GO shock absorber option. The shock pads are assembled between the shock stop (and stop collar) and the slide body. The purpose of this option is to complement the shock absorber by eliminating metal-to-metal contact at the end of slide extension. Shock pads do not affect length adders for shock absorber options.

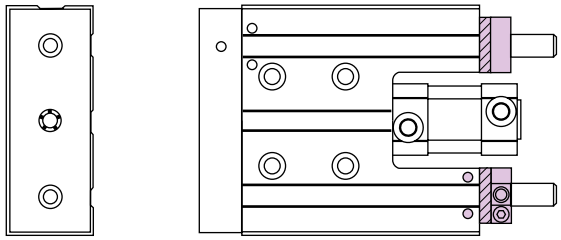
BT SHOCK PADS ON RETRACTION

The -BT option adds shock pads on retraction to either the -GN or -GO shock absorber option. The shock pads are assembled between the shock stop (and stop collar) and the slide body. The purpose of this option is to complement the shock absorber by eliminating metal-to-metal contact at the end of slide retraction. Shock pads do not affect length adders for shock absorber options.

GG TRAVEL ADJUSTMENT AND SHOCK PADS ON EXTENSION

This is the same as option -AE, but also includes provision for 8 mm proximity switch targets and brackets on both ends. Switches and bracket kits must be ordered separately. See page 2-71 for bracket/target kits and for 8 or 12 mm switch ordering information.

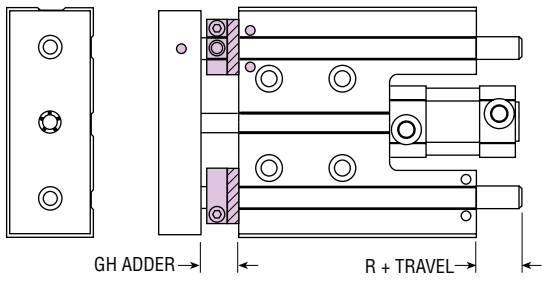
Not available with tool plate extension. With tool plate extension use -GH option.



GH TRAVEL ADJUSTMENT AND SHOCK PADS ON RETRACTION

This option provides both travel adjustment and provision for an 8 mm proximity switch in the retract direction only. Switches and bracket kits must be ordered separately. See page 2-71 for bracket/target kits and for 8 or 12 mm switch ordering information. Same as -AR option with switch brackets and target.

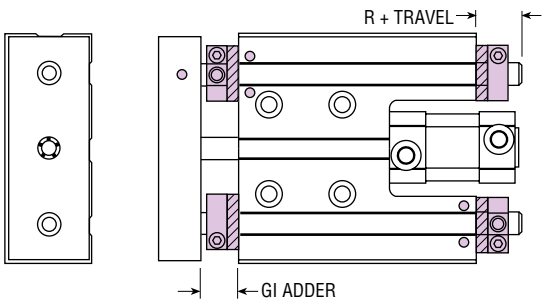
SIZE	GH	R
1	19.0	20.0
2	19.0	20.0
3	22.0	23.0
4	22.0	23.0
5	22.0	23.0
6	25.0	26.0



GI TRAVEL ADJUSTMENTS, SHOCK PADS ON BOTH ENDS

This option provides the ultimate in adjustability, noise absorption, and proximity switch capability in both extension and retraction. Switches and bracket kits must be ordered separately. See page 2-71 for bracket/target kits and for 8 or 12 mm switch ordering information.

SIZE	GI	R
1	19.0	20.0
2	19.0	20.0
3	22.0	23.0
4	22.0	23.0
5	22.0	23.0
6	25.0	26.0

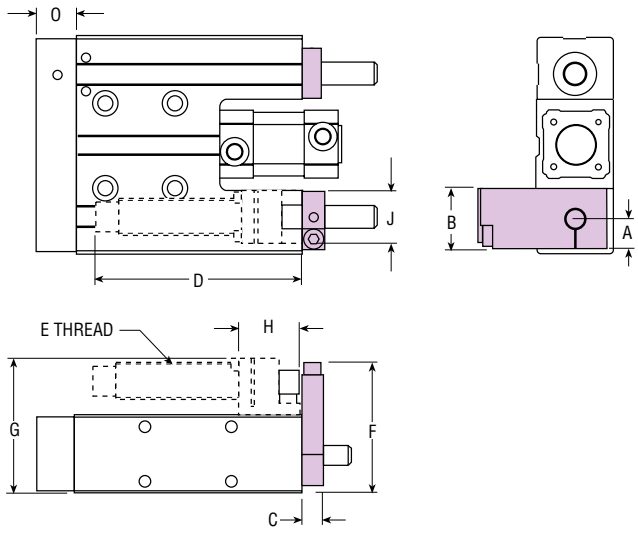


All dimensions are reference only unless specifically toleranced.

GM SHOCK ABSORBER READY ON EXTENSION

This option provides for mounting a bracket for a shock absorber in the extension direction. This includes mounting holes in the slide body, a shock absorber stop on one shaft, and a stop collar on the other shaft. The shock absorber and shock mounting kit must be ordered separately. This arrangement allows the shock absorber to double as a travel adjustment in the extension direction.

See page 2-72 for shock kit and shock absorber ordering information.

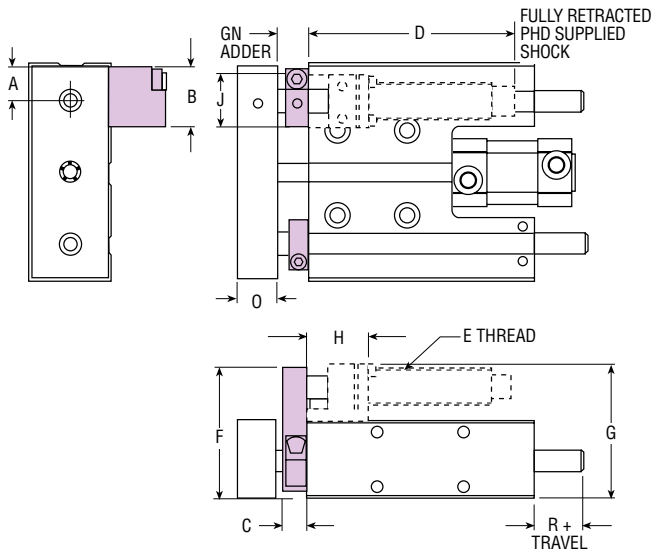


SIZE	A	B	C	D	E THREAD	F	G	H	J	O
1	13	22	12	95	M14 x 1.5	55	56.5	25.5	23.5	23.5
2	14.5	28.5	12	115	M20 x 1.5	71	71.5	31.5	30	24
3	18	32	12	115	M20 x 1.5	76	77	32	30	22
4	22	39	12	148	M25 x 1.5	92.5	93.5	44.5	43	25
5	27	51	16	148	M25 x 1.5	104.5	105.5	44.5	43	30
6	34	63.5	19	164.5	M25 x 1.5	121.5	123.5	76.5	51	35

GN SHOCK ABSORBER READY ON RETRACTION

This option provides for mounting a bracket for a shock absorber in the retraction direction. This includes mounting holes in the slide body, a shock absorber stop on one shaft, and a stop collar on the other shaft. The shock absorber and shock mounting kit must be ordered separately. This arrangement allows the shock absorber to double as a travel adjustment in the retraction direction.

See page 2-72 for shock kit and shock absorber ordering information.

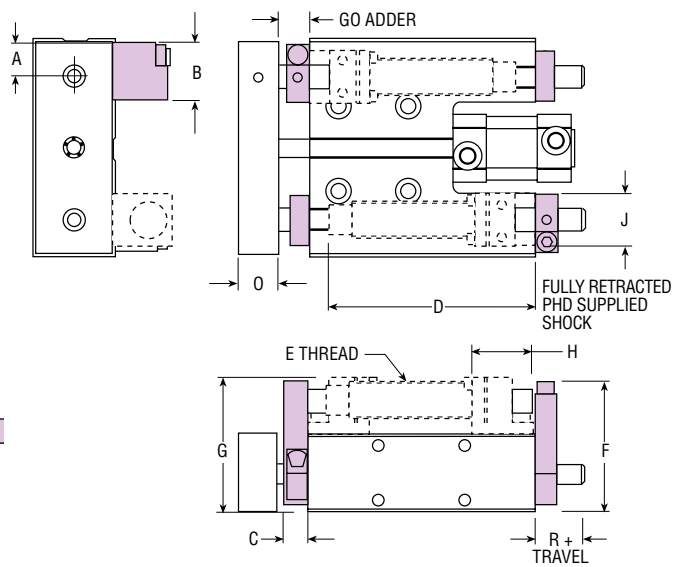


SIZE	A	B	C	D	E THREAD	F	G	GN	H	J	O	R
1	13	22	12	95	M14 x 1.5	55	56.5	19	25.5	23.5	23.5	20
2	14.5	28.5	12	115	M20 x 1.5	71	71.5	19	31.5	30	24	20
3	18	32	12	115	M20 x 1.5	76	77	22	32	30	22	23
4	22	39	12	148	M25 x 1.5	92.5	93.5	22	44.5	43	25	23
5	27	51	16	148	M25 x 1.5	104.5	105.5	22	44.5	43	30	23
6	34	63.5	19	164.5	M25 x 1.5	121.5	123.5	25	76.5	51	35	26

GO SHOCK ABSORBER READY ON EXTENSION AND RETRACTION

This option provides for mounting brackets for shock absorbers in both the extension and retraction directions. This includes two sets of mounting holes in the slide body, shock absorber stops mounted on the shafts in each direction, and stop collars mounted on the opposite shafts. The shock absorbers and shock mounting kits must be ordered separately. This arrangement allows the shock absorbers to double as travel adjustments in both directions.

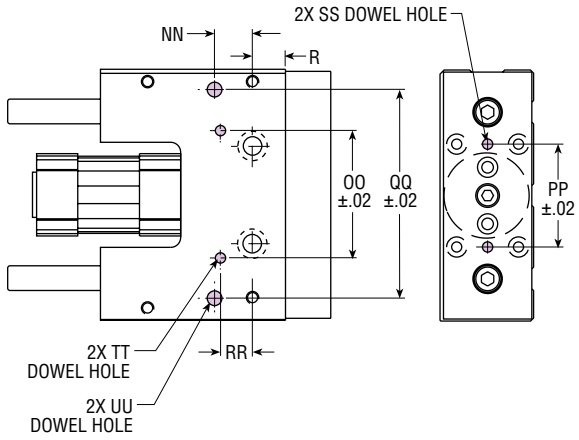
See page 2-72 for shock kit and shock absorber ordering information.



SIZE	A	B	C	D	E THREAD	F	G	GO	H	J	O	R
1	13	22	12	95	M14 x 1.5	55	56.5	19	25.5	23.5	23.5	20
2	14.5	28.5	12	115	M20 x 1.5	71	71.5	19	31.5	30	24	20
3	18	32	12	115	M20 x 1.5	76	77	22	32	30	22	23
4	22	39	12	148	M25 x 1.5	92.5	93.5	22	44.5	43	25	23
5	27	51	16	148	M25 x 1.5	104.5	105.5	22	44.5	43	30	23
6	34	63.5	19	164.5	M25 x 1.5	121.5	123.5	25	76.5	51	35	26

J3 TRANSITIONAL FIT DOWEL PIN HOLES

This option provides a compromise fit between clearance and interference. Transitional fits are used where accuracy of location is important, but a small amount of clearance or interference is permissible.



J8 PRECISION FIT DOWEL HOLES

This option provides an H7 tolerance precision fit with dowel pins. Precision fits are used where accuracy of location is of prime importance, and for parts requiring rigidity and alignment.

SIZE	R	NN	OO	PP	QQ	RR	SS	TT	UU
1	20	17.25	49	39	66	11.5	Ø 5 x 6 mm DP	Ø 5 x 4 mm DP	Ø 5 x 4 mm DP
2	23	17.5	50	49	76.5	15	Ø 5 x 8 mm DP	Ø 5 x 6 mm DP	Ø 8 x 5 mm DP
3	16	19.5	64	50	100.5	16	Ø 5 x 12 mm DP	Ø 6 x 8 mm DP	Ø 8 x 8 mm DP
4	22	18	75	64	114	18	Ø 6 x 10 mm DP	Ø 8 x 8 mm DP	Ø 8 x 8 mm DP
5	22.5	20.25	90	75	139.5	22.5	Ø 8 x 10 mm DP	Ø 10 x 10 mm DP	Ø 8 x 8 mm DP
6	25.5	38	—	90	197	—	Ø 10 x 12 mm DP	—	Ø 10 x 12 mm DP

NOTE: Dowel holes are centered on centerline of slide and located to the nominal values shown ± .35 unless otherwise specified.

Ø HOLE	STANDARD TOLERANCE	J3 OPTION TOLERANCE	J8 OPTION TOLERANCE
5 mm	+.010/-.024	+.037/-.011	+.012/-.000
6 mm	+.010/-.024	+.038/-.013	+.012/-.000
8 mm	+.013/-.020	+.041/-.016	+.015/-.000
10 mm	+.013/-.020	+.041/-.016	+.015/-.000

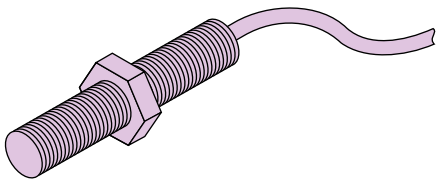
Q1 CORROSION RESISTANT GUIDE SHAFTS

Extremely hard corrosion-resistant coating on the guide shafts for use in applications where moisture may corrode untreated hardened and ground shafts. End faces of the shafts remain uncoated. Consult PHD for totally coated shafts.

All dimensions are reference only unless specifically toleranced.

INDUCTIVE PROXIMITY SWITCHES

Two models of inductive proximity switches are available for use with PHD Models SK and SL Slides (-GG, -GH, -GI options).



PART NO.	DESCRIPTION
51422-005-02	8 mm Inductive Proximity Switch NPN with 2 meter Cable
51422-006-02	8 mm Inductive Proximity Switch PNP with 2 meter Cable
15561-001*	12 mm Inductive Proximity Switch NPN with 3 meter cable
15561-002*	12 mm Inductive Proximity Switch PNP with3 meter cable
15561-003*	12 mm Inductive Proximity Switch AC 35-250 VAC with 3 meter cable

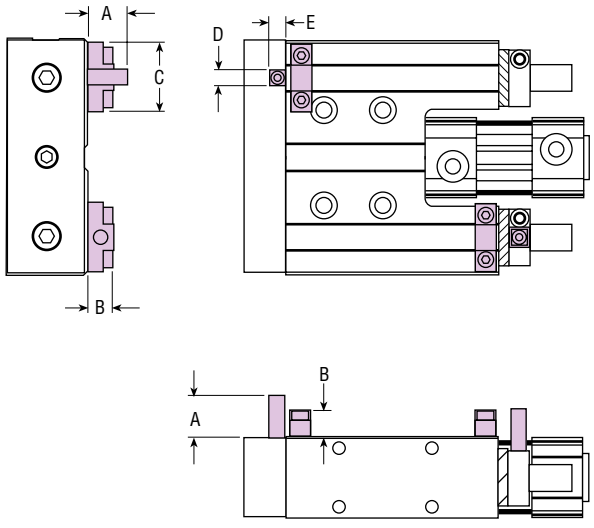
* See Switches section for switch details.

PROXIMITY SWITCH BRACKET & TARGET KITS

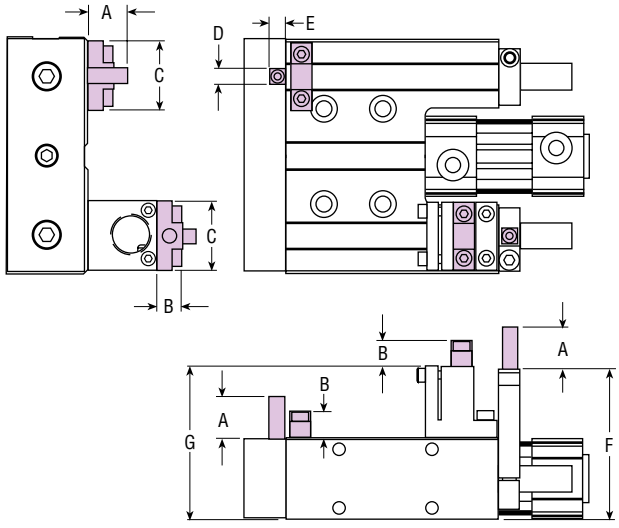
Each kit contains a bracket, target, and hardware for mounting one 8 mm or 12 mm threaded proximity switch on an SK or SL Slide. Switches must be ordered separately. See the Switches section for detailed switch information.

	KIT NUMBERS			
	STANDARD PLATING		Z1 PLATING	
SIZE	8 mm	12 mm	8 mm	12 mm
1	56848-05	—	58243-05	—
2	56848-06	65561-02-1	58243-06	65561-02-2
3	56848-01	65561-02-1	58243-01	65561-02-2
4	56848-02	65561-03-1	58243-02	65561-03-2
5	56848-03	65561-03-1	58243-03	65561-03-2
6	56848-04	65561-04-1	58243-04	65561-04-2

Kit contains all components for one direction only.



UNIT IS SHOWN WITH -GG OPTION AND 2 PROXIMITY SWITCH AND TARGET KITS



UNIT IS SHOWN WITH -GM OPTION AND 2 PROXIMITY SWITCH AND TARGET KITS

8 mm PROXIMITY SWITCH

SIZE	A	B	C	D	E	F	G
1	15	20	25.5	8	8	55	56.5
2	18	16	28.5	8	8	71	71.5
3	20.5	16	28.5	9.5	9.5	77	77
4	25.5	16	42	9.5	9.5	92.5	93.5
5	25.5	16	42	9.5	9.5	104.5	105.5
6	27.5	16.5	51	9.5	9.5	121.5	123.5

12 mm PROXIMITY SWITCH

SIZE	A	B	C	D	E	F	G
1	—	—	—	—	—	—	—
2	38.1	31.8	28.5	12.7	8	71	71.5
3	38.1	31.8	28.5	12.7	8	77	77
4	25.4	22.5	38	12.7	9.5	92.5	93.5
5	25.4	22.5	38	12.7	9.5	104.5	105.5
6	28.6	22.5	51	12.7	9.5	121.5	123.5

All dimensions are reference only unless specifically toleranced.

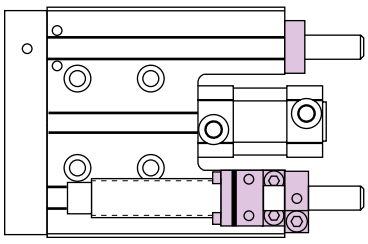
SHOCK ABSORBERS

See individual shock ready options for shock absorber dimensions.

SIZE	PHD NO.
1	57056-01-1, -2, -3
2 & 3	57056-02-1, -2, -3
4 & 5	57056-03-1, -2, -3
6	57056-04-1, -2, -3

SHOCK ABSORBER MOUNTING KITS

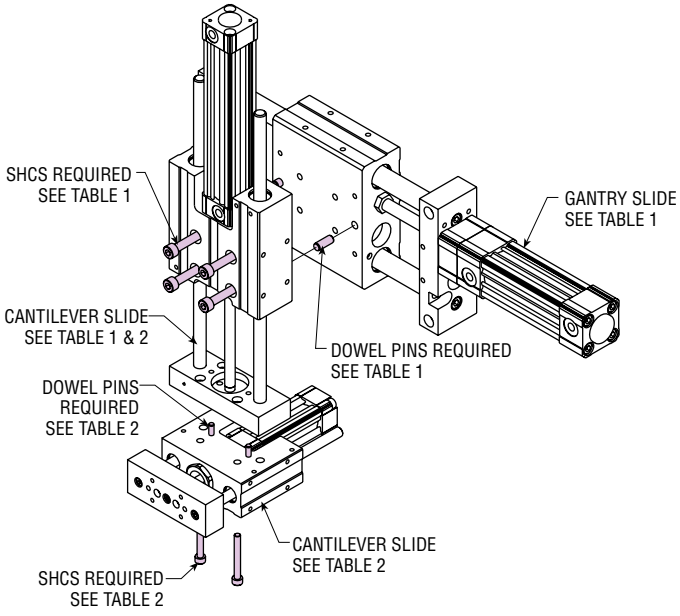
Each mounting kit contains one shock absorber mounting bracket with all necessary hardware for mounting one shock absorber in either direction. Slide unit must be ordered with the shock ready option -GM, -GN, or -GO. Shock absorbers must be ordered separately, see chart.



SIZE	KIT NUMBER
1	57034-04
2	57034-01
3	57034-01
4	57034-02
5	57034-02
6	57034-03

Kit contains all components for standard non-Z1 units for one direction only.

APPLICATION EXAMPLE: SERIES SK & SL SLIDES



NOTE: Series SK/SL Slide tool plate may retract past edge of Series SG Slide saddle without tool plate extension or -AR options.

Modular design of the SK/SL housing allows the unit to bolt and dowel directly to the saddle of the metric Series SG gantry slide without the need for a transition plate. See the chart below for slide compatibility and hardware required. Each kit includes 4 SHCS and 2 dowel pins.

TABLE 1: SERIES SK/SL SLIDE TO SERIES SG SERIES SLIDE

MODULAR DESIGN		HARDWARE KITS	
CANTILEVER	GANTRY	STANDARD	-Z1 OPTION
SK/SLxx81	SGxx82	65578-01-1	65578-01-2
SK/SLxx82	SGxx83	65578-02-1	65578-02-2
SK/SLxx83	SGxx84	65578-03-1	65578-03-2
SK/SLxx84	SGxx85	65578-04-1	65578-04-2
SK/SLxx85	SGxx86	65578-05-1	65578-05-2

TABLE 2: SERIES SK/SL SLIDE TO SERIES SK/SL SERIES SLIDE

MODULAR DESIGN		HARDWARE KITS	
CANTILEVER HOUSING	CANTILEVER TOOL PLATE	STANDARD	-Z1 OPTION
SK/SLxx81	SK/SLxx82	65547-01-1	65547-01-2
SK/SLxx82	SK/SLxx83	65547-02-1	65547-02-2
SK/SLxx83	SK/SLxx84	65547-03-1	65547-03-2
SK/SLxx84	SK/SLxx85	65547-04-1	65547-04-2
SK/SLxx85	SK/SLxx86	65547-05-1	65547-05-2

SCV

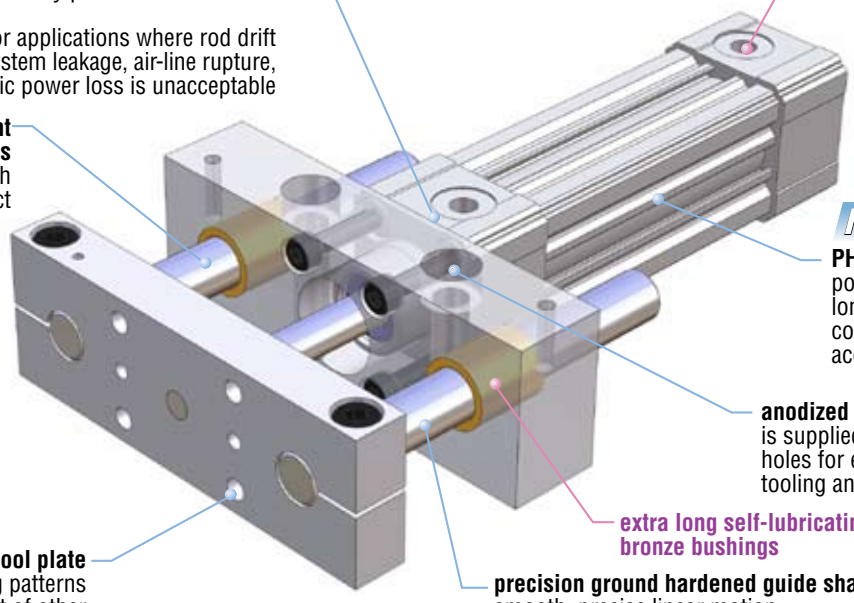
IDEAL FOR NON-ROTATING VERTICAL OR LIGHT DUTY HORIZONTAL APPLICATIONS

Rodlok® can be added to securely hold a static tool plate in place at any point of travel desired

ideal for applications where rod drift due to system leakage, air-line rupture, or electric power loss is unacceptable

optional stroke adjustment collars with shock pads are available on both extend and retract

optional cushions and port controls available



IMPROVED

PHD's Series CV Cylinder powers this unit for extra long life with a wide range of control and switch accessories

anodized aluminum alloy body is supplied with counterbored holes for easy mounting of tooling and fixturing

extra long self-lubricating bronze bushings

anodized aluminum tool plate has modular mounting patterns to allow the attachment of other sizes of Series SCV Slides for 2-axis movement

precision ground hardened guide shafts provide smooth, precise linear motion

Major Benefits

- Oversize guide rods
- Simple design
- Ideal for non-rotating applications
- Easy tooling mounting to tool plate
- 8 bore sizes
- Units are powered by PHD's rugged Series CV Cylinder, now with improved seal & bearing support

Industry Uses

- Material handling/conveyors
- Snack foods
- Assembly machine builders
- General assembly

ORDERING DATA: SERIES SCV SLIDES

TO ORDER, SPECIFY:
Product, Cylinder, Type, Design No., Slide Size, Slide Travel, Tool Plate Extension, and Options.

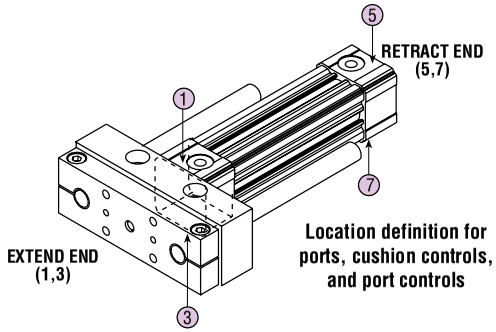
SLIDE TRAVEL

SIZE	TRAVEL in	TRAVEL mm
2	1-6	25-150
3	1-6	25-150
4	1-8	25-200
5	1-8	25-200
6	1-10	25-250
7	1-10	25-250
8	1-12	25-300
9	1-12	25-300

Available in 1" [25 mm] increments. Minimum travel required for all Series SCV Slides is 1" [25 mm]. Consult PHD for other stroke lengths.

SLIDE OPTIONS
AE - Travel adjustment and shock pads on extension**
AR - Travel adjustment and shock pads on retraction**
Z1 - Corrosion resistant; guide shafts are hard chrome plated stainless steel or specially coated hardened steel, and appropriate coating on ferrous parts.

TOOL PLATE EXTENSION
Additional distance between tool plate and bearing body in 1" [25 mm] increments. Leave blank if additional extension is not required.



PRODUCT
S - Slide

DESIGN NO.
2 - Imperial
6 - Metric

S C V 6 3 x 25 x 25 - DB-M - AR-Z1

CYLINDER
C - CV Series Compatible

SLIDES WITH LIGHT DUTY BUSHINGS

TYPE	SLIDE SIZE	BORE in	BORE mm	SHAFT SIZE in	SHAFT SIZE mm
V	2	0.787	20	0.394	10
V	3	0.984	25	0.472	12
V	4	1.260	32	0.630	16
V	5	1.575	40	0.787	20
V	6	1.969	50	0.984	25
V	7	2.480	63	0.984	25
V	8	3.150	80	1.181	30
V	9	3.937	100	1.181	30

NOTES:
1) **Affects unit length. See option drawings for complete details. Options may decrease effective cushion length depending on position of stop collars.
2) -Z1 option may have reduced cylinder performance due to chrome-plated stainless steel rod in place of chrome-plated alloy steel.
3) -H4 and -H47 are not available in -Z1.
4) ***Rodlok® locking device is not available with -Z1.
5) Rodlok must be ordered separately when a replacement cylinder (-H4) is ordered with -H47 unit.
6) *Standard ports, cushion controls, and port controls are in locations 1 & 5. See diagram above. Sizes 2 and 3 use 10-32 [M5] ports when combined with port controls on the same surface.

WITH CYLINDER OPTIONS
*DB - Cushion controls on both ends (locations 1 & 5)
*DE - Cushion controls on extend only (location 1)
*DR - Cushion control retract only (location 5)
H4 - Slide ready cylinder (CVxS cylinder only) replacement (see note 5)
H47 - Rodlok® unit includes rodlok, adaptor, cylinder, and slide preassembled (see note 5)
L9 - NPT Ports (NPT-standard on imperial units BSPP-standard on metric units)
M - Magnetic piston for use with PHD Reed and Solid State Switches
*PB - Port controls on both ends (locations 1 & 5)
*PE - Port controls on extend only (location 1)
*PR - Port control on retract only (location 5)
UBxx - Optional port location

WITHOUT CYLINDER OPTIONS
H1 - No cylinder, slide section only
Sizes 2 and 3 require a Series CVB Cylinder only.
Sizes 4 through 9 use an ISO 6432/VDMA 24562 compliant cylinder.

PORT CONTROL OPTIONS
-P x x x

Port Control Locations	Retract Location	Extend Location
B - Both ends E - Extend end only R - Retract end only	(5 & 7) **Omit if -PEx**	(1 & 3) **Omit if -PRx**

PORT LOCATION OPTIONS
-UB x x

Extend Location	Retract Location
(Head) (1 & 3)	(Cap) (5 & 7)

CUSHION CONTROL OPTIONS
-D x x x

Cushion Control Locations	Retract Location	Extend Location
B - Both ends E - Extend end only R - Retract end only	(5 & 7) **Omit if -DEx**	(1 & 3) **Omit if -DRx**

SERIES 6250 SOLID STATE SWITCHES

PART NO.	DESCRIPTION	COLOR
62505-1-02	NPN (Sink) DC Magnetoresistive, 2 m cable	Brown
62506-1-02	PNP (Source) DC Magnetoresistive, 2 m cable	Tan
62515-1	NPN (Sink) DC Magnetoresistive, Quick Connect	Brown
62516-1	PNP (Source) DC Magnetoresistive, Quick Connect	Tan

SERIES 6250 REED SWITCHES

PART NO.	DESCRIPTION	COLOR
62507-1-02	AC/DC Reed, 2 m cable	Silver
62517-1	AC/DC Reed, Quick Connect	Silver

SPECIFICATIONS	SERIES SCV
OPERATING PRESSURE	35 psi min to 150 psi max [2.4 bar min to 10 bar max] air
OPERATING TEMPERATURE	-20° to +180°F [-29° to +82°C]
TRAVEL TOLERANCE	See table below
REPEATABILITY	±0.001 in [±.025 mm] of original position
VELOCITY	80 in/sec [2 m/sec] max., zero load at 87 psi [6.9 bar]
LUBRICATION	Factory lubricated for rated life
MAINTENANCE	Field repairable

UNIT SIZE	GUIDE SHAFT DIAMETER in	GUIDE SHAFT DIAMETER mm	BORE DIAMETER in	BORE DIAMETER mm	CYLINDER ROD DIAMETER in	CYLINDER ROD DIAMETER mm	SLIDE DIRECTION	EFFECTIVE AREA in²	EFFECTIVE AREA mm²	BASE WEIGHT lb	BASE WEIGHT kg	TYPICAL DYNAMIC LOAD lb	TYPICAL DYNAMIC LOAD N
2	0.394	10	0.787	20	0.315	8	EXTEND	0.49	314	1.75 + (.17 x T)	0.80 + (.003 x T)	8	36
							RETRACT	0.41	264				
3	0.472	12	0.984	25	0.394	10	EXTEND	0.76	491	2.38 + (.22 x T)	1.08 + (.004 x T)	15	67
							RETRACT	0.64	412				
4	0.630	16	1.260	32	0.472	12	EXTEND	1.25	804	3.95 + (.35 x T)	1.79 + (.006 x T)	25	111
							RETRACT	1.07	691				
5	0.787	20	1.575	40	0.630	16	EXTEND	1.95	1257	6.26 + (.50 x T)	2.84 + (.009 x T)	35	156
							RETRACT	1.64	1056				
6	0.984	25	1.969	50	0.787	20	EXTEND	3.04	1963	11.37 + (.75 x T)	5.16 + (.013 x T)	50	222
							RETRACT	2.56	1649				
7	0.984	25	2.480	63	0.787	20	EXTEND	4.83	3117	14.30 + (.79 x T)	6.49 + (.014 x T)	75	334
							RETRACT	4.34	2803				
8	1.181	30	3.150	80	0.984	25	EXTEND	7.79	5027	26.67 + (1.14 x T)	12.11 + (.020 x T)	100	445
							RETRACT	7.03	4536				
9	1.181	30	3.937	100	0.984	25	EXTEND	12.17	7854	35.83 + (1.22 x T)	16.27 + (.022 x T)	150	667
							RETRACT	11.41	7363				

NOTES: 1) T=Travel length inches [mm].
2) Thrust capacity, allowable mass and dynamic moment capacity must be considered when selecting a slide.
3) For additional speed information, consult PHD's Series CV Cylinder pages.

TOTAL TRAVEL TOLERANCES

Tolerance on nominal travel length is shown in the following table:

UNIT SIZE	NOMINAL TRAVEL in	NOMINAL TRAVEL mm	NOMINAL TRAVEL TOLERANCE* in	NOMINAL TRAVEL TOLERANCE* mm
2 & 3	L ≤ 4	L ≤ 100	+0.059/-0.000	+1.50/-0.000
	L > 4	L > 100	+0.079/-0.000	+2.00/-0.000
4, 5, & 6	L ≤ 20	L ≤ 500	+0.079/-0.000	+2.00/-0.000
	L > 20	L > 500	+0.126/-0.000	+3.20/-0.000
7,8, & 9	L ≤ 20	L ≤ 500	+0.098/-0.000	+2.50/-0.000
	L > 20	L > 500	+0.157/-0.000	+4.00/-0.000

***NOTE:** Travel tolerance values measured at 60 ±4 psi, due to impact seal design.

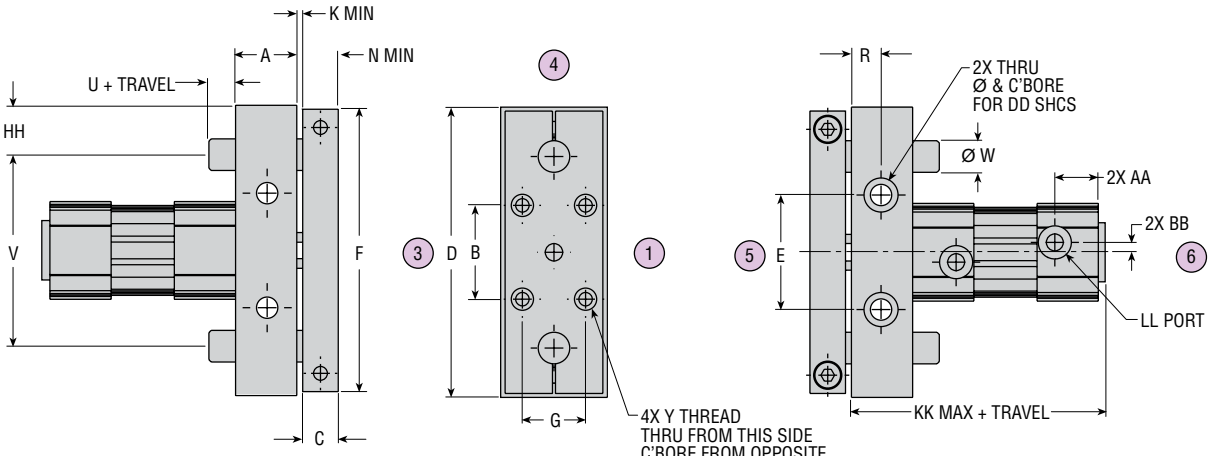
CYLINDER FORCE CALCULATIONS

	IMPERIAL	METRIC
	F = P x A	F = 0.1 x P x A
F = Cylinder Force	lbs	N
P = Operating Pressure	psi	bar
A = Effective Area (Extend or Retract)	in²	mm²

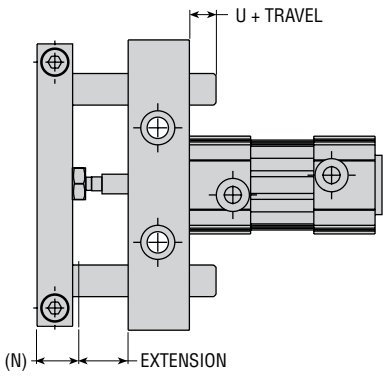
SIZING AND APPLICATION ASSISTANCE

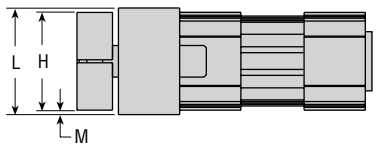
See PHD Product Sizing Catalog for specific and complete sizing information. Online sizing assistance is available at: ***www.phdinc.com/apps/sizing***

DIMENSIONS: SERIES SCV SLIDES



TOOL PLATE EXTENSION





NOTES:
1) FOR OPTION DIMENSIONS AND DETAILS, SEE OPTION PAGES
2) ALL DIMENSIONS ARE CENTERED ON CENTERLINE OF UNIT UNLESS OTHERWISE SPECIFIED
3) UNIT TRAVEL = STROKE + TOOL PLATE EXTENSION. THE TOTAL UNIT TRAVEL SHOULD NOT EXCEED THE MAXIMUM RECOMMENDED TRAVEL.
4) *PORTS MAY APPEAR ON EITHER SIDE OF THE SLIDE CENTERLINE BASED ON OPTION COMBINATIONS.
5) **ALL UNITS, EXCEPT PORT WITH PORT CONTROL ON SAME SIDE, COMPLY WITH DIN 3852 PART 2 PORT SPECIFICATIONS FOR SHORT STUD AND LARGE SEALING SURFACE.

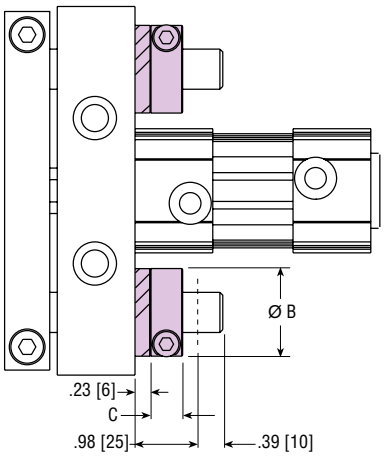
LETTER DIM	MODEL NUMBER															
	SCVx2		SCVx3		SCVx4		SCVx5		SCVx6		SCVx7		SCVx8		SCVx9	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
PHD CYL. BORE	0.787	20.0	0.984	25.0	1.260	32.0	1.575	40.0	1.969	50.0	2.480	63.0	3.150	80.0	3.937	100.0
A	1.102	28.0	1.299	33.0	1.220	31.0	1.417	36.0	1.772	45.0	1.772	45.0	2.205	56.0	2.402	61.0
B	1.516	38.5	1.969	50.0	1.870	47.5	2.283	58.0	2.559	65.0	3.150	80.0	3.543	90.0	4.724	120.0
C	0.630	16.0	0.669	17.0	0.709	18.0	0.906	23.0	1.220	31.0	1.220	31.0	1.732	44.0	1.732	44.0
D	4.409	112.0	4.783	121.5	5.787	147.0	6.929	176.0	8.563	217.5	8.563	217.5	10.748	273.0	11.339	288.0
E	1.969	50.0	1.870	47.5	2.283	58.0	2.559	65.0	3.150	80.0	3.543	90.0	4.724	120.0	5.315	135.0
F	4.252	108.0	4.626	117.5	5.630	143.0	6.772	172.0	8.406	213.5	8.406	213.5	10.591	269.0	11.181	284.0
G	0.906	23.0	1.181	30.0	1.260	32.0	1.417	36.0	1.772	45.0	1.417	36.0	1.496	38.0	1.969	50.0
H	1.417	36.0	1.614	41.0	1.890	48.0	2.283	58.0	2.717	69.0	3.386	86.0	3.937	100.0	4.921	125.0
K MIN	0.098	2.5	0.098	2.5	0.118	3.0	0.118	3.0	0.118	3.0	0.118	3.0	0.118	3.0	0.118	3.0
L	1.575	40.0	1.772	45.0	2.047	52.0	2.441	62.0	2.874	73.0	3.543	90.0	4.331	110.0	5.315	135.0
M	0.079	2.0	0.079	2.0	0.079	2.0	0.079	2.0	0.079	2.0	0.079	2.0	0.197	5.0	0.197	5.0
N MIN	0.728	18.5	0.768	19.5	0.827	21.0	1.024	26.0	1.339	34.0	1.339	34.0	1.850	47.0	1.850	47.0
P	#8	M4	#10	M5	1/4	M6	5/16	M8	3/8	M10	3/8	M10	7/16	M12	7/16	M12
R	0.630	16.0	0.709	18.0	0.709	18.0	0.906	23.0	1.063	27.0	1.063	27.0	1.299	33.0	1.299	33.0
U	0.394	10.0	0.394	10.0	0.394	10.0	0.394	10.0	0.394	10.0	0.394	10.0	0.394	10.0	0.394	10.0
V	2.992	76.0	3.189	81.0	3.819	97.0	4.606	117.0	5.630	143.0	5.630	143.0	7.283	185.0	7.874	200.0
W	0.394	10.0	0.472	12.0	0.630	16.0	0.787	20.0	0.984	25.0	0.984	25.0	1.181	30.0	1.181	30.0
Y	10-32	M5 x 0.8	1/4-20	M6 x 1	5/16-24	M8 x 1.25	3/8-24	M10 x 1.5	7/16-20	M12 x 1.75	7/16-20	M12 x 1.75	5/8-18	M16 x 2.0	5/8-18	M16 x 2.0
AA*	0.354	9.0	0.354	9.0	0.630	16.0	0.728	18.5	.728	18.5	0.787	20.0	0.709	18.0	0.866	22.0
BB*	0.167	4.2	0.177	4.5	0.197	5.0	0.236	6.0	0.236	6.0	0.394	10.0	0.394	10.0	0.472	12.0
DD	1/4	M6	5/16	M8	3/8	M10	7/16	M12	7/16	M12	5/8	M16	3/4	M20	3/4	M20
HH	0.709	18.0	0.797	20.25	0.984	25.0	1.161	29.5	1.467	37.3	1.467	37.3	1.732	44.0	1.732	44.0
KK	3.819	97.0	4.134	105.0	5.079	129.0	5.709	145.00	6.102	155.0	6.693	170.0	7.402	188.0	7.992	203.0
LL**	1/8	G 1/8	1/8	G 1/8	1/8	G 1/8	1/4	G 1/4	1/4	G1/4	3/8	G 3/8	3/8	G 3/8	1/2	G 1/2

All dimensions are reference only unless specifically toleranced.

AE TRAVEL ADJUSTMENT AND SHOCK PADS ON EXTENSION

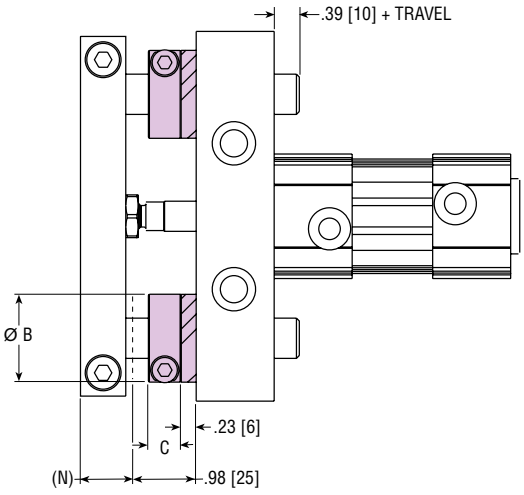
Two travel adjustment stop collars with polyurethane shock pads are used for adjustment of slide extension. The travel adjustment stop collars allow precise adjustment while the shock pads eliminate metal to metal contact, thereby reducing noise levels.

(SHOWN WITH ZERO TRAVEL)



AR TRAVEL ADJUSTMENT AND SHOCK PADS ON RETRACTION

Two travel adjustment stop collars with polyurethane shock pads are used for adjustment of slide retraction. The travel adjustment stop collars allow precise adjustment while the shock pads eliminate metal to metal contact, thereby reducing noise levels.



LETTER DIM	MODEL NUMBER															
	SCVx2		SCVx3		SCVx4		SCVx5		SCVx6		SCVx7		SCVx8		SCVx9	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
Ø B	0.984	25	1.102	28	1.378	35	1.654	42	1.890	48	1.890	48	2.165	55	2.165	55
C	0.394	10	0.433	11	0.512	13	0.591	15	0.591	15	0.591	15	0.591	15	0.591	15
N	0.728	18.5	0.768	19.5	0.827	21	1.024	26	1.339	34	1.339	34	1.850	47	1.850	47

NOTE: -AE and -AR options may decrease effective cushion length depending on position of stop collars.

L9 NPT PORTS

This option provides NPT ports on metric (SCV6x) units instead of the standard BSPP ports. The NPT ports are located in the same location as the BSPP ports.

MODEL	OPTIONAL NPT PORT	STANDARD BSPP PORT
SCVx2	1/8*	G 1/8*
SCVx3	1/8*	G 1/8*
SCVx4	1/8	G 1/8
SCVx5	1/4	G 1/4
SCVx6	1/4	G 1/4
SCVx7	3/8	G 3/8
SCVx8	3/8	G 3/8
SCVx9	1/2	G 1/2

*When port controls are specified on the same face as ports, the standard metric port is M5 and the -L9 option provides a 10-32 port.

Z1 CORROSION RESISTANT

This option provides a stainless steel piston rod with hard chrome plating in place of the standard hard chrome plated steel material. Guide shafts are hard chrome plated stainless steel or coated hardened steel in place of the standard material. An appropriate corrosion resistant treatment is applied to ferrous parts.

DB CUSHION CONTROL IN BOTH DIRECTIONS

(standard location 1 & 5)

DE CUSHION CONTROL ON EXTEND ONLY

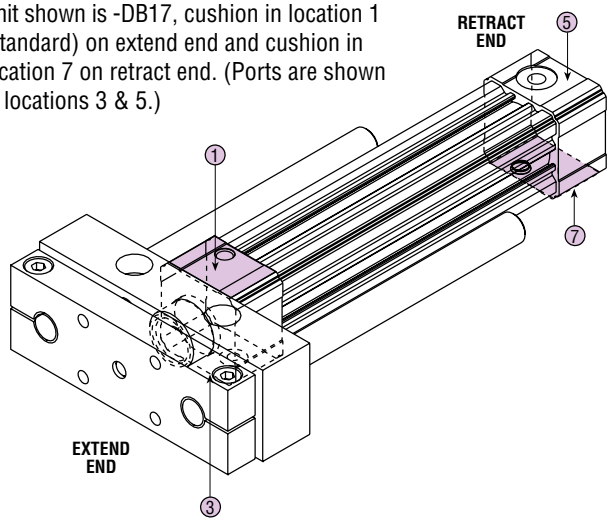
(standard location 1)

DR CUSHION CONTROL ON RETRACT ONLY

(standard location 5)

PHD cushions are designed for smooth deceleration at the ends of cylinder stroke. When the cushion is activated, the remaining volume in the cylinder must exhaust past an adjustable needle valve which controls the amount of deceleration. The effective cushion length for each bore size is shown in the table below. To specify alternative cushion control locations on the head or cap, see the option code below right.

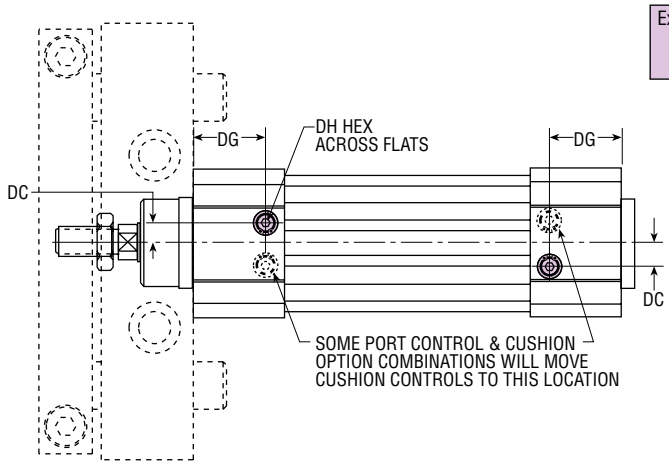
Unit shown is -DB17, cushion in location 1 (standard) on extend end and cushion in location 7 on retract end. (Ports are shown in locations 3 & 5.)



CUSHION CONTROL OPTIONS

-D x x x

- Cushion Control Locations: B - Both ends; E - Extend end only; R - Retract end only
- Retract Location (5, 7) **Omit if -DEx**
- Extend Location (1, 3) **Omit if -DRx**



LETTER DIM	MODEL NUMBER															
	SCVx2		SCVx3		SCVx4		SCVx5		SCVx6		SCVx7		SCVx8		SCVx9	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
DC	.190	4.8	.226	5.7	.276	7.0	.374	9.5	.394	10.0	.354	9.0	.591	15.0	.630	16.0
DG	.581	14.8	.561	14.2	.965	24.5	1.083	27.5	1.043	26.5	1.201	30.5	1.181	30.0	1.339	34.0
DH	—	2.5	—	2.5	—	2.5	—	2.5	—	2.5	—	2.5	—	3.0	—	3.0
EFFECTIVE CUSHION LENGTH*	.441	11.2	.468	11.9	.599	15.2	.808	20.5	.871	22.1	.805	20.4	.892	22.7	1.190	30.2

*-AE and -AR options may decrease effective cushion length depending on position of stop collars.

All dimensions are reference only unless specifically toleranced.

H47 RODLOK® SLIDE & RODLOK®

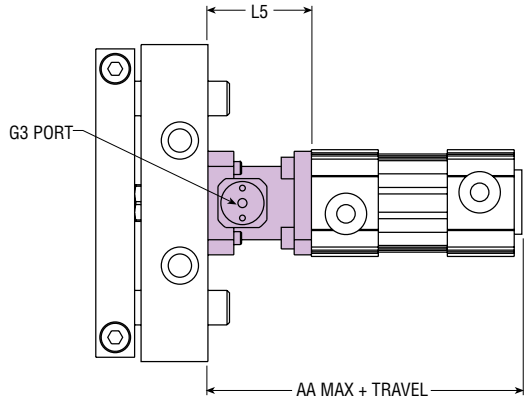
PHD's Rodlok® is ideal for locking the tool plate while in a static/stationary position. When the pressure is removed from the port of the Rodlok®, the mechanism will grip the piston rod of the cylinder and prevent it from moving. The loads are held indefinitely without power. Rodlok® performance is application and environment sensitive (Cleanliness of rod or Rodlok® will also affect performance). THE RODLOK® IS NOT DESIGNED TO BE USED AS A PERSONNEL SAFETY DEVICE.

SIZE	STATIC LOCKING FORCE* lb	N
2	79	350
3	90	400
4	135	600
5	225	1000
6	337	1500
7	495	2200
8	674	3000
9	1124	5000

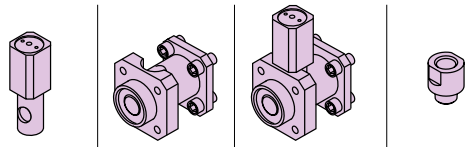
NOTE: *Locking force indicated above is the actual locking force with a dry clean rod and does not include any safety factor.

OPERATING PRESSURE

The operating pressure for the locking device is different than the operating pressure for the slide to which it is attached. The locking device of the Rodlok® is designed with an operating pressure range of 60 psi minimum to 150 psi maximum [4 to 10 bar]. The Series SCV Slide with a Rodlok® attached has an operating pressure range of 45 psi minimum to 150 psi maximum [3 to 10 bar].



RODLOK® KITS



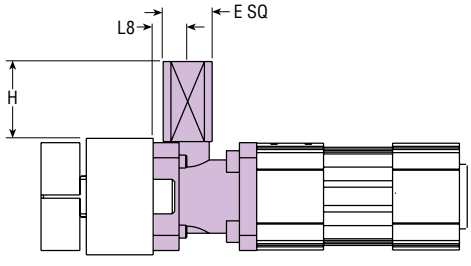
SIZE	LOCKING DEVICE KIT	ADAPTOR KIT*	COMPLETE RODLOK®*	IMPERIAL PORT ADAPTOR
2	63459-07-1	63460-07-1	63461-07-1	—
3	63459-08-1	63460-08-1	63461-08-1	—
4	63459-01-1	63460-01-1	63461-01-1	—
5	63459-02-1	63460-02-1	63461-02-1	63465-1
6	63459-03-1	63460-03-1	63461-03-1	63465-1
7	63459-04-1	63460-04-1	63461-04-1	63465-1
8	63459-05-1	63460-05-1	63461-05-1	63465-1
9	63459-06-1	63460-06-1	63461-06-1	63465-1

NOTES:
1) *Kits ship with cylinder mounting hardware.
2) Part numbers listed above are intended for replacement purposes only and are to be used specifically on slides with the -H47 option.
3) Imperial port adaptor converts port from G 1/8 to 1/8 NPT.
4) When ordering a replacement cylinder (-H4), Rodlok® must be ordered separately.

SIZE	DEVICE WEIGHT lb	kg	ADAPTOR WEIGHT lb	kg	TOTAL WEIGHT lb	kg
2	0.14	0.06	0.14	0.06	0.31	0.14
3	0.14	0.06	0.16	0.07	0.36	0.16
4	0.20	0.09	0.28	0.13	0.57	0.26
5	0.30	0.14	0.44	0.20	0.93	0.42
6	0.54	0.24	0.84	0.38	1.76	0.80
7	0.88	0.40	1.3	0.59	2.56	1.16
8	1.40	0.64	2.88	1.31	5.04	2.29
9	2.12	0.96	4.76	2.16	7.66	3.47

NOTE: Total weight includes rod adder for -H46/-H47 cylinder.

The Rodlok® locking device and adaptor can be purchased separately as kits. See chart above. The locking device and adaptor are not available with a corrosion resistant (-Z1 option) finish.



LETTER DIM	MODEL NUMBER SCVx2 in	mm	SCVx3 in	mm	SCVx4 in	mm	SCVx5 in	mm	SCVx6 in	mm	SCVx7 in	mm	SCVx8 in	mm	SCVx9 in	mm
H	1.280	32.5	1.181	30.0	1.339	34.0	1.476	37.5	1.811	46.0	1.811	46.0	2.520	64.0	2.224	56.5
E	.807	20.5	.807	20.5	.984	25.0	1.083	27.5	1.280	32.5	1.614	41.0	1.929	49.0	2.087	53.0
G3	M5	M5	M5	M5	1/8	G 1/8	1/8	G 1/8	1/8	G 1/8	1/8	G 1/8	1/8	G 1/8	1/8	G 1/8
L5	1.575	40	1.732	44	1.890	48	2.165	55	2.756	70	2.756	70	3.543	90	3.622	92
L8	0.512	13	0.512	13	0.630	16	0.768	19.5	0.827	21	0.827	21	1.102	28	1.063	27
AA	4.291	109	4.567	116	6.969	177	7.874	200	8.858	225	9.449	240	10.945	278	1.1614	295

All dimensions are reference only unless specifically toleranced.

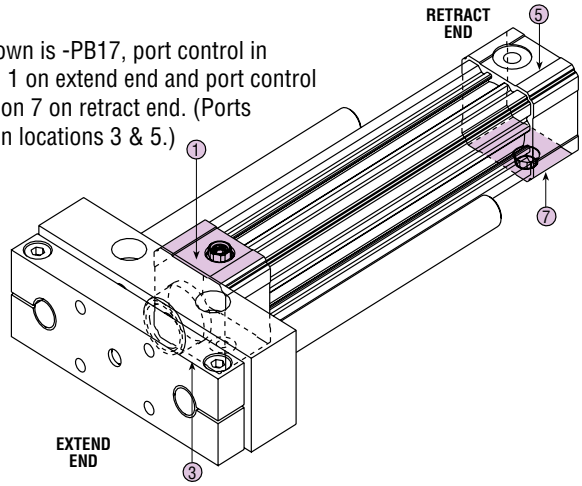
PB PORT CONTROLS® ON BOTH ENDS
(standard location 1 & 5)

PE PORT CONTROLS® ON EXTEND ONLY (standard location 1)

PR PORT CONTROLS® ON RETRACT ONLY (standard location 5)

PHD's Port Control® is a built-in flow control for regulating the speed of the slide through its entire stroke. The Port Control operates on the "meter-out" principle and features an adjustable needle in a cartridge with a check seal. The self-locking needle has micrometer threads and is adjustable under pressure. The needle determines the orifice size which controls the exhaust flow rate of the actuator. The check seal expands while air is exhausting from the actuator, forcing the air to exhaust past the adjustable needle. The check seal collapses to allow a free flow of incoming air. The PHD Port Control saves space and eliminates the cost of fittings and installation for external flow control valves. Refer to option code below left to specify port control locations.

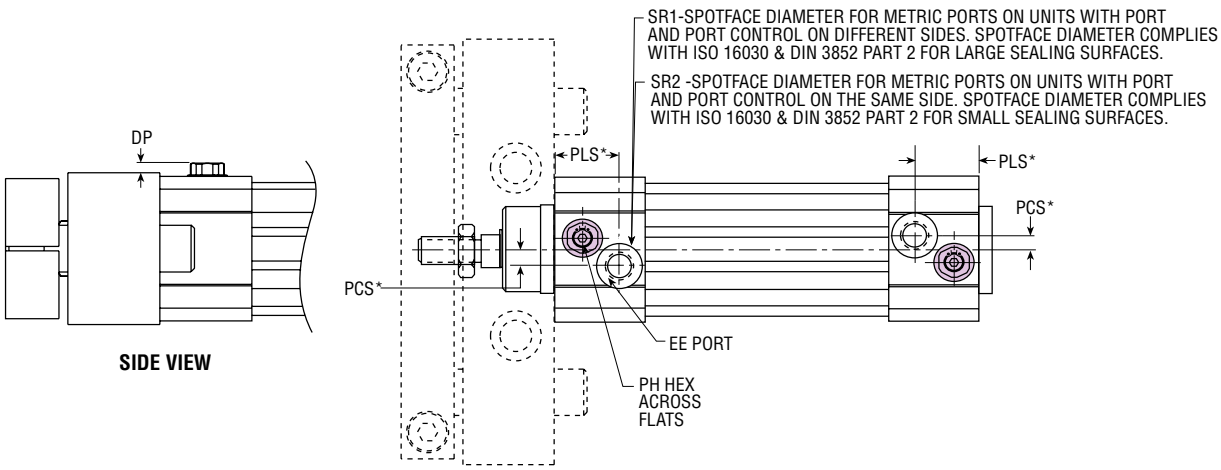
Unit shown is -PB17, port control in location 1 on extend end and port control in location 7 on retract end. (Ports shown in locations 3 & 5.)



PORT CONTROL OPTIONS

-P x x x

- Port Control Locations: B - Both ends; E - Extend end only; R - Retract end only
- Retract Location (5, 7) **Omit if -PEx**
- Extend Location (1, 3) **Omit if -PRx**



LETTER DIM	MODEL NUMBER															
	SCVx2		SCVx3		SCVx4		SCVx5		SCVx6		SCVx7		SCVx8		SCVx9	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
EE*	10-32	M5	10-32	M5	1/8 NPT	G 1/8	1/4 NPT	G 1/4	1/4 NPT	G 1/4	3/8 NPT	G 3/8	3/8 NPT	G 3/8	1/2 NPT	G 1/2
PCS*	.276	7.0	.276	7.0	.197	5.0	.236	6.0	.236	6.0	.450	11.4	.512	13.0	.906	23.0
PH	—	2.5	—	2.5	—	2.5	—	2.5	—	2.5	—	3.0	—	3.0	—	6.0
PLS*	.571	14.5	.571	14.5	.867	22.0	.925	23.5	.905	23.0	.984	25.0	1.024	26.0	1.142	29.0
SR1*	—	16.5	—	16.5	—	19.0	—	25.0	—	25.0	—	28.0	—	28.0	—	34.0
SR2	.354	9.0	.354	9.0	—	16.5	—	19.0	—	19.0	—	23.0	—	23.0	—	27.0
DP*	.066	1.7	.026	0.7	.209	5.3	.122	3.1	.024	0.6	.004	0.1	-.201	-5.1	-.189	-4.8

*Dimensions shown are for units with port and port control in the same location. For units with other port and port control combinations, standard port location dimensions apply. Ports may be located on either side of the slide centerline depending on port control and cushion option combinations.
in = Table information for imperial units mm = Table information for metric units

All dimensions are reference only unless specifically toleranced.

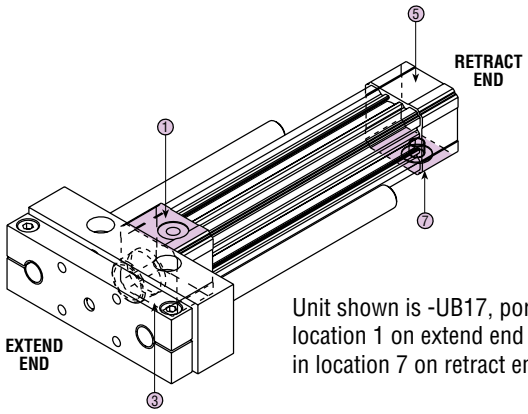
UB ALTERNATE PORT LOCATION

With this option, alternate port locations can be specified, providing increased flexibility and customer convenience. See option code below to specify port locations.

PORT LOCATION OPTIONS

-UB x x

- Extend Location (Head) (1, 3)
- Retract Location (Cap) (5, 7)



Unit shown is -UB17, port in location 1 on extend end and port in location 7 on retract end.

SCV

M MAGNET FOR PHD REED AND SOLID STATE SWITCHES

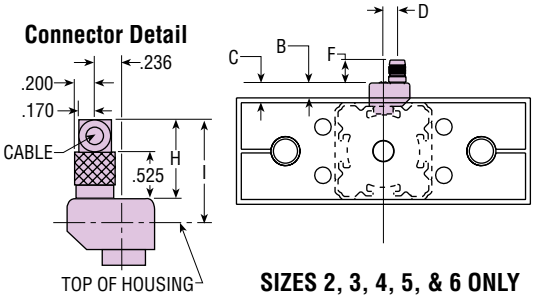
This option equips the cylinder with a magnetic band on the piston for use with PHD Reed and Solid State Switches listed below. These switches mount easily to the cylinder using "T" slots in the body. See the Switch section for complete switch information.

SERIES 6250 SOLID STATE SWITCHES

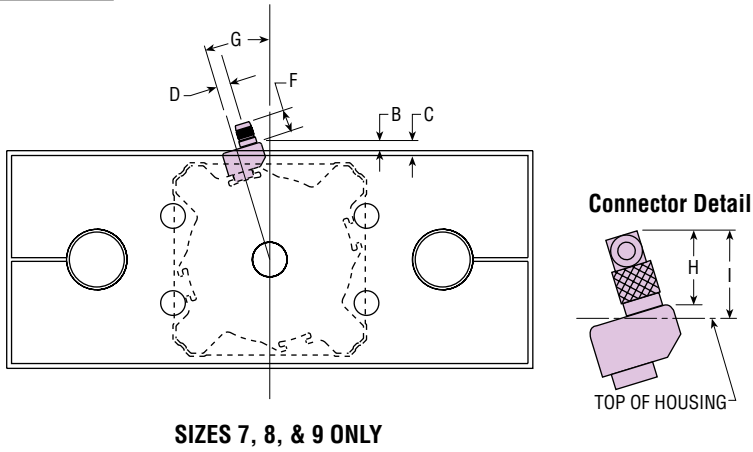
PART NO.	DESCRIPTION	COLOR
62505-1-02	NPN (Sink) DC Solid State, 2 m cable	Brown
62506-1-02	PNP (Source) DC Solid State, 2 m cable	Tan
62515-1	NPN (Sink) DC Solid State, Quick Connect	Brown
62516-1	PNP (Source) DC Solid State, Quick Connect	Tan

SERIES 6250 REED SWITCHES

PART NO.	DESCRIPTION	COLOR
62507-1-02	AC/DC Reed, 2 m cable	Silver
62517-1	AC/DC Reed, Quick Connect	Silver



SIZES 2, 3, 4, 5, & 6 ONLY

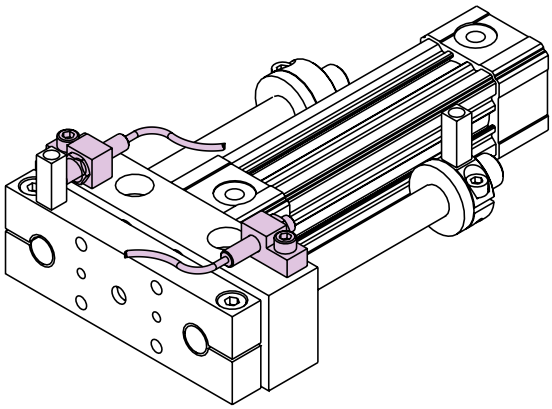


SIZES 7, 8, & 9 ONLY

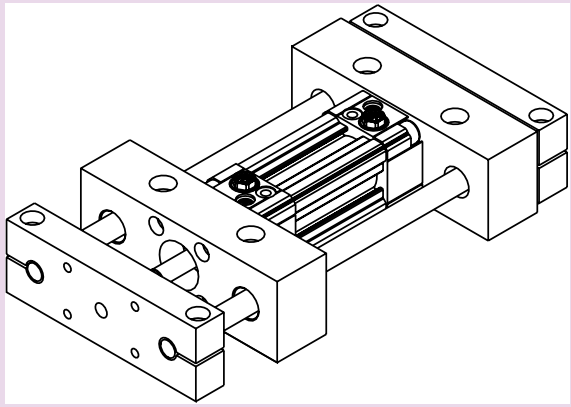
LETTER DIM	MODEL NUMBER															
	SCVx2		SCVx3		SCVx4		SCVx5		SCVx6		SCVx7		SCVx8		SCVx9	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
B	.223	5.7	.223	5.7	.187	4.8	.138	3.5	.187	4.8	.138	3.5	.059	1.5	-.079*	-2.0*
C	.302	7.7	.302	7.7	.266	6.8	.217	5.5	.266	6.8	.217	5.5	.256	6.5	.000	0.0
D	.228	5.8	.228	5.8	.228	5.8	.228	5.8	.228	5.8	.228	5.8	.228	5.8	.228	5.8
F	.373	9.5	.373	9.5	.373	9.5	.373	9.5	.373	9.5	.373	9.5	.373	9.5	.373	9.5
G	—	—	—	—	—	—	—	—	—	—	17°	17°	20°	20°	24°	24°
H	.870	22.1	.870	22.1	.870	22.1	.870	22.1	.870	22.1	.831	21.1	.819	20.8	.795	20.2
I	1.113	28.3	1.113	28.3	1.077	27.3	1.008	25.6	1.037	26.3	.969	24.6	.878	22.3	.717	18.2

*Dimension is below the indicated surface.

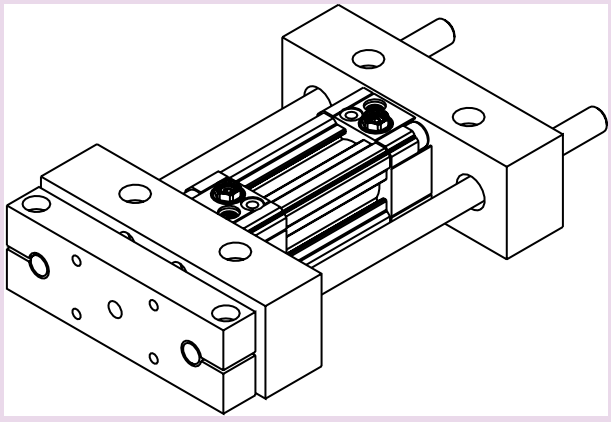
The following are examples of Series SCV Slide variations which can be easily configured. Contact PHD for additional information on these or other configurations.



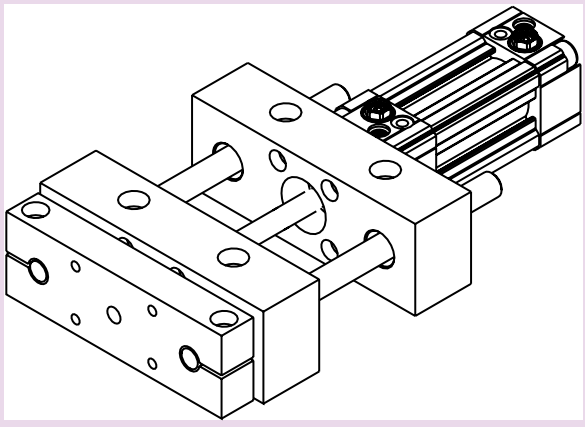
This Series SCV Slide is fitted with travel adjustment on extend and metal sensing proximity switches in both directions of travel. These switches can easily be adapted to the SCV Slide in place of PHD's Series 6250 Switches.



Shown is a version that produces a base type slide. The cylinder, bearing housings, and base plate move and the two tool plates remain fixed.



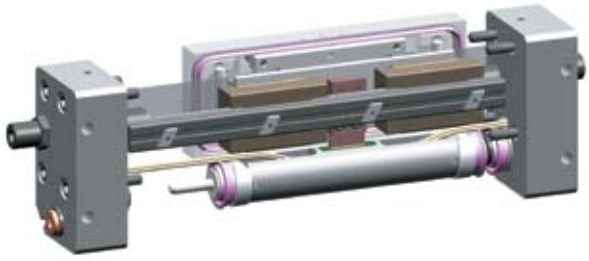
This Series SCV Slide has extended guide shafts and a second bearing housing attached to the cylinder cap. This configuration provides a higher load carrying capability while reducing wear.



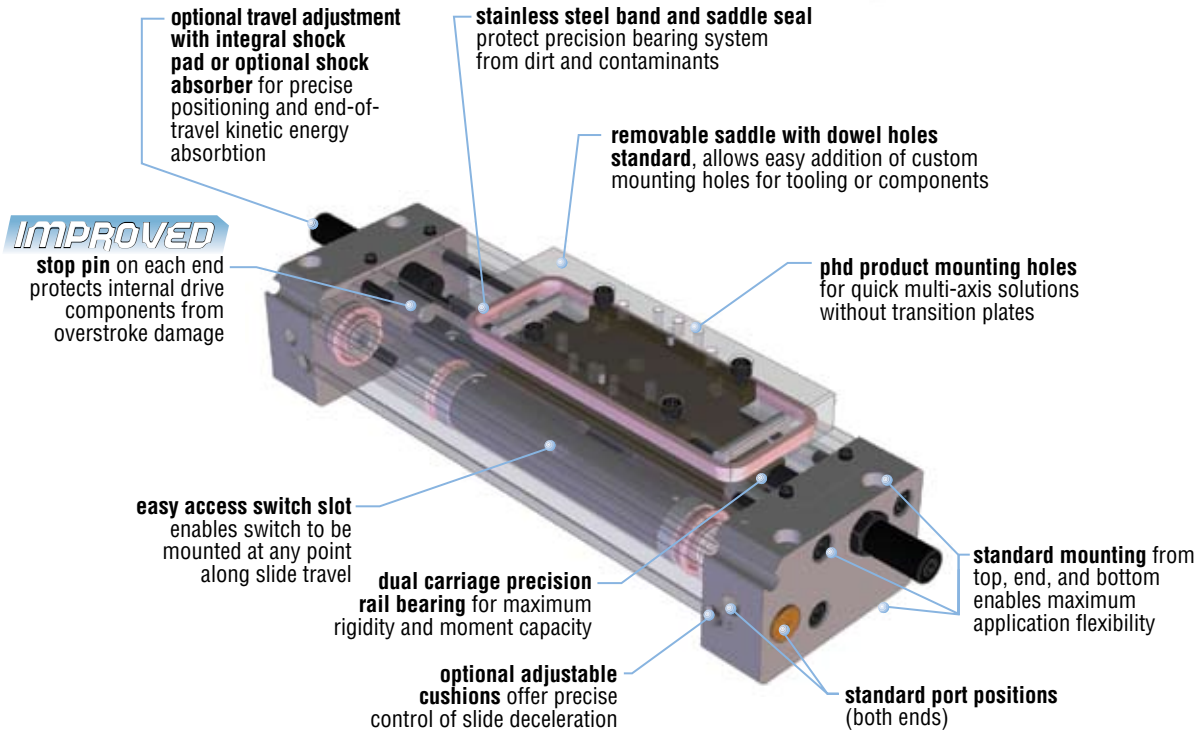
This is another variation where a second bearing housing is combined with a tool plate extension. This also provides a more rigid bearing base for higher load carrying capability.

SFP

LOWEST DEFLECTION AND HIGHEST MOMENT CAPACITY COMBINATION IN THE INDUSTRY



U.S. PATENT #6,857,780
INTERNATIONAL PATENTS PENDING



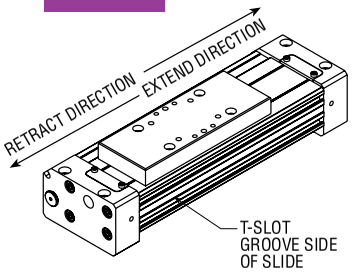
Major Benefits

- Space-saving design
- Smooth, precise movement
- High load capacity with very low deflection
- Improved moment capacity
- Two bore sizes offered (27 and 40 mm)
- Long travel lengths (27 mm bore up to 1800 mm, 40 mm bore up to 3400 mm)

Industry Uses

- General automation
- Packaging
- Assembly machine builders
- Medical
- Semiconductor
- Optical
- Plastics
- Automotive

ORDERING DATA: SERIES SFP SLIDES



TO ORDER SPECIFY:
Product, Series, Type, Design No., Package Size, Travel, and Options.

PRODUCT
S - Slide

TYPE
P - Ground Profile Rail

PACKAGE SIZE
BORE
27 mm
40 mm

SHOCK ABSORBERS
NBx - Shock installed both directions
NEx - Shock installed on extend
NRx - Shock installed on retract
"x" indicates shock absorber damping constant which must be specified by the customer. (See PHD Product Sizing Catalog) See Note 4.

EXTERNAL FLOW CONTROL
PB - Flow controls installed in both directions
PE - Flow controls installed on extend
PR - Flow controls installed on retract

S F P 6 27 x 25 – NRx – AE – DB – PB – M

SERIES
F - Pneumatic Rodless

DESIGN NO.
6 - Metric

METRIC TRAVEL
STANDARD TRAVEL LENGTHS
(in 25 mm Increments)

Size	Travel
27	25 mm - 1800 mm
40	25 mm - 3400 mm

(Longer travel lengths available, contact PHD)

TRAVEL ADJUSTMENT
(See Notes 1 & 4)
AB - Travel adjustment with shock pads installed in both directions
AE - Travel adjustment with shock pads installed on extend
AR - Travel adjustment with shock pads installed on retract

CUSHION CONTROL
(See Note 1)
DB - Cushion control both directions
DE - Cushion control on extend
DR - Cushion control on retract

SLIDE OPTIONS
M - Magnets for use with PHD 6790 Switches
Z1 - Corrosion resistant plating on ferrous parts
L9 - NPT ports

Options may affect unit length. See unit dimension and options pages for adders.

SERIES 6790 SWITCHES

PART NO.	DESCRIPTION
67902-1-02	NPN (Sink) or PNP (Source) DC Reed, 2 m cable
67902-1-05	NPN (Sink) or PNP (Source) DC Reed, 5 m cable
67903-1-02	NPN (Sink) DC Solid State, 2 m cable
67903-1-05	NPN (Sink) DC Solid State, 5 m cable
67904-1-02	PNP (Source) DC Solid State, 2 m cable
67904-1-05	PNP (Source) DC Solid State, 5 m cable
67922-1	NPN (Sink) or PNP (Source) DC Reed, Quick Connect
67929-2	AC Reed, Current Limited, Quick Connect
67923-1	NPN (Sink) DC Solid State, Quick Connect
67924-1	PNP (Source) DC Solid State, Quick Connect
63549-02	2 m Cordset with Quick Connect
63549-05	5 m Cordset with Quick Connect

NOTES:
1) If travel adjustment AB, AE, or AR is ordered, corresponding cushion option DB, DE, or DR must also be ordered.
2) Switches and switch bracket kits must be ordered separately.
3) Option -M required with Series 6790 Switch.
4) Each direction of travel must have either a travel adjustment or shock absorber specified.
5) Saddle dowel holes are standard.
6) Modular mounting interface with PHD Series STP and SK/SL Slides is standard.
7) Mounting on top, bottom, ends, and t-slots is standard.

UNIQUE SLIDES ARE AVAILABLE. PLEASE CONSULT PHD.

SPECIFICATIONS	SERIES SFP
OPERATING PRESSURE	36 psi min to 116 psi max [2.5 bar min to 8 bar max] air
OPERATING TEMPERATURE	41° to 140°F [5° to 60°C]
TRAVEL TOLERANCE	+.12/-.00 in [+3.0/-0.0 mm]
REPEATABILITY	±.001 in [±.025 mm] of original position
VELOCITY	4 to 60 in/sec [.1 to 1.5 m/sec]
LUBRICATION	Factory lubricated for life
MAINTENANCE	Field repairable

UNIT SIZE	MAXIMUM TRAVEL in	MAXIMUM TRAVEL mm	BORE DIAMETER in	BORE DIAMETER mm	EFFECTIVE AREA in²	EFFECTIVE AREA mm²	BASE WEIGHT lb	BASE WEIGHT kg	ADDER WEIGHT (per 25mm) lb	ADDER WEIGHT (per 25mm) kg	TYPICAL DYNAMIC LOAD lb	TYPICAL DYNAMIC LOAD N	MOVING SADDLE lb	MOVING SADDLE kg
27	70.8	1800	1.06	27	.88	570	7.20	3.27	0.37	0.17	0 - 100	0 - 440	2.3	1.04
40	133.8	3400	1.57	40	1.95	1260	20.1	9.12	0.71	0.32	20 - 250	89 - 1100	6.5	2.95

NOTE: Thrust capacity, allowable mass and dynamic moment capacity must be considered when selecting a slide.

MAXIMUM BEARING CAPACITY

SIZE	LOAD lb	LOAD N	PITCH MOMENT in-lb	PITCH MOMENT Nm	YAW MOMENT in-lb	YAW MOMENT Nm	ROLL MOMENT in-lb	ROLL MOMENT Nm
27	946	4208	460	52.0	460	52.0	299	33.8
40	1971	8767	1535	173.4	1535	173.4	911	102.9

FORCE TABLE

DIRECTION	SFP627 lb/psi	SFP627 N/bar	SFP640 lb/psi	SFP640 N/bar
Extend	.887	57.3	1.948	125.7
Retract	.887	57.3	1.948	125.7

CYLINDER FORCE CALCULATIONS

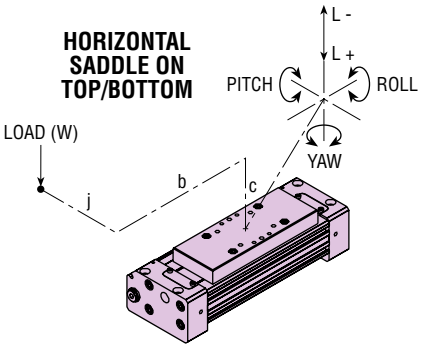
		IMPERIAL F = P x A	METRIC F = 0.1 x P x A
F =	Cylinder Force	lbs	N
P =	Operating Pressure	psi	bar
A =	Effective Area	in²	mm²
	(Extend or Retract)		

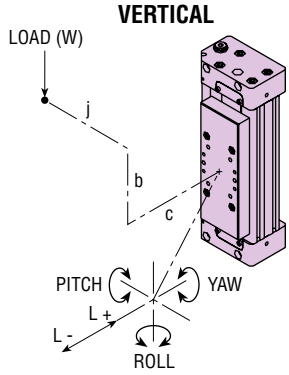
STATIC MOMENT CHART

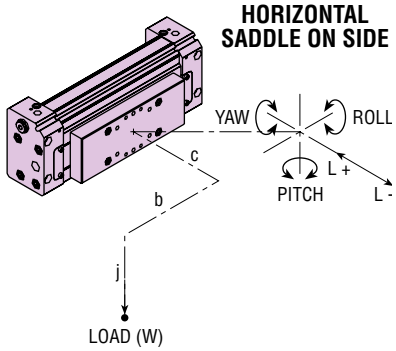
HORIZONTAL SADDLE TOP OR BOTTOM	VERTICAL	HORIZONTAL SADDLE ON SIDE
Mp (Pitch) = Load x b	Mp = Load x e	Mp = 0
My (Yaw) = 0	My = Load x j	My = Load x b
Mr (Roll) = Load x j	Mr = 0	Mr = Load x e

SIZE	"d" CONSTANT in	"d" CONSTANT mm
27	1.448	36.8
40	1.713	43.5

NOTE: e = c + d



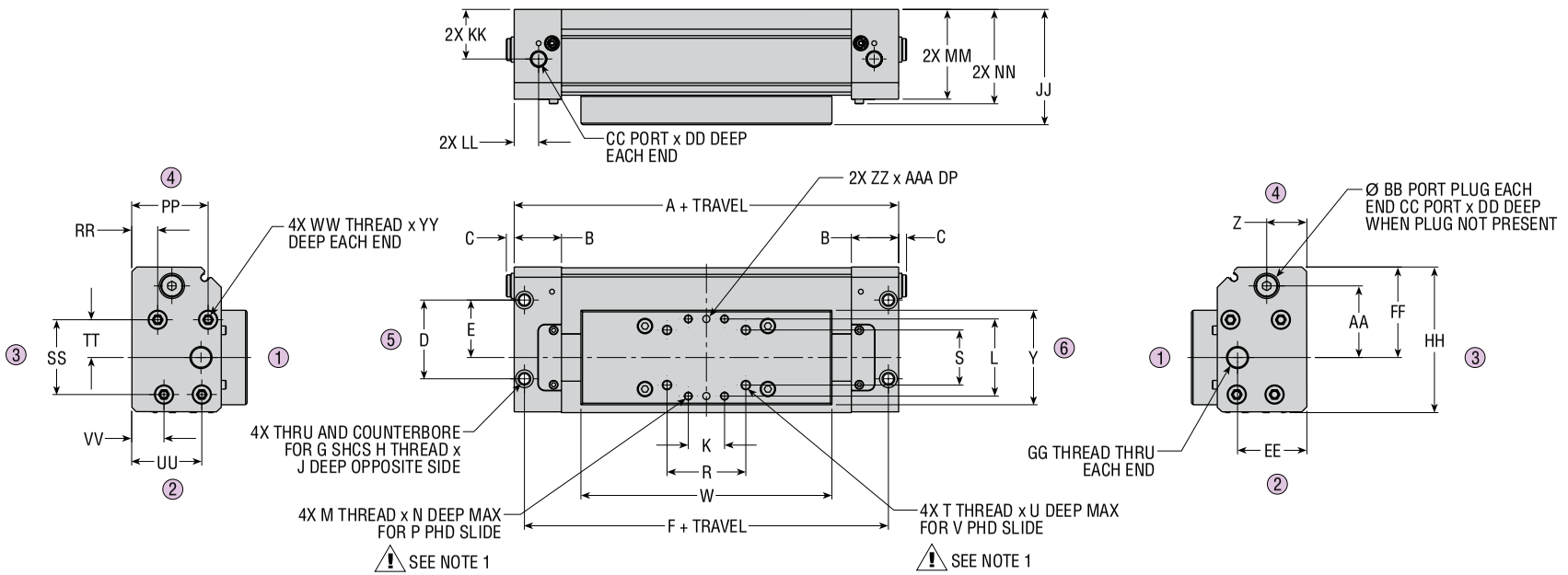




SIZING AND APPLICATION ASSISTANCE

See PHD Product Sizing Catalog for specific and complete sizing information.
Online sizing assistance is available at: ***www.phdinc.com/apps/sizing***

DIMENSIONS: SERIES SFP SLIDES



SIZE	LETTER DIMENSION															
	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S
27	9.606	1.181	.157	1.969	1.437	9.094	M6	M8 x 1.25	.394	.906	1.929	M5 x 0.8	.354	STPD516	1.969	1.378
	[244.0]	[30.0]	[4.0]	[50.0]	[36.5]	[231.0]	M6	M8 x 1.25	[10.0]	[23.0]	[49.0]	M5 x 0.8	[9.0]	STPD516	[50.0]	[35.0]
40	13.386	1.732	.157	2.520	1.878	12.441	M8	M10 x 1.50	.551	1.260	2.677	M6 x 1.0	.374	STPD525	2.283	1.417
	[340.0]	[44.0]	[4.0]	[64.0]	[47.7]	[316.0]	M8	M10 x 1.50	[14.0]	[32.0]	[68.0]	M6 x 1.0	[9.5]	STPD525	[58.0]	[36.0]

SIZE	LETTER DIMENSION														
	T	U	V	W	Y	Z	AA	BB	CC	DD	EE	FF	GG	HH	JJ
27	M6 X 1.0	.365	SK / SLxxx2	6.272	2.362	1.004	1.791	.472	1/8 BSPP	.216	1.732	2.264	M14 x 1.5	3.642	2.884
	M6 X 1.0	[9.3]	SK / SLxxx2	[159.3]	[60.0]	[25.5]	[45.5]	[12.0]	1/8 BSPP	[5.5]	[44.0]	[57.5]	M14 x 1.5	[92.5]	[73.3]
40	M10 x 1.5	.559	SK / SLxxx4	8.661	3.307	1.260	2.354	.688	1/4 BSPP	.394	2.441	3.126	M20 x 1.5	5.035	3.835
	M10 x 1.5	[14.2]	SK / SLxxx4	[220.0]	[84.0]	[32.0]	[59.8]	[17.5]	1/4 BSPP	[10.0]	[62.0]	[79.4]	M20 x 1.5	[127.9]	[97.4]

SIZE	LETTER DIMENSION														
	KK	LL	MM	NN	PP	RR	SS	TT	UU	VV	WW	YY	ZZ	ZZ TOL.	AAA
27	1.240	.610	2.244	2.359	1.909	.650	1.870	.945	1.752	.807	M5 x 0.8	.590	.19702	+.00030/-.00020	.197
	[31.5]	[15.5]	[57.0]	[59.9]	[48.5]	[16.5]	[47.5]	[24.0]	[44.5]	[20.5]	M5 x 0.8	[15.0]	[5.0043]	[+.0075/-.0051]	[5.0]
40	1.535	.945	2.992	3.146	2.657	.925	2.540	1.232	2.657	.925	M6 x 1.0	.945	.23639	+.00030/-.00020	.315
	[39.0]	[24.0]	[76.0]	[79.9]	[67.5]	[23.5]	[64.5]	[31.3]	[67.5]	[23.5]	M6 x 1.0	[24.0]	[6.0043]	[+.0075/-.0051]	[8.0]

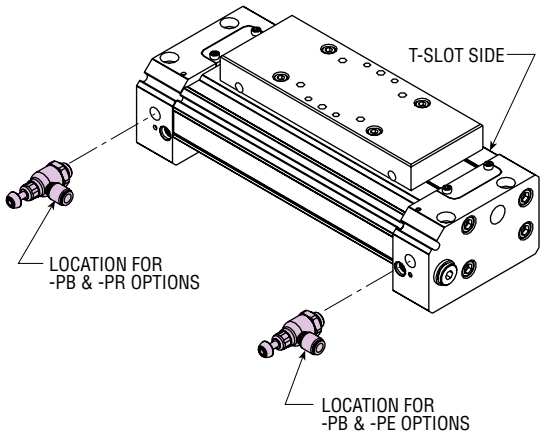
NOTES:
1) ⚠ CAUTION: THREADING FASTENERS DEEPER THAN SPECIFIED DEPTHS MAY ADVERSELY AFFECT UNIT PERFORMANCE.
2) NUMBERS IN [ ] ARE METRIC.

All dimensions are reference only unless specifically toleranced.

PB PORT CONTROLS ON EXTEND AND RETRACT

PR PORT CONTROLS ON RETRACT

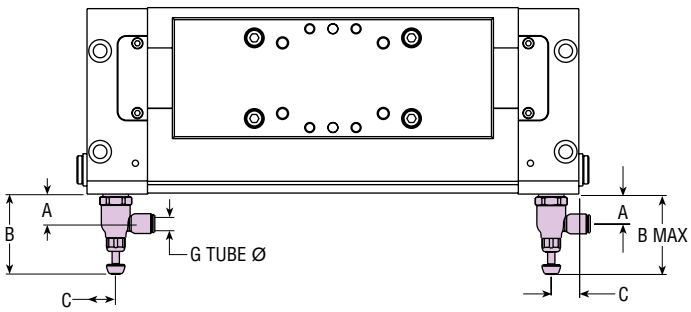
PE PORT CONTROLS ON EXTEND

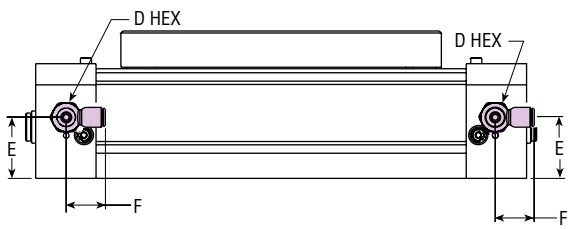


The PHD Series SFP Slide utilizes external compact banjo flow control fittings to adjust the saddle velocity. The control fittings are unidirectional flow control valves where intake air flows freely through the flow control and exhaust air is metered out through an adjustment screw. Intake capacity is slightly greater than the full open exhaust capacity, enabling maximum variation of saddle speeds.

The PHD Series SFP flow control fittings are supplied for direct mounting to the caps and provide integral tube fitting connection. They also swivel 360 degrees around the ports, easing tube routing installation. Saddle velocities are adjusted and maintained by the captivated fine adjustment screw with a locking nut, which ensures precise velocity control and repeatability.

Note: Flow control fitting is effective throughout the Series SFP temperature and pressure range.





SIZE	SPEED CONTROL REPLACEMENT KIT NO. METRIC	IMPERIAL
27	70696-03	70695-03
40	70696-06	70695-05

Kit includes flow control for one end.

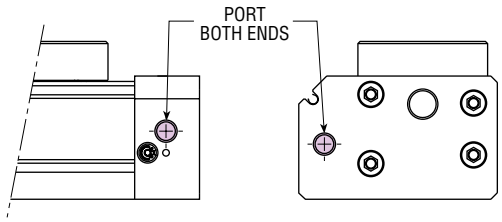
SIZE	LETTER DIMENSIONS A	B MAX	C	D HEX
27	.630 [16.0]	1. 730 [44.0]	.610 [15.5]	.630 [16.0]
40	.730 [18.5]	1.890 [48.0]	.945 [24.0]	.750 [19.0]

SIZE	E	F	STANDARD G	-L9 OPTION G
27	1.240 [31.5]	.870 [22.0]	[6.0]	.250
40	1.535 [39.0]	1.100 [28.0]	[8.0]	.375

Numbers in [ ] are metric.

L9 NPT PORTS

This option provides NPT ports instead of the standard BSPP ports. The NPT ports are located in the same location as the BSPP ports.



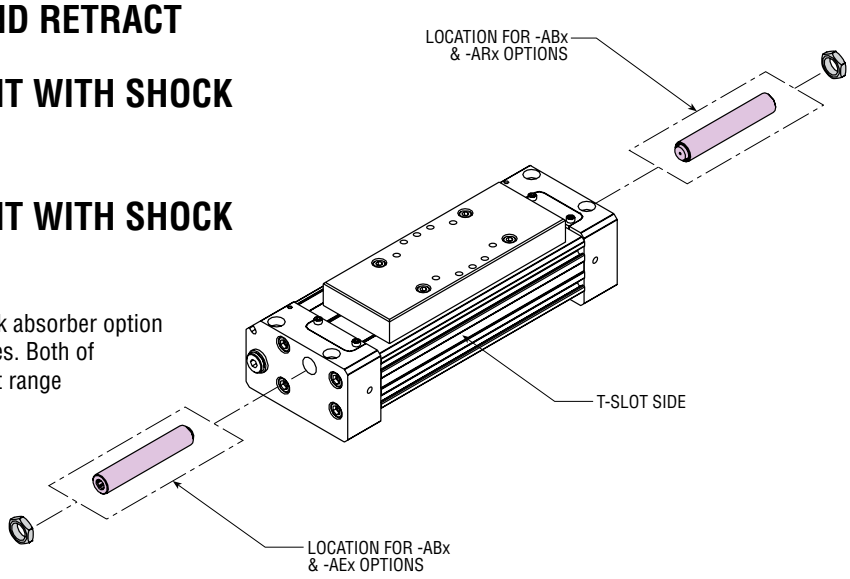
SIZE	PORT SIZE
27	1/8-27 NPT
40	1/4-18 NPT

NOTE: Port locations are the same as BSPP ports on page 2-84.

AB TRAVEL ADJUSTMENT WITH SHOCK PADS ON EXTEND AND RETRACT

AR TRAVEL ADJUSTMENT WITH SHOCK PADS ON RETRACT

AE TRAVEL ADJUSTMENT WITH SHOCK PADS ON EXTEND

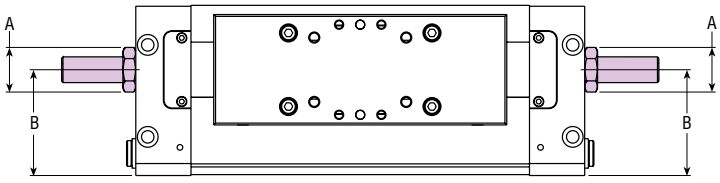


A travel adjustment option and/or a shock absorber option must be ordered with all PHD Series SFP Slides. Both of these mechanical stops provide an adjustment range of 0.55 in [14 mm] from each end of travel.

The travel adjustment screw works in conjunction with its specified cushion and is supplied with a shock pad, which provides quiet actuator operation. In more demanding applications, shock absorbers handle the energy dissipation.

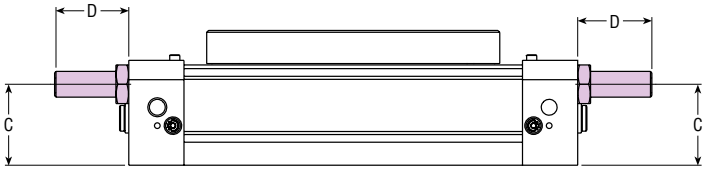
NOTE: Travel adjustment must be specified with corresponding cushion option, shown below.

Caution: Care should be taken to ensure that stopping is always accomplished with either Travel Adjustment Screws, Shock Absorbers, or customer applied tooling or fixturing.



SIZE	TRAVEL ADJUSTMENT REPLACEMENT KIT NO. -STD	-Z1 PLATING
27	72139-00	72139-03
40	72443-00	72443-03

Kit includes one travel adjustment screw and nut for one end.



SIZE	LETTER DIMENSIONS A	B	C	D
27	.955 [24.3]	2.264 [57.5]	1.732 [44.0]	.787 [20.0]
40	1.364 [34.6]	3.126 [78.4]	2.441 [62.0]	1.731 [44.0]

Numbers in [ ] are metric.

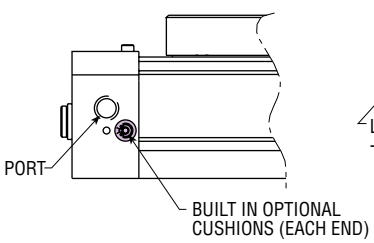
DB CUSHIONS ON EXTEND AND RETRACT

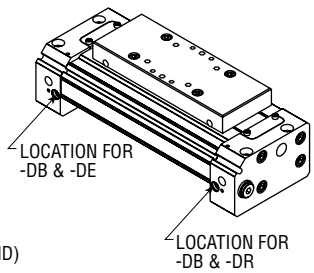
DR CUSHION ON RETRACT

DE CUSHION ON EXTEND

Optional adjustable cushions at each end of travel provide smooth deceleration of the applied load. Threaded cushion control needles, located on the side of the slide, provide a wide adjustment range making the cushion ideal for reduction of impact forces at the end of travel. **NOTE:** Cushion option must be specified with above corresponding travel adjustment option. See PHD Product Sizing Catalog for cushion capabilities.

CAUTION: The use of the travel adjustment screw will affect the kinetic energy capacity of the cushions. Therefore, to get the maximum capabilities from the cushion, specify the stroke of the slide to match the required travel of the application.



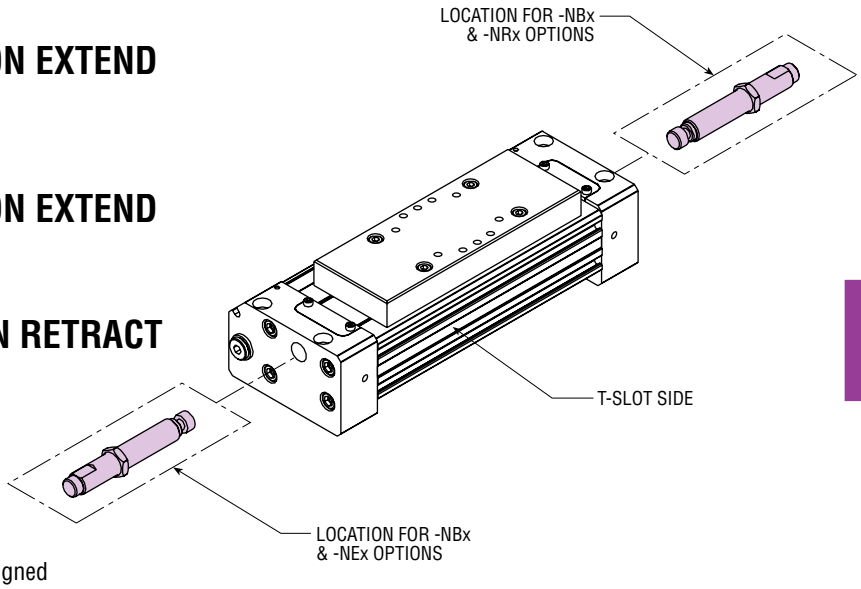


All dimensions are reference only unless specifically toleranced.

NBx SHOCK ABSORBER ON EXTEND AND RETRACT

NEx SHOCK ABSORBER ON EXTEND

NRx SHOCK ABSORBER ON RETRACT

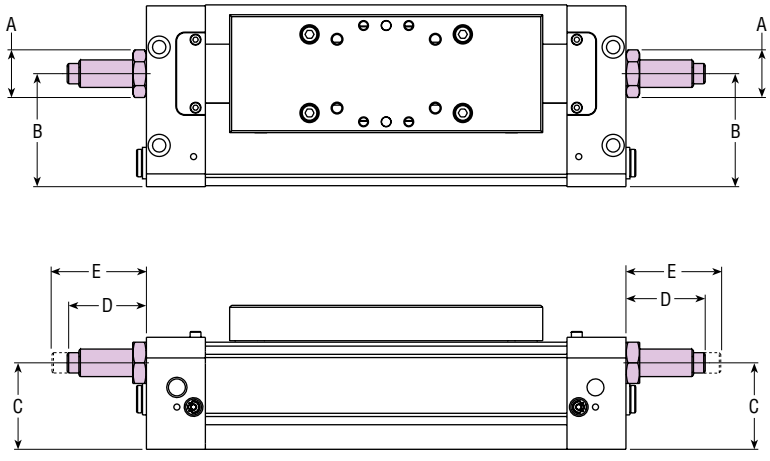


The shock absorber option and/or travel adjustment option must be ordered with all PHD Series SFP Slides. Both of these mechanical stops provide an adjustment range of 0.55 in [14 mm] from each end of stroke.

The hydraulic shock absorber options are designed for the maximum deceleration control and load stopping ability. The -NBx, -NEx, and -NRx options provide the Series SFP actuator with the hydraulic shock absorber factory installed. See PHD Product Sizing Catalog for details on shock absorber stopping capacity and to determine proper damping constant value (Damping constant NBx, NEx, NRx).

Caution: Care should be taken to ensure that stopping is always accomplished with either Travel Adjustment Screws, Shock Absorbers, or customer applied tooling or fixturing.

SIZE	AVAILABLE DAMPING CONSTANT NBx, NEx, NRx
27	2 = -02, 3 = -03, 5 = -05, 6 = -06
40	2 = -02, 3 = -03, 4 = -04



SIZE	SHOCK ABSORBER REPLACEMENT KIT NO.
27	63290-02-00-xx
40	63290-03-00-xx

Kit includes one shock and nut for one end.
-xx = Shock Damping Constant (See PHD Product Sizing Catalog)

SIZE	LETTER DIMENSIONS				
	A	B	C	D -2, -3, -4	E -5, -6
27	.955 [24.3]	2.264 [57.5]	1.732 [44.0]	1.390 [35.3]	1.660 [42.2]
40	1.364 [34.6]	3.126 [78.4]	2.441 [62.0]	1.66 [42.2]	— —

Numbers in [ ] are metric.

Z1 CORROSION RESISTANT PLATING

This option provides corrosion resistant plating on all externally exposed ferrous parts. This optional plating can be used to protect the slide from severe or corrosive environments.

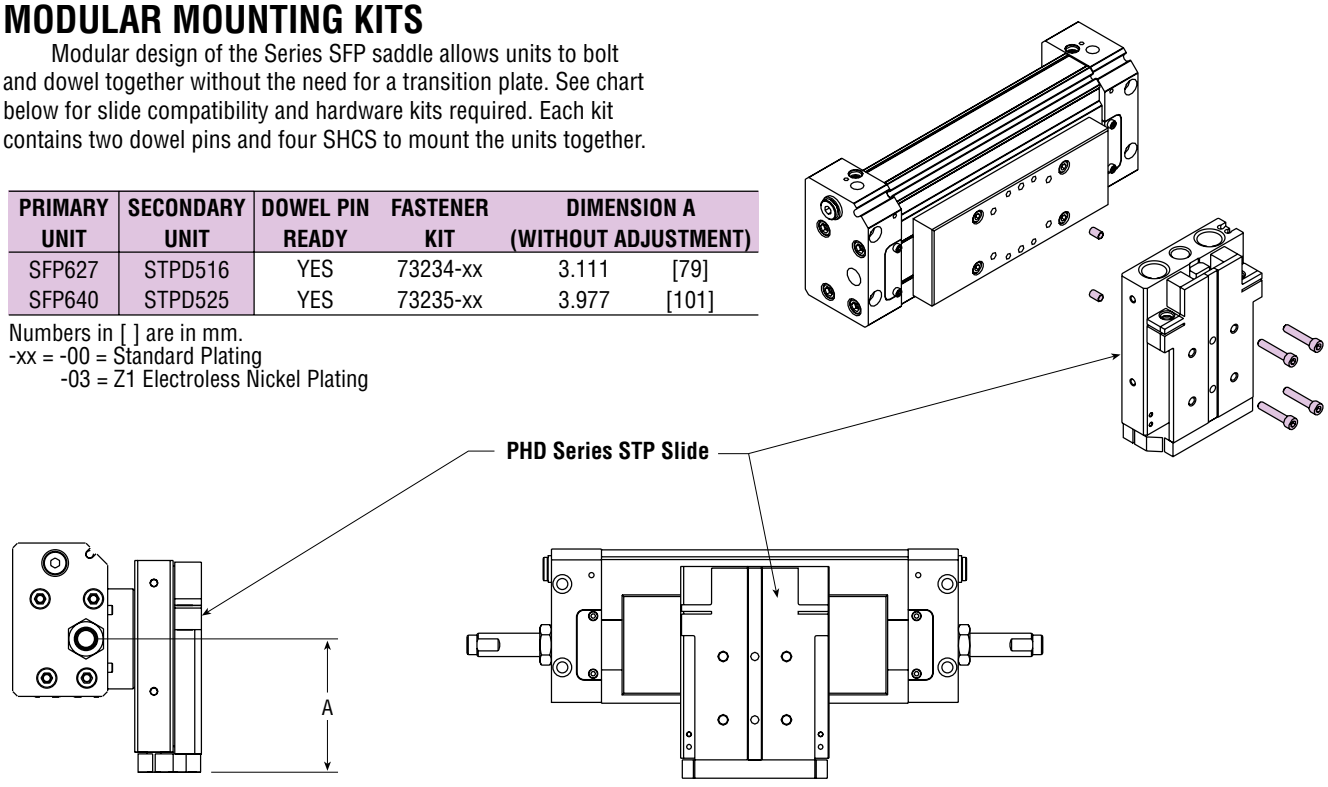
NOTE: Shock Absorbers are not plated with -Z1 option.

MODULAR MOUNTING KITS

Modular design of the Series SFP saddle allows units to bolt and dowel together without the need for a transition plate. See chart below for slide compatibility and hardware kits required. Each kit contains two dowel pins and four SHCS to mount the units together.

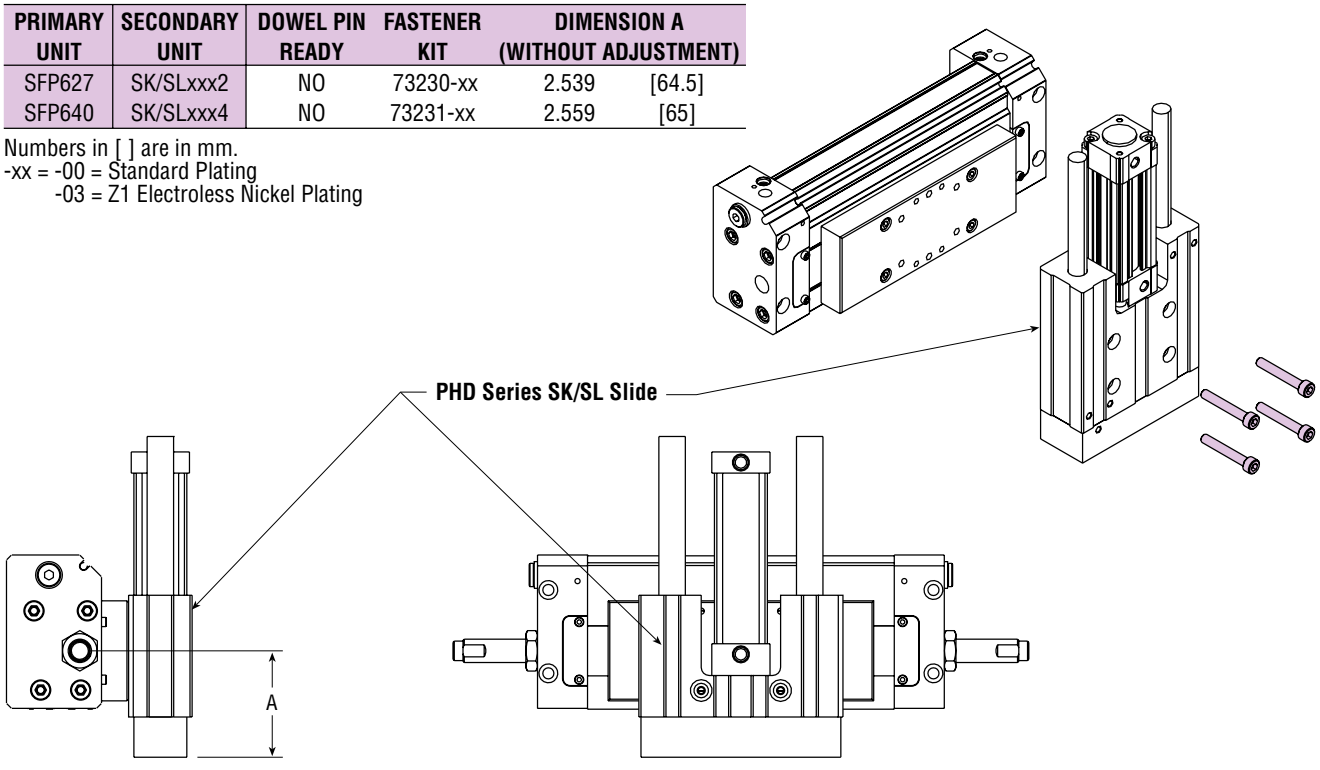
PRIMARY UNIT	SECONDARY UNIT	DOWEL PIN READY	FASTENER KIT	DIMENSION A (WITHOUT ADJUSTMENT)	
SFP627	STPD516	YES	73234-xx	3.111	[79]
SFP640	STPD525	YES	73235-xx	3.977	[101]

Numbers in [ ] are in mm.
-xx = -00 = Standard Plating
-03 = Z1 Electroless Nickel Plating



PRIMARY UNIT	SECONDARY UNIT	DOWEL PIN READY	FASTENER KIT	DIMENSION A (WITHOUT ADJUSTMENT)	
SFP627	SK/SLxxx2	NO	73230-xx	2.539	[64.5]
SFP640	SK/SLxxx4	NO	73231-xx	2.559	[65]

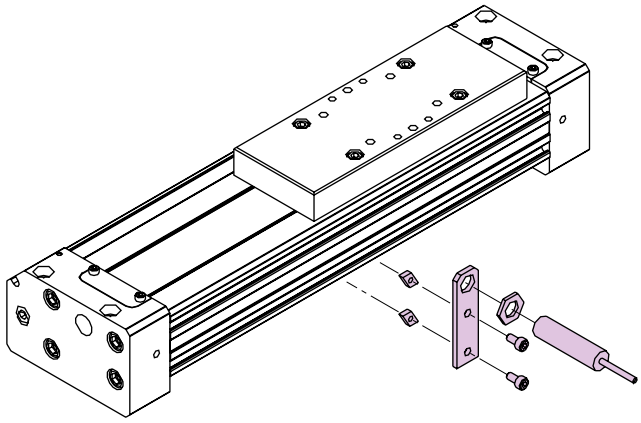
Numbers in [ ] are in mm.
-xx = -00 = Standard Plating
-03 = Z1 Electroless Nickel Plating

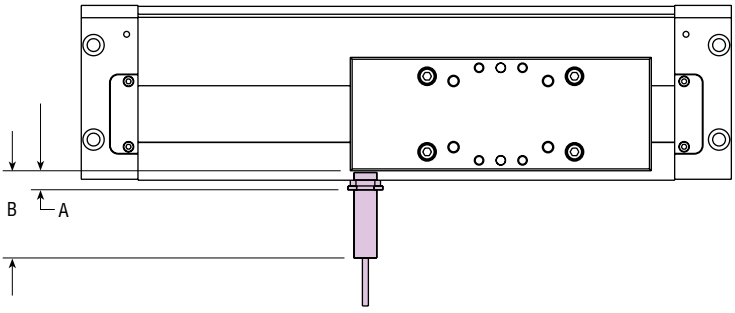


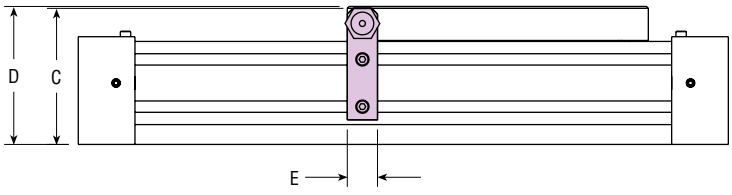
All dimensions are reference only unless specifically toleranced.

EXTERNAL PROXIMITY SWITCH READY BRACKETS

This accessory provides for external mounting of a 12 mm round metal sensing proximity switch. One switch mount kit is required per switch and includes the bracket with the required mounting hardware. The Series SFP Slide utilizes the t-slots on the side of the tube to attach the proximity mounting bracket. Proximity switches are ordered separately. See Switches and Sensors section.





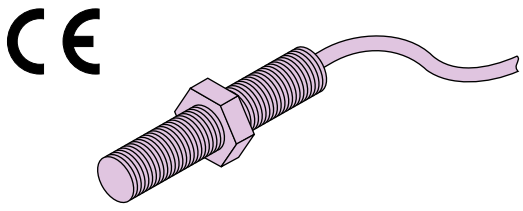


SIZE	LETTER DIMENSIONS				
	A	B	C	D	E
27	.396	2.192	2.835	2.884	.630
27	[10.1]	[55.7]	[72.0]	[73.3]	[16.0]
40	.376	2.132	3.702	3.846	.787
40	[9.6]	[54.6]	[94.0]	[97.7]	[20.0]

SIZE	PROXIMITY MOUNTING KIT (METRIC)
27	72137-xx
40	72441-xx

Kit includes hardware for one end.
Switches ordered separately.
-xx = -00 = Standard Plating
-03 = Z1 Electroless Nickel Plating

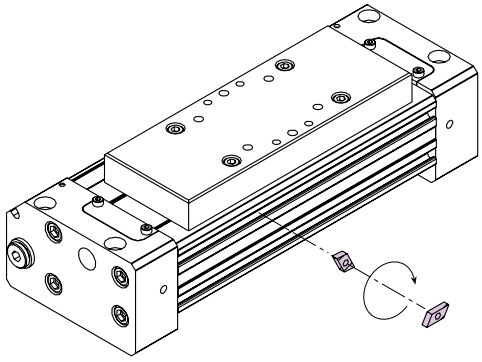
12 mm THREADED

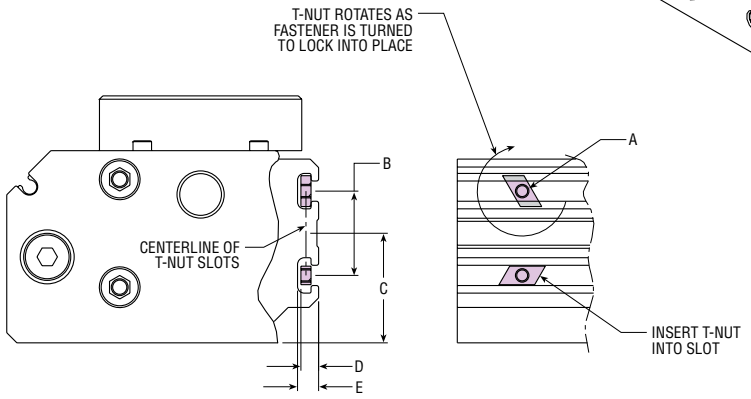


PART NO.	DESCRIPTION
15561-001	NPN (Sink) 10-30 VDC, 3 meter cable
15561-002	PNP (Source) 10-30 VDC, 3 meter cable
15561-003	20-250 VAC, 3 meter cable

T-NUTS

T-nuts allow attachment of switches, cable carriers, or other accessories to be easily mounted to the actuator. T-nuts can be positioned at any point along the t-slot grooves. The swiveling t-nut design allows insertion from the top of the slot. When the nut is tightened, it rotates into the locking position and securely clamps the bolted part.





SIZE	LETTER DIMENSIONS				
	A	B	C	D	E
27	M3 x 0.5	.984	1.280	.195	.246
27	M3 x 0.5	[25.0]	[32.5]	[5.0]	[6.2]
40	M5 x 0.8	1.181	1.732	.303	.386
40	M5 x 0.8	[30.0]	[44.0]	[7.7]	[9.8]

NOTE: Dimensions D and E are for minimum (D) and maximum (E) thread engagement.

SIZE	SWIVEL T-NUT (METRIC)
27	72128-xx
40	72129-xx

NOTE: Each number represents one T-Nut.
-xx = -00 = Standard Plating
-03 = Z1 Electroless Nickel Plating

SIZE	TORQUE	
	in-lb	Kgf-m
27	20	9.1
40	80	36.3

NOTE: Over torquing fastener may damage tube, t-nut, and/or fastener.

M MAGNET FOR PHD SERIES 6790 MINIATURE REED AND SOLID STATE SWITCHES

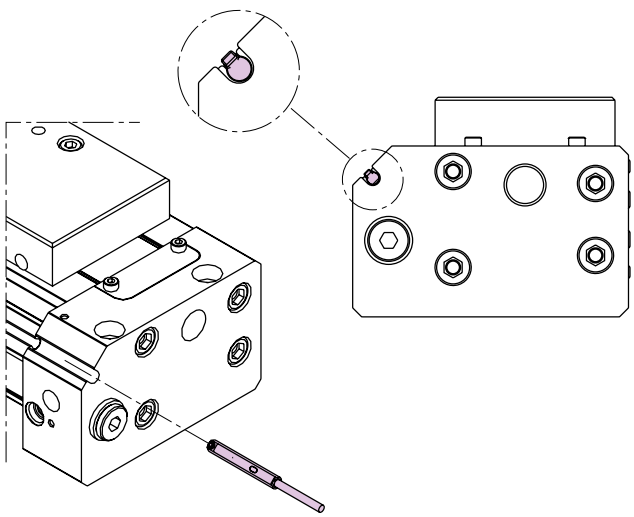
Series SFP Slides are optionally internally equipped with a magnet for use with PHD Series 6790 Switches. These switches mount easily to the unit using the switch slot on the side of the tube.

PHD Series 6790 Solid State and Reed Switches are designed specifically to provide an input signal to various types of programmable controllers or logic systems. See the Switches and Sensors section for complete switch specifications.

SERIES 6790 SWITCHES

PART NO.	DESCRIPTION
67902-1-02	NPN (Sink) or PNP (Source) DC Reed, 2 m cable
67902-1-05	NPN (Sink) or PNP (Source) DC Reed, 5 m cable
67903-1-02	NPN (Sink) DC Solid State, 2 m cable
67903-1-05	NPN (Sink) DC Solid State, 5 m cable
67904-1-02	PNP (Source) DC Solid State, 2 m cable
67904-1-05	PNP (Source) DC Solid State, 5 m cable
67922-1	NPN (Sink) or PNP (Source) DC Reed, Quick Connect
67929-2	AC Reed, Current Limited, Quick Connect
67923-1	NPN (Sink) DC Solid State, Quick Connect
67924-1	PNP (Source) DC Solid State, Quick Connect
63549-02	2 m Cordset with Quick Connect
63549-05	5 m Cordset with Quick Connect

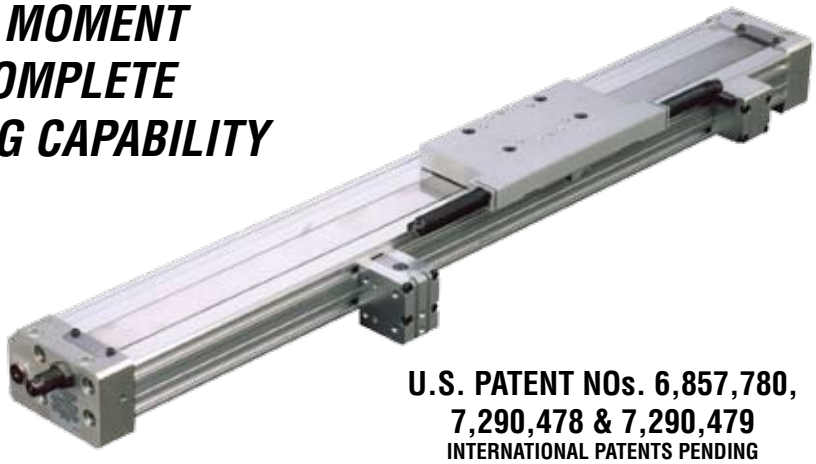
NOTES:
1) Switch set screw torque to 16 in-oz [.11 Nm] max.
2) See Switches and Sensors section for additional switch information and complete specification.



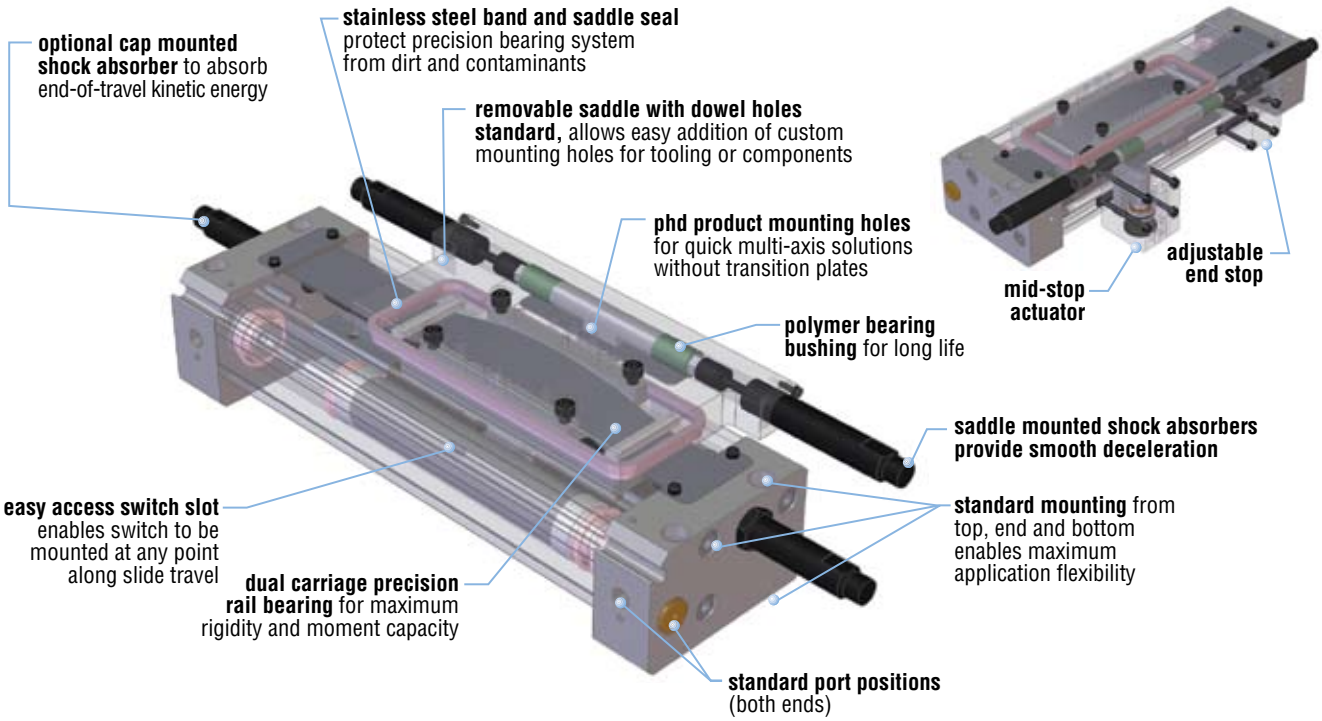
All dimensions are reference only unless specifically toleranced.

SFM

LOW DEFLECTION, HIGH MOMENT RODLESS SLIDE WITH COMPLETE INTERMEDIATE STOPPING CAPABILITY



U.S. PATENT NOs. 6,857,780, 7,290,478 & 7,290,479
INTERNATIONAL PATENTS PENDING



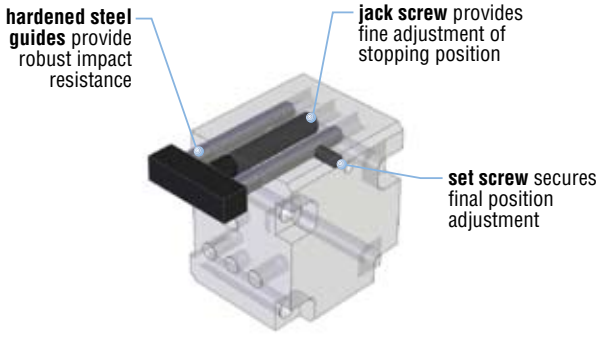
Major Benefits

- Modular multi-position stop system includes optional mid-stop actuator and adjustable end stop to support diverse applications.
- Multiple intermediate stopping positions are available, limited only by the length of the Series SFM Slide.

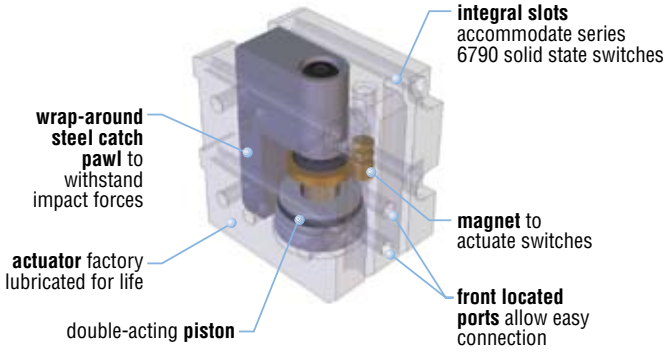
Industry Uses

- General automation
- Packaging
- Assembly machine builders
- Medical
- Semiconductor
- Optical
- Plastics
- Automotive

ADJUSTABLE END STOP -NNxx



MID-STOP ACTUATOR -NPxx



Adjustable End Stop

- Adjustable end stop can be used in combination with the saddle assembly shocks, eliminating the need for shocks in the end caps.
- Adjustable end stop can be positioned anywhere along the length of the slide to limit travel.
- Adjustable end stop can be used to provide fine adjustment of mid-stop actuator position.

Mid-Stop Actuator

- Mid-stop actuator stops the saddle assembly at intermediate positions along the length of the slide.
- Mid-stop actuator can be located anywhere along the entire length of the slide travel.
- Location of mid-stop actuator can be easily adjusted at any time.
- Double-acting for maximum flexibility in engaging and disengaging stop.
- Optional switches can be used to sense both engaged and disengaged condition of actuator.

SAFE OPERATION

Proper control valving is essential for safe and reliable operation of the Series SFM Slide! Only center pressurized (pressure center) or equivalent valving should be used to control Series SFM Slides. This product uses back-pressure on the exhaust side of the slide piston to regulate the speed of the saddle. The presence of adequate back-pressure is critical when the saddle stopped by a stop actuator is released. If the air opposite the pressurized side of the slide piston is exhausted to ambient pressure before the saddle is released, the saddle can rapidly accelerate to high velocity before sufficient back-pressure can build to regulate saddle speed. Use of center pressurized valving ensures that exhaust side air is always at full supply pressure prior to stop release.

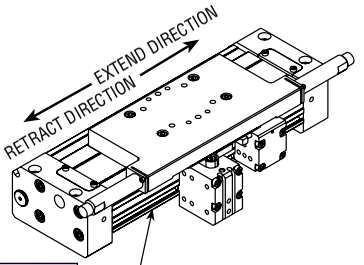
TO ORDER SPECIFY:
Product, Series, Type, Design No., Package Size, Travel, Mandatory/Required Options, and Options.

Mandatory/Required Options
See page 2-96 for valid option sequences.

PORTED MID-STOP (See Note 10)
NP1 x
Quantity of Stops
1 - 1 Stop
2 - 2 Stops
9 - 9 Stops

VALVE READY MID-STOP (See Note 10)
NP3 x
Quantity of Stops
1 - 1 Stop
2 - 2 Stops
9 - 9 Stops

CAP MOUNTED SHOCK ABSORBER/PLUG (See Note 6.)
NT x x
Extend Direction of Travel
0 - Plug installed (no shock absorber)
* - Shock absorber installed with *damping constant value (no plug)
Retract Direction of Travel
0 - Plug installed (no shock absorber)
* - Shock absorber installed with *damping constant value (no plug)



PRODUCT
S - Slide

TYPE
M - Multi-position adjustable stop slide, normal duty, ground profile rail

PACKAGE SIZE
BORE
27 mm
40 mm

ADJUSTABLE END STOP (See Note 6.)
NN x x
Extend Direction of Travel
0 - No end stop provided
1 - End stop provided
Retract Direction of Travel
0 - No end stop provided
1 - End stop provided

EXTERNAL FLOW CONTROL
PB - Flow controls installed in both directions
PE - Flow controls installed on extend
PR - Flow controls installed on retract

S F M 5 27 x 50 – NP14 – NN01 – NM22 – NT20 – PB – M

SERIES
F - Pneumatic Rodless

DESIGN NO.
5 - Metric

METRIC TRAVEL
STANDARD TRAVEL LENGTHS
(50 mm minimum travel in 25 mm Increments)

Size	Travel
527	50 mm - 1800 mm
540	50 mm - 3400 mm

SADDLE MOUNTED SHOCK ABSORBER FOR USE WITH ADJUSTABLE STOPS (END AND MID STOPS)
NM x x
Extend Direction of Travel
* - Shock absorber installed in with * damping constant value
Retract Direction of Travel
* - Shock absorber installed with * damping constant value

SLIDE OPTIONS
M - Magnets for use with PHD 6790 Switches
Z1 - Corrosion resistant plating on ferrous parts
L9 - NPT ports

SERIES 6790 SWITCHES

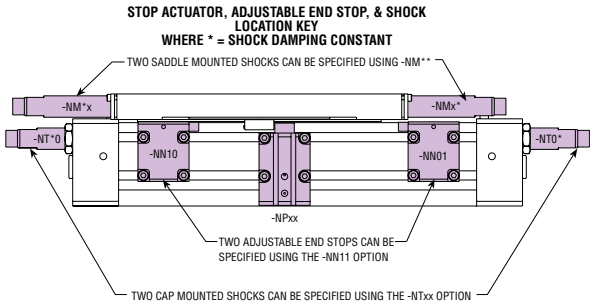
PART NO.	DESCRIPTION
67902-1-02	NPN (Sink) or PNP (Source) DC Reed, 2 m cable
67902-1-05	NPN (Sink) or PNP (Source) DC Reed, 5 m cable
67903-1-02	NPN (Sink) DC Solid State, 2 m cable
67903-1-05	NPN (Sink) DC Solid State, 5 m cable
67904-1-02	PNP (Source) DC Solid State, 2 m cable
67904-1-05	PNP (Source) DC Solid State, 5 m cable
67922-1	NPN (Sink) or PNP (Source) DC Reed, Quick Connect
67929-2	AC Reed, Current Limited, Quick Connect
67923-1	NPN (Sink) DC Solid State, Quick Connect
67924-1	PNP (Source) DC Solid State, Quick Connect
63549-02	2 m Cordset with Quick Connect
63549-05	5 m Cordset with Quick Connect

NOTES:
1) Switches must be ordered separately.
2) Option -M required to operate Series 6790 solid state switch with slide saddle.
3) Option -NP3x required to manifold mount MAC Series 43 valve to mid-stop actuator.
4) At least one mid-stop actuator (option -NPx1) or one adjustable end stop (option -NNx1 or option -NN1x) must be ordered with slide.
5) Saddle mounted shock absorbers (option -NMxx) are required (mandatory option).
6) Either cap mounted shock absorber (option -NTxx) or adjustable end stop (option -NNxx) must be ordered for each direction of saddle travel.
7) Saddle dowel holes are standard.
8) Modular mounting interface with PHD Series STP and SK/SL Slides is standard.
9) Mounting on top, bottom, ends, and T-slots is standard.
10) Leave blank if option is not required. Both options may be ordered together (must be specified separately). Example: -NP12-NP31-

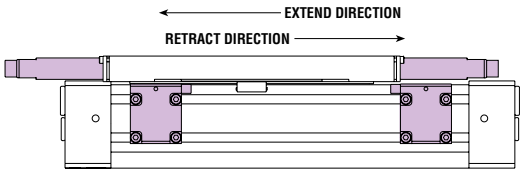
PHD UNLIMITED UNIQUE SOLUTIONS

UNIQUE SLIDES ARE AVAILABLE. PLEASE CONSULT PHD.

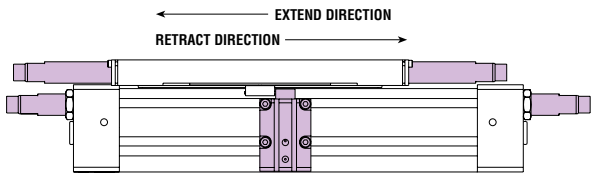
Options may affect unit length. See unit dimension and options pages for adders.



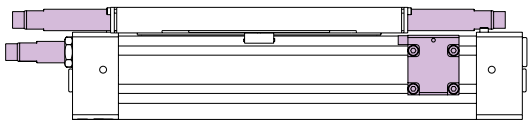
The figures below can be used to determine the proper option ordering sequence for a desired slide configuration. Find the combination of mid-stop actuator and/or adjustable end-stops that fit your application and read the option sequence below the corresponding figure. **Note:** -NMxx option must be ordered. Either -NNxx or -NTxx option must be ordered for each direction of saddle travel.



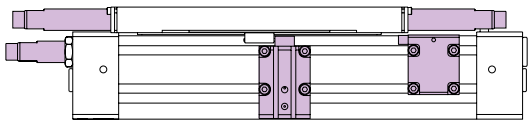
-NN11 - NM**



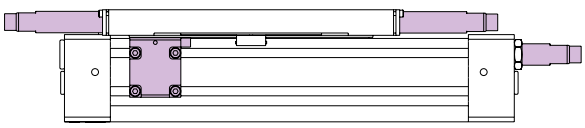
-NPxx -NM - NT****



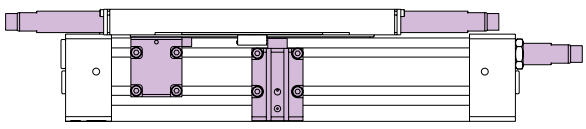
-NN01 - NM - NT*0**



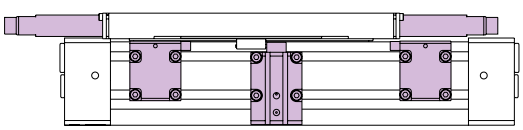
-NPxx - NN01 - NM - NT*0**



-NN10 - NM - NT0***



-NPxx - NN10 - NM - NT0***



-NPxx - NN11 - NM**

SPECIFICATIONS	SERIES SFM
OPERATING PRESSURE	36 psi min to 116 psi max [2.5 bar min to 8 bar max] air
OPERATING TEMPERATURE	41° to 140°F [5° to 60°C]
TRAVEL TOLERANCE	+.12/-.00 in [+3.0/-0.0 mm]
REPEATABILITY	±0.0016 in [±0.04 mm] of original position
VELOCITY	4 to 60 in/sec [.1 to 1.5 m/sec]
LUBRICATION	Factory lubricated for life
MAINTENANCE	Field repairable

SIZE	MAXIMUM TRAVEL in	MAXIMUM TRAVEL mm	BORE DIAMETER in	BORE DIAMETER mm	EFFECTIVE AREA in²	EFFECTIVE AREA mm²	BASE WEIGHT lb	BASE WEIGHT kg	ADDER WEIGHT (per 25 mm) lb	ADDER WEIGHT (per 25 mm) kg	TYPICAL DYNAMIC LOAD lb	TYPICAL DYNAMIC LOAD N	MOVING SADDLE lb	MOVING SADDLE kg
27	70.8	1800	1.06	27	.88	570	7.9	3.58	0.37	0.17	0 - 100	0 - 440	3.0	1.36
40	133.8	3400	1.57	40	1.95	1260	21.6	9.80	0.71	0.32	20 - 250	89 - 1100	8.0	3.63

NOTE: Thrust capacity, allowable mass and dynamic moment capacity must be considered when selecting a slide.

MAXIMUM BEARING CAPACITY

SIZE	LOAD lb	LOAD N	PITCH MOMENT in-lb	PITCH MOMENT Nm	YAW MOMENT in-lb	YAW MOMENT Nm	ROLL MOMENT in-lb	ROLL MOMENT Nm
27	946	4208	460	52.0	460	52.0	299	33.8
40	1971	3767	1535	173.4	1535	173.4	911	102.9

FORCE TABLE

DIRECTION	SFM527 lb/psi	SFM527 N/bar	SFM540 lb/psi	SFM540 N/bar
Extend	.887	57.3	1.948	125.7
Retract	.887	57.3	1.948	125.7

CYLINDER FORCE CALCULATIONS

	IMPERIAL F = P x A	METRIC F = 0.1 x P x A
F = Cylinder Force	lbs	N
P = Operating Pressure	psi	bar
A = Effective Area (Extend or Retract)	in²	mm²

STATIC MOMENT CAPACITY

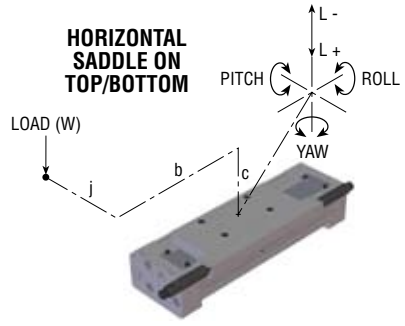
HORIZONTAL SADDLE TOP OR BOTTOM	VERTICAL	HORIZONTAL SADDLE ON SIDE
Mp (Pitch) = Load x b	Mp = Load x e	Mp = 0
My (Yaw) = 0	My = Load x j	My = Load x b
Mr (Roll) = Load x j	Mr = 0	Mr = Load x e

NOTE: Values apply when stopping with cap mounted shock absorbers. See PHD product sizing catalog for detailed information on calculating static moments at all stopping positions.

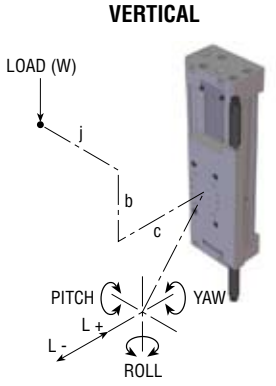
SIZE	"d" CONSTANT in	"d" CONSTANT mm
27	1.448	36.8
40	1.713	43.5

NOTE: e = c + d

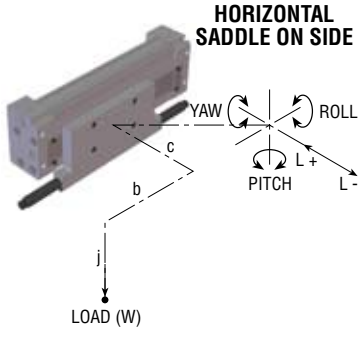
HORIZONTAL SADDLE ON TOP/BOTTOM



VERTICAL



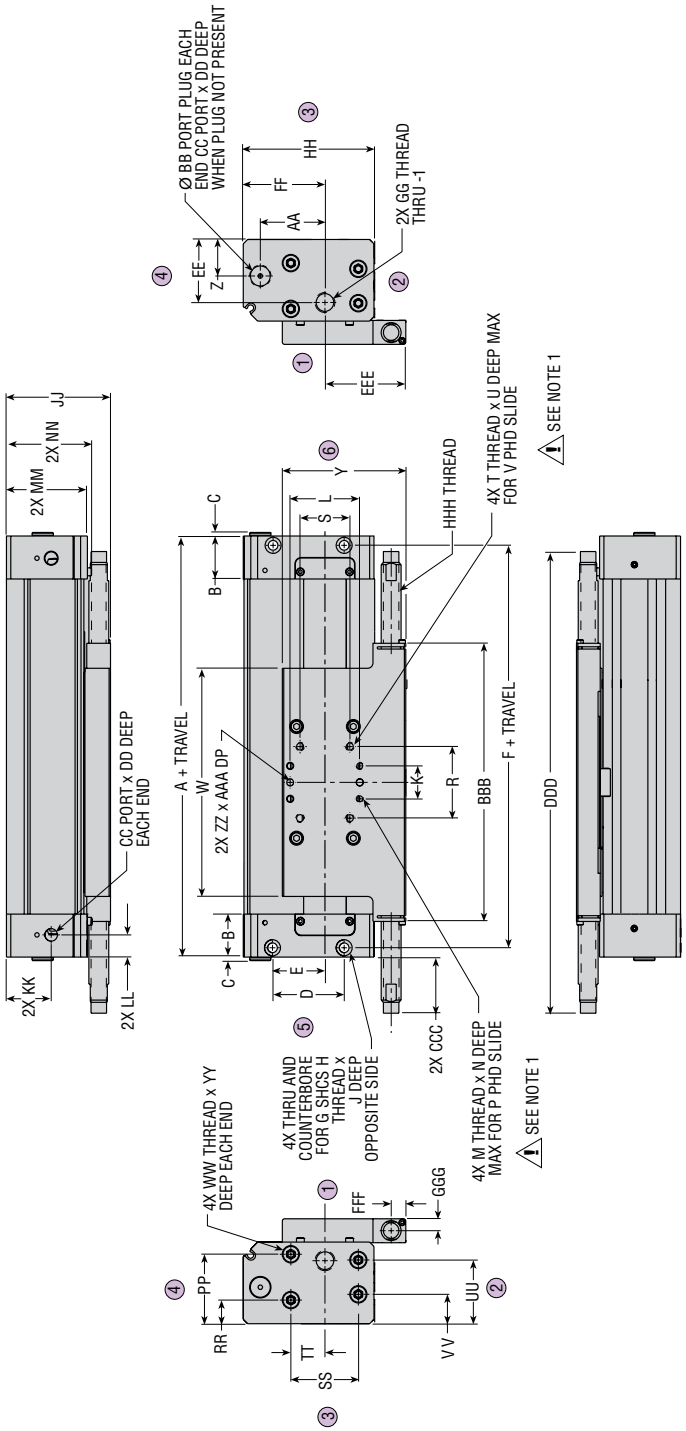
HORIZONTAL SADDLE ON SIDE



SIZING AND APPLICATION ASSISTANCE

See PHD Product Sizing Catalog for specific and complete sizing information. Online sizing assistance is available at: ***www.phdinc.com/apps/sizing***

DIMENSIONS: SERIES SFM SLIDES



SIZE	LETTER DIMENSION																			
	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T			
27	9.606	1.181	.098	1.969	1.437	9.094	M6	M8 x 1.25	.394	.906	1.929	M5 x 0.8	.354	STPD516	1.969	1.378	M6 x 1.0			
	[244.0]	[30.0]	[2.5]	[50.0]	[36.5]	[231.0]	M6	M8 x 1.25	[10.0]	[23.0]	[49.0]	M5 x 0.8	[9.0]	STPD516	[50.0]	[35.0]	M6 x 1.0			
40	13.386	1.732	.118	2.520	1.878	12.441	M8	M10 x 1.50	.551	1.260	2.677	M6 x 1.0	.374	STPD525	2.283	1.417	M10 x 1.5			
	[340.0]	[44.0]	[3.0]	[64.0]	[47.7]	[316.0]	M8	M10 x 1.50	[14.0]	[32.0]	[68.0]	M6 x 1.0	[9.5]	STPD525	[58.0]	[36.0]	M10 x 1.5			

SIZE	LETTER DIMENSION																			
	U	V	W	Y	Z	AA	BB	CC	DD	EE	FF	GG	HH	JJ	KK	LL	MM			
27	.365	SK / SLxxx2	6.272	3.421	1.004	1.791	.590	1/8 BSPP	.216	1.732	2.264	M14 x 1.5	3.642	2.884	1.240	.610	2.244			
	[9.3]	SK / SLxxx2	[159.3]	[86.9]	[25.5]	[45.5]	[15.0]	1/8 BSPP	[5.5]	[44.0]	[57.5]	M14 x 1.5	[92.5]	[73.3]	[31.5]	[15.5]	[57.0]			
40	.559	SK / SLxxx4	8.661	4.508	1.260	2.354	.945	1/4 BSPP	.394	2.441	3.126	M20 x 1.5	5.035	3.835	1.535	.945	2.992			
	[14.2]	SK / SLxxx4	[220.0]	[114.5]	[32.0]	[59.8]	[23.5]	1/4 BSPP	[10.0]	[62.0]	[79.4]	M20 x 1.5	[127.9]	[97.4]	[39.0]	[24.0]	[76.0]			

SIZE	LETTER DIMENSION																			
	NN	PP	RR	SS	TT	UU	VV	WW	YY	ZZ	ZZ TOL.	AAA	BBB	CCC	DDD	EEE	FFF	GGG	HHH	
27	2.359	1.909	.650	1.870	.945	1.752	.807	M5 x 0.8	.590	.19702	+.00030/-.00020	.197	7.647	1.851	13.307	2.240	.228	.325	M14 x 1.5	
	[59.9]	[48.5]	[16.5]	[47.5]	[24.0]	[44.5]	[20.5]	M5 x 0.8	[15.0]	[5.0043]	[+.0075/-.0051]	[5.0]	[194.2]	[47.0]	[338.0]	[56.9]	[5.8]	[8.25]	M14 x 1.5	
40	3.146	2.657	.925	2.540	1.232	2.657	.925	M6 x 1.0	.945	.23639	+.00030/-.00020	.315	9.661	.528	14.441	2.854	.456	.527	M20 x 1.5	
	[79.9]	[67.5]	[23.5]	[64.5]	[31.3]	[67.5]	[23.5]	M6 x 1.0	[24.0]	[6.0043]	[+.0075/-.0051]	[8.0]	[245.4]	[13.4]	[366.8]	[72.5]	[11.5]	[13.4]	M20 x 1.5	

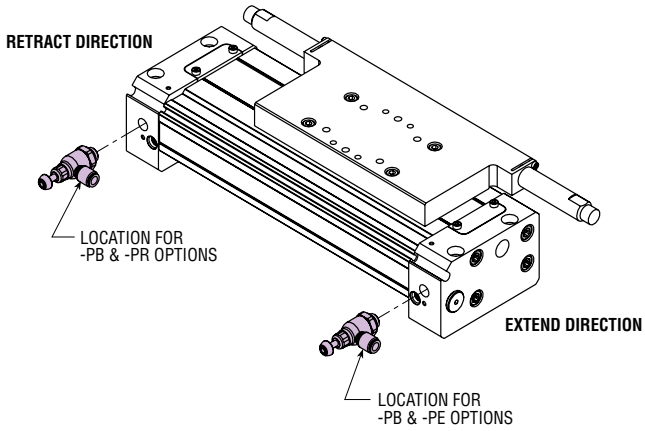
NOTES:
1) ⚠ CAUTION: THREADING FASTENERS DEEPER THAN SPECIFIED DEPTHS MAY ADVERSELY AFFECT UNIT PERFORMANCE.
2) NUMBERS IN [ ] ARE METRIC.
3) DIMENSIONS CCC AND DDD FOR SIZE 27 APPLY TO -05 AND -06 SHOCK ABSORBERS.

All dimensions are reference only unless specifically toleranced.

PB FLOW CONTROLS ON EXTEND AND RETRACT

PR FLOW CONTROLS ON RETRACT

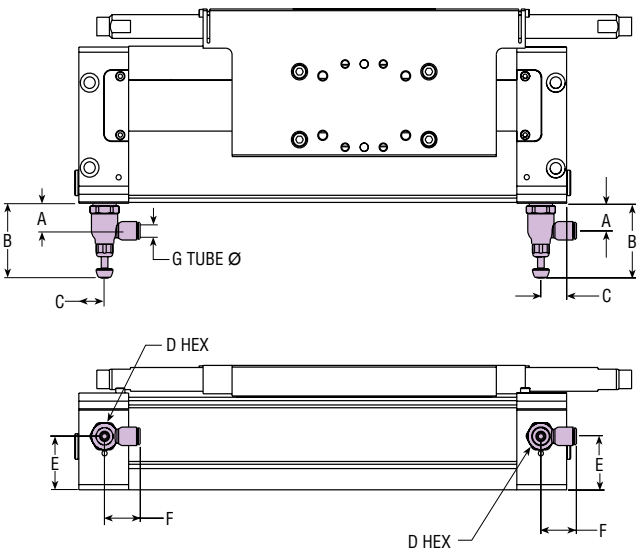
PE FLOW CONTROLS ON EXTEND



The PHD Series SFM Slide utilizes external compact banjo flow control fittings to adjust the saddle velocity. The control fittings are unidirectional flow control valves where intake air flows freely through the flow control and exhaust air is metered out through an adjustment screw. Intake capacity is slightly greater than the full open exhaust capacity, enabling maximum variation of saddle speeds.

The PHD Series SFM flow control fittings are supplied for direct mounting to the caps and provide integral tube fitting connection. They also swivel 360 degrees around the ports, easing tube routing installation. Saddle velocities are adjusted and maintained by the captivated fine adjustment screw with a locking nut, which ensures precise velocity control and repeatability.

Note: Flow control fitting is effective throughout the Series SFM temperature and pressure range.



SIZE	SPEED CONTROL REPLACEMENT KIT NO. METRIC	IMPERIAL
27	70696-03	70695-03
40	70696-06	70695-05

Kit includes flow control for one end.

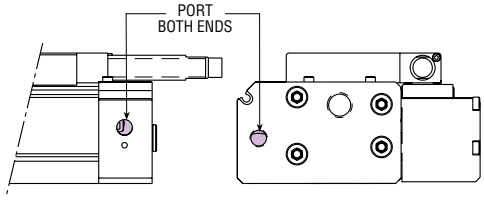
SIZE	LETTER DIMENSIONS A	B MAX	C	D HEX
27	.630 [16.0]	1.730 [44.0]	.610 [15.5]	.630 [16.0]
40	.730 [18.5]	1.890 [48]	.945 [24.0]	.750 [19.0]

SIZE	E	F	STANDARD G	-L9 OPTION G
27	1.240 [31.5]	.870 [22.0]	[6.0]	1/4
40	1.535 [39.0]	1.100 [28.0]	[8.0]	3/8

Numbers in [ ] are metric.

L9 NPT PORTS

This option provides NPT ports instead of the standard BSPP ports. The NPT ports are located in the same location as the BSPP ports.



SIZE	PORT SIZE
27	1/8-27 NPT
40	1/4-18 NPT

NOTE: Port locations are the same as BSPP ports on page 7.

Z1 CORROSION RESISTANT PLATING

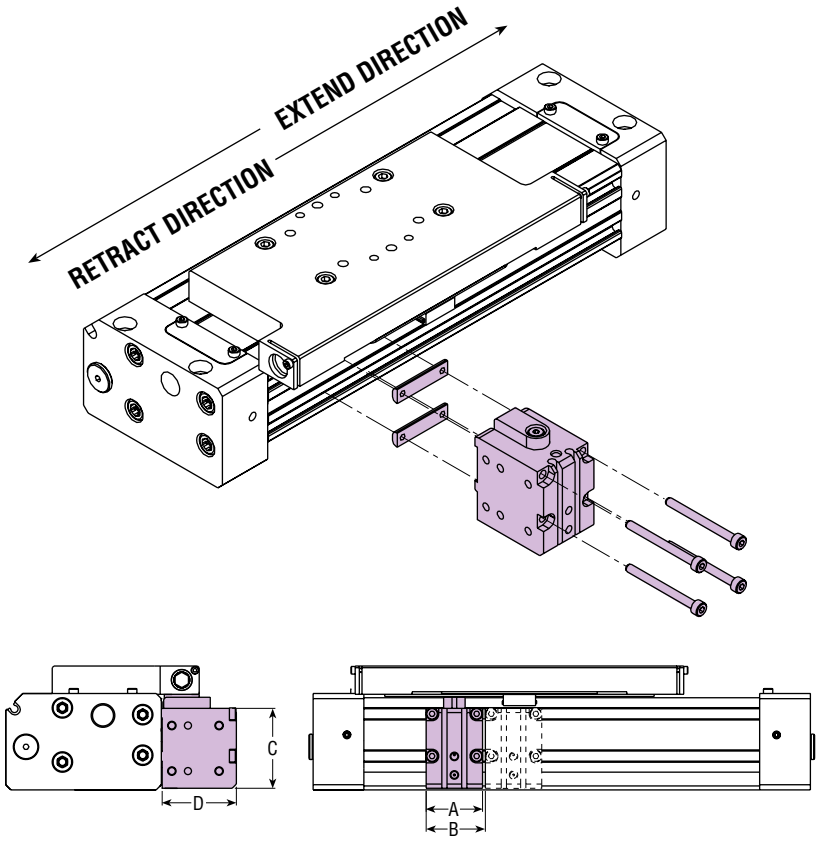
This option provides corrosion resistant plating on all externally exposed ferrous parts. This optional plating can be used to protect the slide from severe or corrosive environments.

NOTE: Shock Absorbers are not plated with -Z1 option.

NP1x PORTED MID-STOP ACTUATOR

NP3x VALVE READY MID-STOP ACTUATOR

This option provides mid-stop actuators to stop the saddle at intermediate positions of travel. Actuators are double-acting for flexible system configuration and can stop the saddle in both directions of travel. Actuators can be positioned anywhere along the length of travel. Ported version (-NP1x) accepts standard 10-32 [M5] threaded fittings. Valve-ready version (-NP3x) directly interfaces to MAC 43A-AAA-Rxxx-xxx valve with included valve mounting kit. (Valves must be ordered separately from your MDN Distributor.) Mid-stop actuators are switch ready with internal magnet to actuate PHD Series 6790 Solid State Switches. (Series 6790 Reed Switches are not compatible with Series SFM Slide.) Actuators with associated mounting hardware are packed with the slide, ready for installation onto the slide at desired intermediate stopping positions.



SIZE	LETTER DIMENSIONS			
	A	B (min)	C	D
27	1.313 [33.4]	1.378 [35.0]	1.860 [47.2]	1.727 [43.9]
40	1.500 [38.1]	1.575 [40.0]	2.050 [52.1]	1.727 [43.9]

NOTES:
1) Numbers in [ ] are in mm.
2) Dimension B refers to spacing between adjacent stops.

OPTION CODE

-NP x x

- Stop Type: 1 = Ported, 3 = Valve Ready
- Quantity of Stops: 1 = 1 Stop, 2 = 2 Stops … 9 = 9 Stops

All dimensions are reference only unless specifically toleranced.

NN10 ADJUSTABLE END STOP IN EXTEND DIRECTION

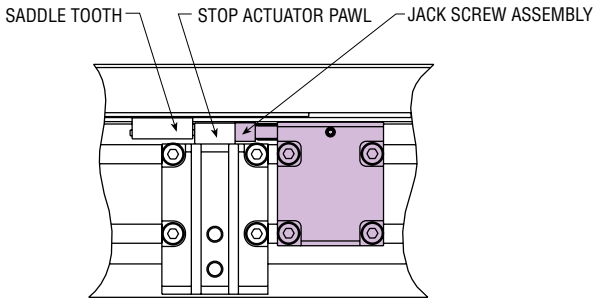
NN01 ADJUSTABLE END STOP IN RETRACT DIRECTION

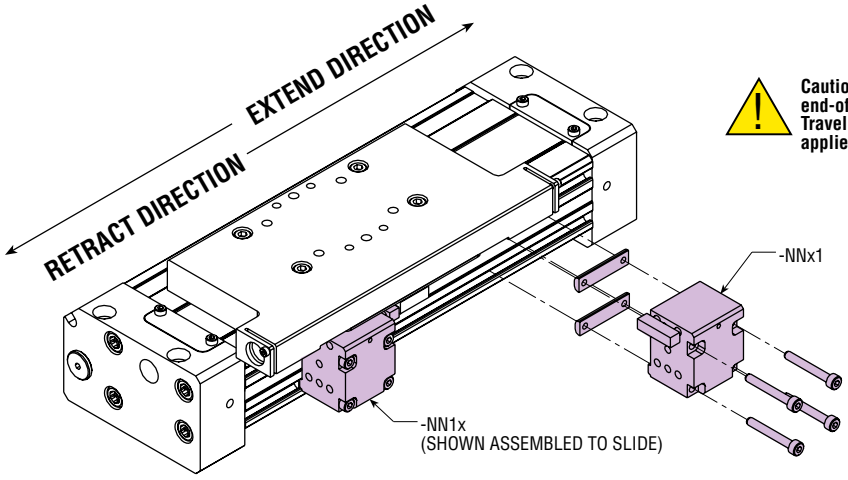
NN11 ADJUSTABLE END STOP IN BOTH DIRECTIONS

This option provides adjustable end stops to control the end-of-travel stopping position. The end stop can be positioned anywhere along the length of travel and features an additional ±0.118 in [3 mm] of fine position adjustment once the stop has been mounted to the slide. A single adjustable end stop can also be used to provide ±0.118 in [3 mm] of fine position adjustment for multiple mid-stop actuators. End stops with associated mounting hardware are packed with the slide, ready for installation onto the slide at desired end-of-travel stopping positions.

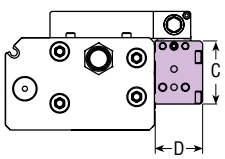
FINE POSITIONING STOP ACTUATOR WITH ADJUSTABLE END STOP

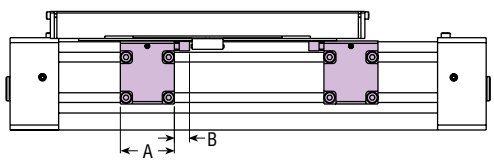
- Locate stop actuator at approximate desired mounting location
- Snug stop actuator fasteners leaving stop actuator free to slide
- Firmly mount adjustable end stop next to stop actuator
- Pressurize slide to push saddle against stop actuator pawl
- Adjust jack screw of end stop to fine position stop actuator pawl
- Tighten stop actuator fasteners to secure and remove end stop





Caution: Care should be taken to ensure that stopping at end-of-travel position is always accomplished with either Travel Adjustment Screws, Shock Absorbers, or customer applied tooling or fixturing.





SIZE	LETTER DIMENSIONS			
	A	B (RANGE)	C	D
27	1.313 [33.4]	.250 - .485 [6.4 - 12.3]	1.533 [38.9]	1.152 [29.3]
40	1.500 [38.1]	.375 - .611 [9.5 - 15.5]	1.920 [48.8]	1.288 [32.7]

Numbers in [ ] are in mm.

OPTION CODE

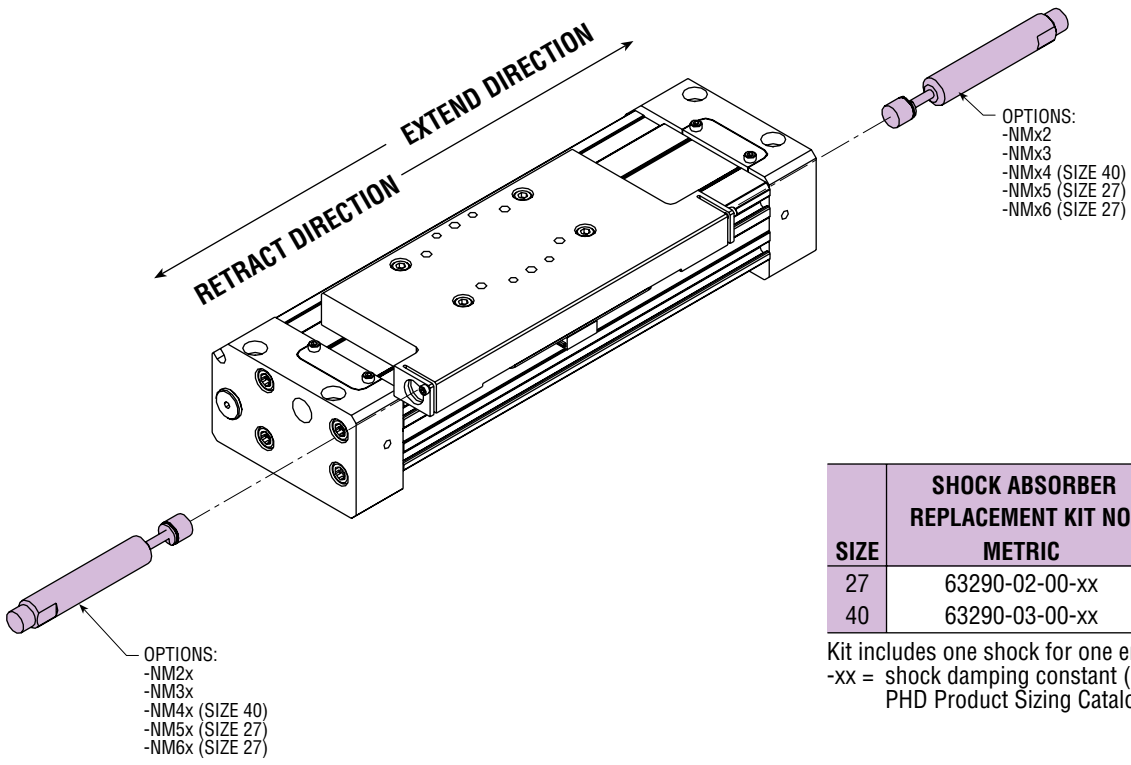
-NN x x

- First x: Extend Direction of Travel — 0 = No end stop provided; 1 = End stop provided
- Second x: Retract Direction of Travel — 0 = No end stop provided; 1 = End stop provided

All dimensions are reference only unless specifically toleranced.

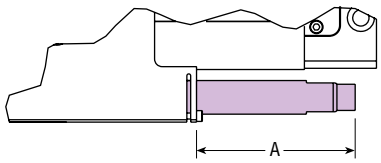
NMxx SADDLE MOUNTED SHOCK ABSORBER

This option must be ordered. See Ordering Data section for additional information on how to specify -NMxx option. See PHD Product Sizing Catalog or product sizing software for details on shock absorber stopping capacity and to determine the proper damping constant value.



SIZE	SHOCK ABSORBER REPLACEMENT KIT NO. METRIC
27	63290-02-00-xx
40	63290-03-00-xx

Kit includes one shock for one end.
-xx = shock damping constant (see PHD Product Sizing Catalog)



SIZE	SHOCK DAMPING CONSTANT	LETTER DIMENSION A	
27	2	2.60	[66.0]
	3	2.60	[66.0]
	5	2.83	[71.9]
	6	2.83	[71.9]
40	2	2.39	[60.7]
	3	2.39	[60.7]
	4	2.39	[60.7]

Numbers in [ ] are in mm.

OPTION CODE

-NM x x

Extend Direction of Travel	Retract Direction of Travel
2 = Damping constant 3 = Damping constant 4 = Damping constant (size 40 only) 5 = Damping constant (size 27 only) 6 = Damping constant (size 27 only)	2 = Damping constant 3 = Damping constant 4 = Damping constant (size 40 only) 5 = Damping constant (size 27 only) 6 = Damping constant (size 27 only)

All dimensions are reference only unless specifically toleranced.

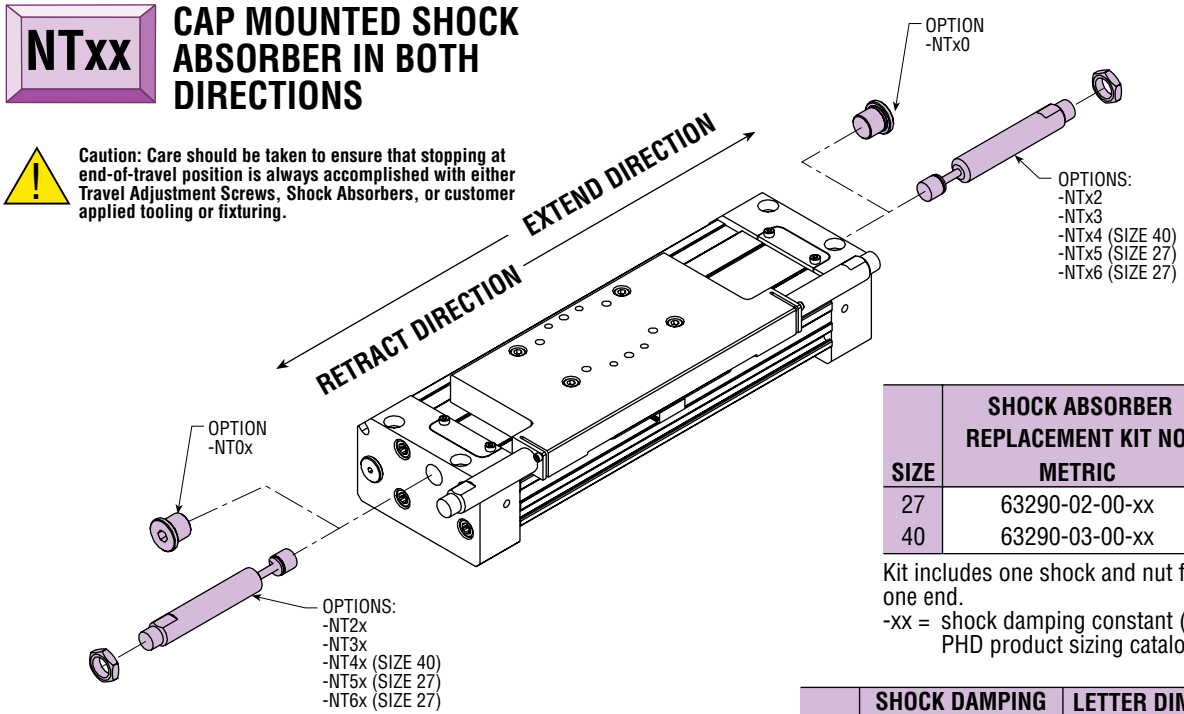
NTx0 CAP MOUNTED SHOCK ABSORBER IN EXTEND DIRECTION

NT0x CAP MOUNTED SHOCK ABSORBER IN RETRACT DIRECTION

NTxx CAP MOUNTED SHOCK ABSORBER IN BOTH DIRECTIONS

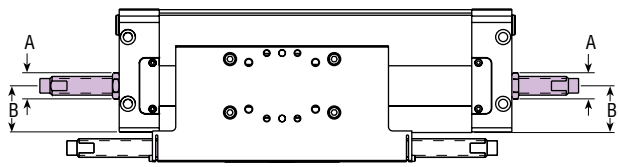
This option provides end cap mounted shock absorbers. This option or adjustable end stop (-NNxx option) must be ordered for each direction of travel. End cap mounted shock absorbers can also be ordered in addition to adjustable end stops to provide redundant end-of-travel stopping. Shock absorbers provide an adjustment range of .55 [14 mm] from each end of travel. See PHD Product Sizing Catalog or product sizing software for details on shock absorber stopping capacity and to determine the proper damping constant value.

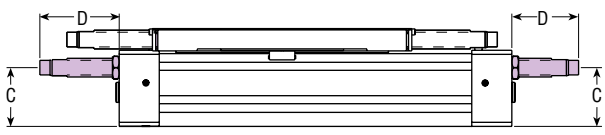
Caution: Care should be taken to ensure that stopping at end-of-travel position is always accomplished with either Travel Adjustment Screws, Shock Absorbers, or customer applied tooling or fixturing.



SIZE	SHOCK ABSORBER REPLACEMENT KIT NO. METRIC
27	63290-02-00-xx
40	63290-03-00-xx

Kit includes one shock and nut for one end.
-xx = shock damping constant (see PHD product sizing catalog)





SIZE	SHOCK DAMPING CONSTANT	LETTER DIMENSION D	
27	2	1.39	[35.3]
	3	1.39	[35.3]
	5	1.66	[42.2]
	6	1.66	[42.2]
40	2	1.66	[42.2]
	3	1.66	[42.2]
	4	1.66	[42.2]

Numbers in [ ] are in mm.

SIZE	LETTER DIMENSIONS A	B	C
27	.955 [24.3]	1.378 [35.0]	1.732 [44.0]
40	1.364 [34.6]	1.909 [48.5]	2.441 [62.0]

Numbers in [ ] are in mm.

OPTION CODE

-NT x x

Extend Direction Cap Shock	Retract Direction Cap Shock
0 = Plug installed no shock	0 = Plug installed no shock
2 = Damping constant	2 = Damping constant
3 = Damping constant	3 = Damping constant
4 = Damping constant (size 40 only)	4 = Damping constant (size 40 only)
5 = Damping constant (size 27 only)	5 = Damping constant (size 27 only)
6 = Damping constant (size 27 only)	6 = Damping constant (size 27 only)

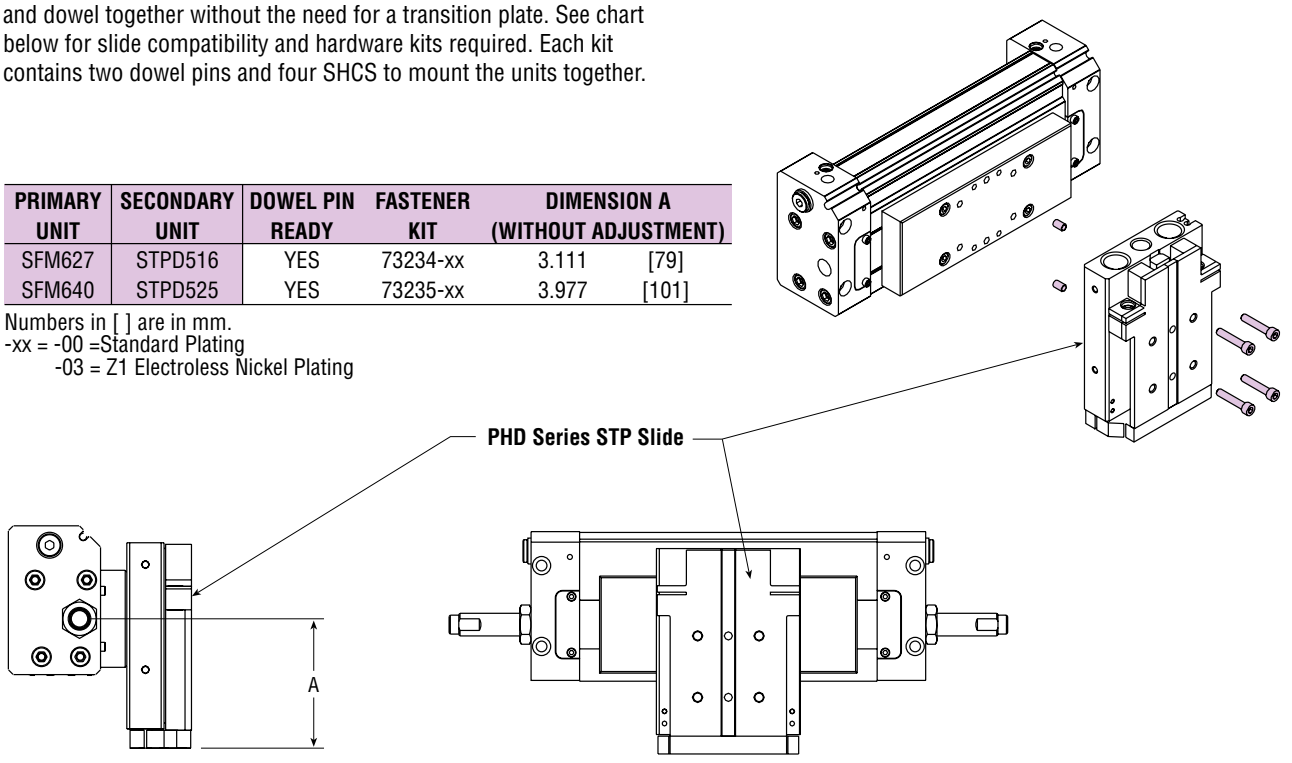
All dimensions are reference only unless specifically toleranced.

MODULAR MOUNTING KITS

Modular design of the Series SFM saddle allows units to bolt and dowel together without the need for a transition plate. See chart below for slide compatibility and hardware kits required. Each kit contains two dowel pins and four SHCS to mount the units together.

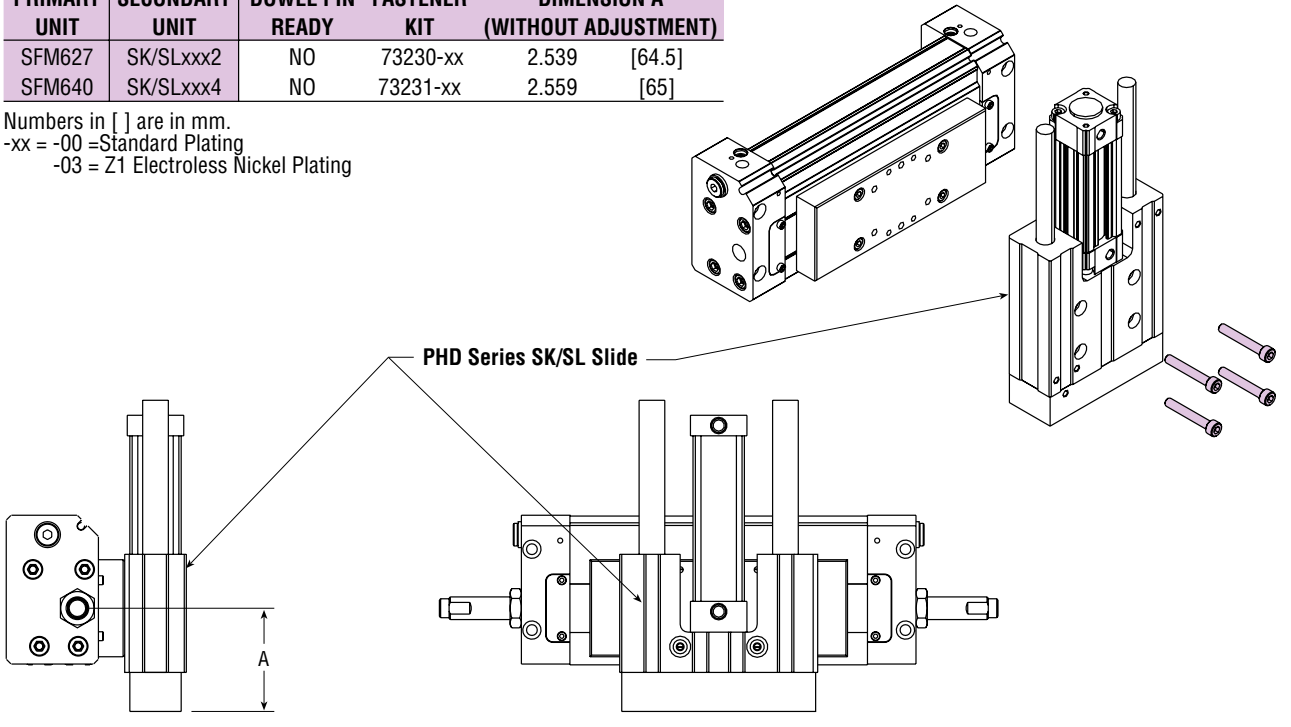
PRIMARY UNIT	SECONDARY UNIT	DOWEL PIN READY	FASTENER KIT	DIMENSION A (WITHOUT ADJUSTMENT)	
SFM627	STPD516	YES	73234-xx	3.111	[79]
SFM640	STPD525	YES	73235-xx	3.977	[101]

Numbers in [ ] are in mm.
-xx = -00 =Standard Plating
-03 = Z1 Electroless Nickel Plating



PRIMARY UNIT	SECONDARY UNIT	DOWEL PIN READY	FASTENER KIT	DIMENSION A (WITHOUT ADJUSTMENT)	
SFM627	SK/SLxxx2	NO	73230-xx	2.539	[64.5]
SFM640	SK/SLxxx4	NO	73231-xx	2.559	[65]

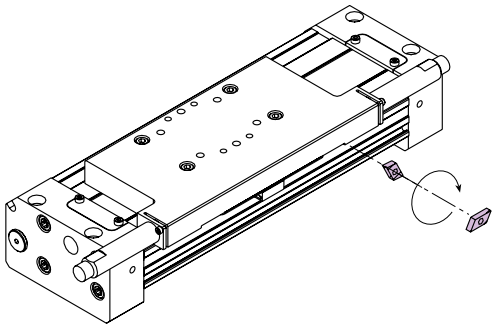
Numbers in [ ] are in mm.
-xx = -00 =Standard Plating
-03 = Z1 Electroless Nickel Plating

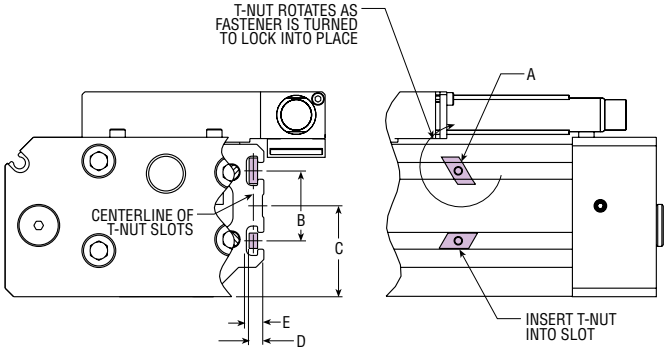


All dimensions are reference only unless specifically toleranced.

T-NUTS

T-nuts allow attachment of switches, cable carriers, or other accessories to be easily mounted to the slide. T-nuts can be positioned at any point along the T-slot grooves. The swiveling T-nut design allows insertion from the top of the slot. When the nut is tightened, it rotates into the locking position and securely clamps the bolted part.





SIZE	LETTER DIMENSIONS				
	A	B	C	D	E
27	M3 x 0.5	.984	1.280	.195	.246
	M3 x 0.5	[25.0]	[32.5]	[5.0]	[6.2]
40	M5 x 0.8	1.181	1.732	.303	.386
	M5 x 0.8	[30.0]	[44.0]	[7.7]	[9.8]

NOTE: Dimensions D and E are for minimum (D) and maximum (E) thread engagement.

SIZE	SWIVEL T-NUT	
	-STD	-Z1
27	72128-00	72128-03
40	72129-00	72129-03

NOTE: Each number represents one T-Nut.

SIZE	TORQUE	
	in-lb	Kgf-m
27	20	9.1
40	80	36.3

NOTE: Over torquing fastener may damage tube, T-nut, and/or fastener.

M MAGNET FOR PHD SERIES 6790 SOLID STATE SWITCHES

Series SFM Slides are optionally internally equipped with a magnet for use with PHD Series 6790 Solid State Switches. These switches mount easily to the unit using the switch slot on the side of the tube.

PHD Series 6790 Solid State Switches are designed specifically to provide an input signal to various types of programmable controllers or logic systems. See the Switches and Sensors section for complete switch specifications.

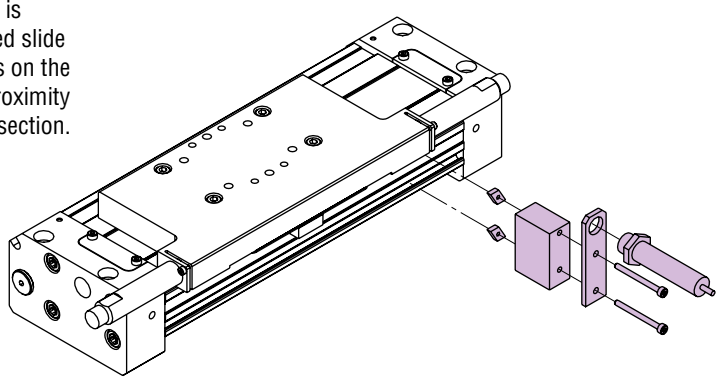
SERIES 6790 SWITCHES

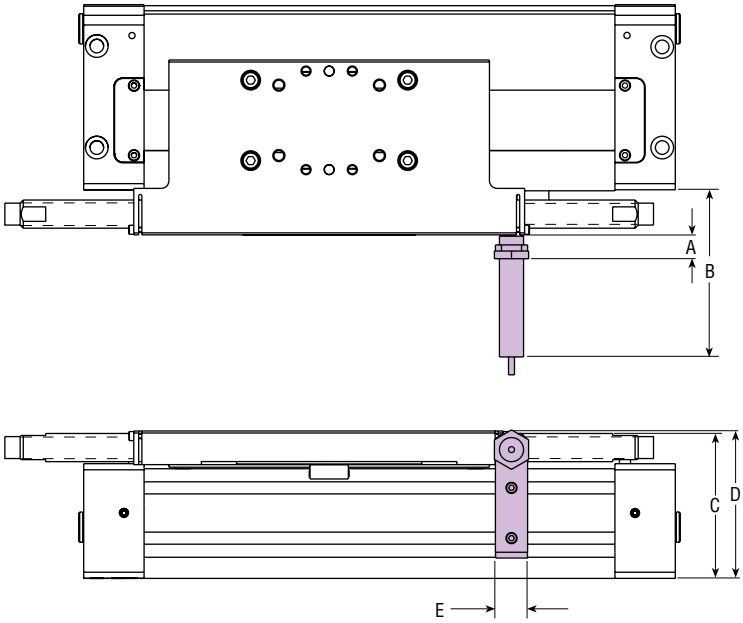
PART NO.	DESCRIPTION
67902-1-02	NPN (Sink) or PNP (Source) DC Reed, 2 m cable
67902-1-05	NPN (Sink) or PNP (Source) DC Reed, 5 m cable
67903-1-02	NPN (Sink) DC Solid State, 2 m cable
67903-1-05	NPN (Sink) DC Solid State, 5 m cable
67904-1-02	PNP (Source) DC Solid State, 2 m cable
67904-1-05	PNP (Source) DC Solid State, 5 m cable
67922-1	NPN (Sink) or PNP (Source) DC Reed, Quick Connect
67929-2	AC Reed, Current Limited, Quick Connect
67923-1	NPN (Sink) DC Solid State, Quick Connect
67924-1	PNP (Source) DC Solid State, Quick Connect
63549-02	2 m Cordset with Quick Connect
63549-05	5 m Cordset with Quick Connect

NOTES:
1) Switch set screw torque to 16 in-oz [.11 Nm] max.
2) See Switches and Sensors section for additional switch information and complete specification.

EXTERNAL PROXIMITY SWITCH READY BRACKETS

This accessory provides for external mounting of a 12 mm round metal sensing proximity switch. One switch mount kit is required per switch and includes the bracket with the required slide mounting hardware. The Series SFM Slide utilizes the T-slots on the side of the tube to attach the proximity mounting bracket. Proximity switches are ordered separately. See Switches and Sensors section.





SIZE	LETTER DIMENSIONS				
	A	B	C	D	E
27	.396 [10.1]	3.251 [82.6]	2.835 [72.0]	2.884 [73.3]	.630 [16.0]
40	.376 [9.6]	3.352 [85.1]	3.777 [95.9]	3.835 [97.4]	.787 [20.0]

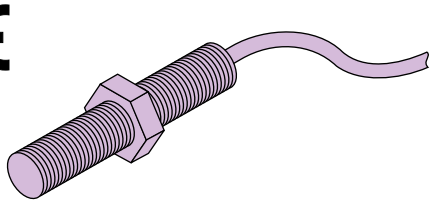
Numbers in [ ] are in mm.

SIZE	PROXIMITY MOUNTING KIT (METRIC)	
	-STD	-Z1 PLATING
27	78422-011	78422-012
40	78422-021	78422-022

Kit includes hardware for one switch.
Switches ordered separately.

12 mm THREADED PROXIMITY SWITCH

CE

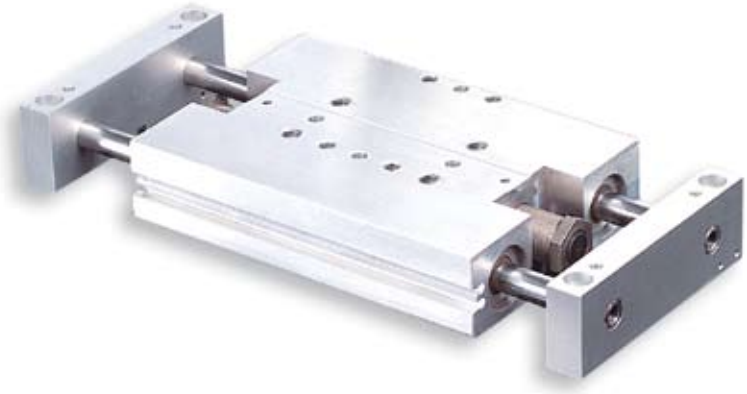


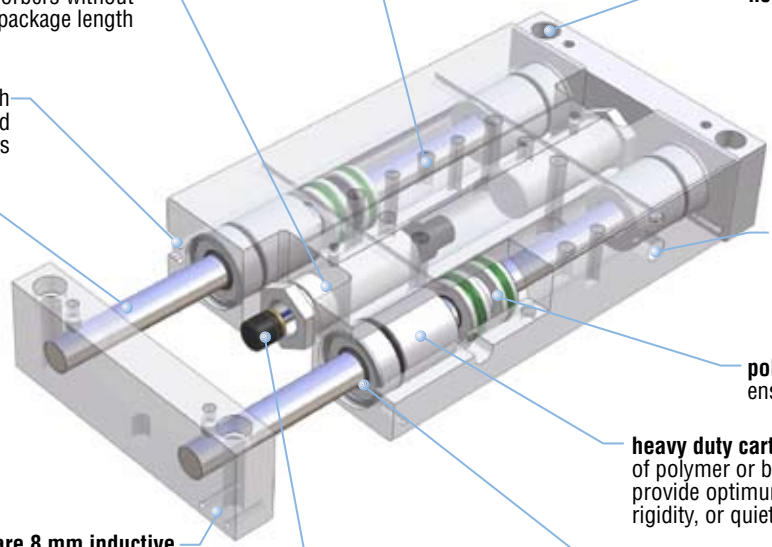
PART NO.	DESCRIPTION
15561-001	NPN (Sink) 10-30 VDC, 3 meter cable
15561-002	PNP (Source) 10-30 VDC, 3 meter cable
15561-003	20-250 VAC, 3 meter cable

All dimensions are reference only unless specifically toleranced.

SM

SMOOTH LINEAR MOTION CAPABLE OF HIGH SPEED OPERATION AT TWICE THE THRUST





modular mounting patterns and dowel holes in body allow attachment of Series STP Rail Slides and are available with various fits

internally threaded holes allow installation of optional travel adjustments with shock absorbers without increasing package length

switch slots for flush installation of Series 6790 Reed and Solid State Switches

hard chrome plated guide shafts are standard on SMH units and are available with optional corrosion resistant option -Q6

precision ground hardened guide shaft on SMB units for precision friction free operation

units are 8 mm inductive proximity switch ready with external mounting kits, which prevent flexing of electrical connectors of switches

optional internal shock absorber/travel adjustment with shock pad for high speed operation

rod seals/wipers provide resistance against external environmental contamination

heavy duty cartridges allow the use of polymer or ball bushings to provide optimum load carrying, rigidity, or quiet operation requirements

polyurethane piston seals ensure long life

porting is standard in body with optional porting available in the guide shafts which can prevent the flexing of air lines

counterbored and thru mounting holes for easy slide mounting

Major Benefits

- Precision ball or polymer bushings
- Smooth linear motion at twice the thrust of a single bore cylinder
- 5 bore sizes
- Series STP directly mounts to Series SM Slide
- Optional internal shock absorbers or travel adjustment with shock pad

Industry Uses

- Assembly machine builders
- Optical
- Life science
- Semiconductor
- Medical
- Cosmetic
- Light bulb
- Automotive

ORDERING DATA: SERIES SM SLIDES

TO ORDER SPECIFY:
Product, Series, Type, Design No., Bore Size, Travel, Travel Adjustment, Shock Absorber Installed, and Miscellaneous Options.

PRODUCT
S - Slide

TYPE
B - Ball Bushing
(Not Available on Sizes 8 & 12)
H - Polymer Bushing

BORE SIZE
08
12
16
25
32

TRAVEL ADJUSTMENT OPTION
AE - Travel adjustment and shock pad in position 6
AR - Travel adjustment and shock pad in position 5

MISCELLANEOUS OPTIONS
J3 - Transitional fit dowel holes
J8 - Precision fit dowel holes
M - Magnetic piston for use with PHD Series 6790 Switches
Q6 - Corrosion resistant shaft complete
UB55 - Ports in shafts located in position 5
UB66 - Ports in shafts located in position 6
See Notes 1, 2, & 3

S M B 5 25 x 50 – AR – NEx – M – Q6

SERIES
M - Modular Base

DESIGN NO.
1 - Imperial
5 - Metric

BORE SIZE	TRAVEL IMPERIAL (in)	TRAVEL METRIC (mm)
08	1, 2, 3	25, 50, 75
12	1, 2-1/2, 4	25, 60, 100
16	1-1/2, 3, 5	38, 75, 125
25	2, 4, 6	50, 100, 150
32	3, 6	75, 150

SHOCK ABSORBER INSTALLED OPTION
NEx - Shock absorber installed in position 6
NRx - Shock absorber installed in position 5
"x" indicates shock absorber damping constant which must be specified by the customer.
(See PHD Product Sizing Catalog)

NOTE:
1) UBxx options include NPT port adaptors for imperial units and BSPP port adaptors for metric units on SMxx25, SMxx32 units, and barb fittings on SMxx12 units.
2) -UB and -Q6 options not available on Series SMxx08 units.
3) -Q6 options not available on Series SMxx12 units. For ball bushings on Series SMxx12 units, consult your local PHD distibutor.

SHOCK ABSORBER REPLACEMENTS

BORE SIZE	PART NO.
08	68149-01-x
12	68149-02-x
16	68015-01-x
25	67127-01-x
32	71451-01-x

SERIES 6790 SWITCHES

PART NO.	DESCRIPTION
67902-1-02	NPN (Sink) or PNP (Source) DC Reed, 2 m cable
67902-1-05	NPN (Sink) or PNP (Source) DC Reed, 5 m cable
67903-1-02	NPN (Sink) DC Solid State, 2 m cable
67903-1-05	NPN (Sink) DC Solid State, 5 m cable
67904-1-02	PNP (Source) DC Solid State, 2 m cable
67904-1-05	PNP (Source) DC Solid State, 5 m cable
67922-1	NPN (Sink) or PNP (Source) DC Reed, Quick Connect
67929-2	AC Reed, Current Limited, Quick Connect
67923-1	NPN (Sink) DC Solid State, Quick Connect
67924-1	PNP (Source) DC Solid State, Quick Connect
63549-02	2 m Cordset with Quick Connect
63549-05	5 m Cordset with Quick Connect

SPECIFICATIONS	SERIES SM
OPERATING PRESSURE	20 psi min to 150 psi max [1.4 bar min to 10 bar max] air
OPERATING TEMPERATURE	-20° to + 180°F [-29° to +82°C]
TRAVEL	Minimum travel +.098/-.000 [+2.5 mm/-0 mm]
REPEATABILITY	±.001 in [±.025 mm]
VELOCITY	60 in/sec [1.5 m/sec] max., zero load at 87 psi [6 bar]
LUBRICATION	Factory lubricated for life
MAINTENANCE	Field repairable

SIZING AND APPLICATION ASSISTANCE
See PHD Product Sizing Catalog for specific and complete sizing information. Online sizing assistance is available at: ***www.phdinc.com/apps/sizing***

SM

SIZE	TRAVEL in	TRAVEL mm	ROD DIAMETER in	ROD DIAMETER mm	BORE DIAMETER in	BORE DIAMETER mm	EFFECTIVE AREA in^2	EFFECTIVE AREA mm^2	BASE WEIGHT lb	BASE WEIGHT kg	MAX STATIC LOAD lb	MAX STATIC LOAD N	TYPICAL DYNAMIC LOAD lb	TYPICAL DYNAMIC LOAD N
08	1	25	.157	4	.315	8	.12	75	.55	.25	25	111	0 - 2	0 - 9
	2	51							.65	.30	17	76		
	3	76							.75	.34	13	58		
12	1	25	.236	6	.472	12	.27	172	1.25	.57	62	276	2 - 8	9 - 35
	2-1/2	63.5							1.56	.71	43	191		
	4	102							1.86	.84	33	147		
16	1-1/2	38	.315	8	.630	16	.47	302	2.0	.91	144	641	8 - 15	35 - 67
	3	76							2.5	1.14	100	445		
	5	127							3.0	1.36	71	316		
25	2	51	.472	12	.984	25	1.17	756	4.6	2.09	380	1690	15 - 35	67 - 155
	4	102							5.9	2.68	260	1156		
	6	152							7.0	3.18	198	881		
32	3	76	.630	16	1.260	32	1.87	1206	8.8	3.97	620	2758	35 - 70	155 - 311
	6	152							11.7	5.31	420	1868		

NOTES: Thrust capacity, allowable mass and dynamic moment capacity must be considered when selecting a slide.

CYLINDER FORCE CALCULATIONS

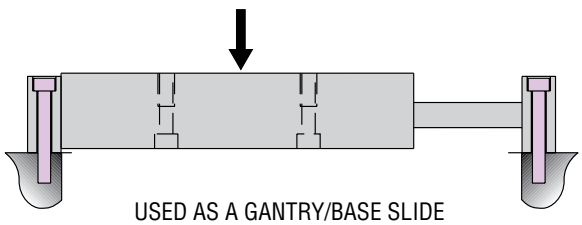
		IMPERIAL	METRIC
		F = P x A	F = 0.1 x P x A
F	= Cylinder Force	lbs	N
P	= Operating Pressure	psi	bar
A	= Effective Area (Extend or Retract)	in^2	mm^2

SIZE	TRAVEL in	TRAVEL mm	OPTION WEIGHT ADDERS -AR OR -AE lb	-AR OR -AE kg	-NEx OR -NRx lb	-NEx OR -NRx kg
08	1	25	0.06	0.03	0.06	0.03
	2	50				
	3	75				
12	1	25	0.03	0.01	0.05	0.02
	2-1/2	60				
	4	100				
16	1-1/2	38	0.12	0.05	0.14	0.06
	3	75				
	5	125				
25	2	50	0.29	0.13	0.34	0.15
	4	100				
	6	150				
32	3	75	0.2	0.09	0.35	0.16
	6	150				

MOUNTING THE UNIT

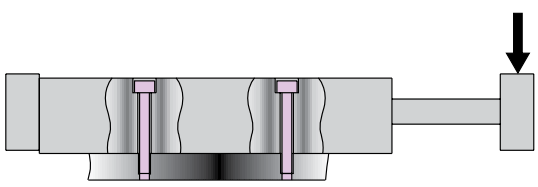
IMPORTANT! Units must be mounted and used as a gantry/base slide. Units cannot be mounted and used as a cantilever slide. Consult PHD or your local distributor for a cantilever unit.

MOUNTED CORRECTLY



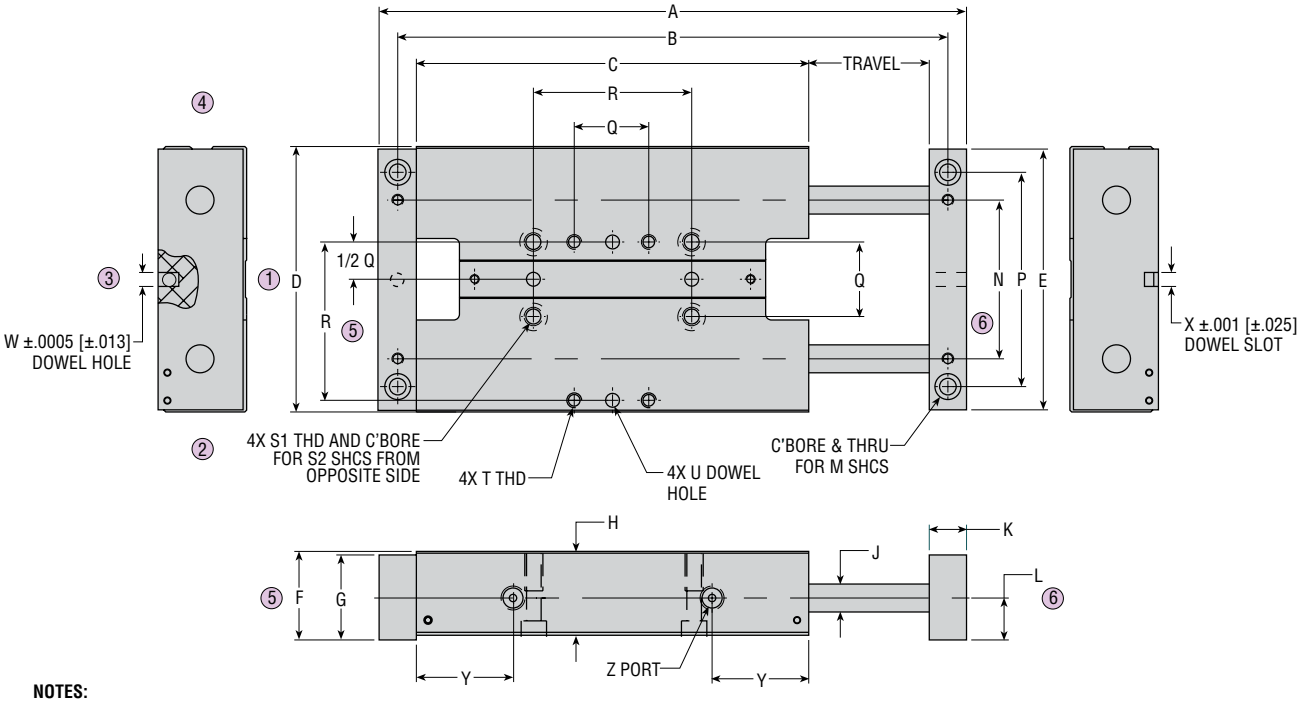
USED AS A GANTRY/BASE SLIDE

MOUNTED INCORRECTLY



NOT TO BE USED AS A CANTILEVER SLIDE.

DIMENSIONS: SERIES SM SLIDES



NOTES:

1) CIRCLED NUMBERS INDICATE POSITION
2) METRIC INFORMATION SHOWN IN [ ].
3) * SEE PAGE 2-96 FOR J3 AND J8 OPTIONS FOR AVAILABLE TOLERANCE RANGES.

LETTER DIM.	BORE SIZE 08						12						16						25						32			
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
TRAVEL	1	25	2	50	3	75	1	25	2-1/2	60	4	100	1-1/2	38	3	75	5	125	2	50	4	100	6	150	3	75	6	150
A	5.551	141.0	7.559	192.0	9.527	242.0	6.614	168.0	9.606	244.0	12.64	321.0	8.032	204.0	11.024	280.0	15.040	382.0	9.922	252.0	13.938	354.0	17.914	455.0	12.638	321.0	18.622	473.0
B	5.236	133.0	7.244	184.0	9.212	234.0	6.220	158.0	9.212	234.0	12.24	311.0	7.599	193.0	10.591	269.0	14.607	371.0	9.292	236.0	13.308	338.0	17.284	439.0	11.890	302.0	17.874	454.0
C	3.878	98.5	4.882	124.0	5.866	149.0	4.803	122.0	6.299	160.0	7.815	198.5	5.630	143.0	7.126	181.0	9.134	232.0	6.634	168.5	8.642	219.5	10.630	270.0	8.110	206.0	11.102	282.0
D			2.165	55.0					2.638	67.0					3.504	89.0					4.488	114.0					5.788	147.0		
E			2.126	54.0					2.638	67.0					3.425	87.0					4.409	112.0					5.630	143.0		
F			0.610	15.5					0.874	22.2					0.984	25.0					1.497	38.0					1.790	45.5		
G			0.590	15.0					0.807	20.5					0.945	24.0					1.437	36.5					1.673	42.5		
H			0.551	14.0					0.795	20.2					0.906	23.0					1.418	36.0					1.673	42.5		
J			0.157	4.0					0.236	6.0					0.315	8.0					0.472	12.0					0.630	16.0		
K			0.315	8.0					0.394	10.0					0.433	11.0					0.630	16.0					0.748	19.0		
L			0.315	8.0					0.457	11.6					0.531	13.5					0.709	18.0					0.954	24.2		
M			#5	M3					#8	M4					#10	M5					1/4	M6					5/16	M8		
N			1.142	29.0					1.496	38.0					1.969	50.0					2.684	68.2					3.486	88.5		
P			1.575	40.0					2.048	52.0					2.638	67.0					3.623	92.0					4.646	118.0		
Q			0.551	14.0					0.670	17.0					0.905	23.0					1.260	32.0					1.575	40.0		
R			1.102	28.0					1.496	38.0					1.929	49.0					2.677	68.0					3.386	86.0		
S1	8-32 x .315 DP [M4 x 0.7 x 8 DP]						10-24 x .375 [M5 x 0.8 x 9.5 DP]						1/4-20 x .500 DP [M6 x 1.0 x 12 DP]						5/16-18 x .625 DP [M8 x 1.25 x 16 DP]						3/8-16 x .750 DP [M10 x 1.5 x .20 DP]			
S2	#5 [M3]						#8 [M4]						#10 [M5]						1/4 [M6]						5/16 [M8]			
T	5-40 x .236 DP [M3 x 0.5 x 6 DP]						6-32 x .400 DP [M4 x 0.7 x 10 DP]						10-24 x .375 DP [M5 x 0.8 x 10 DP]						1/4-20 x .500 DP [M6 x 1.0 x 12 DP]						5/16-18 x .750 DP [M8 x 1.25 x 20 DP]			
U*	3 mm x 3 mm DP						4 mm x 4 mm DP						5 mm x 5 mm DP						6 mm x 6 mm DP						8 mm x 8 mm DP			
W	.1182 x .118 DP [3.002 x 3 DP]						.1576 x .157 DP [4.003 x 4 DP]						.1969 x .197 DP [5.001 x 5 DP]						.2363 x .236 DP [6.002 x 6 DP]						.3152 x .315 DP [8.006 x 8 DP]			
X	.1191 x .118 DP [3.025 x 3 DP]						.1586 x .157 DP [4.028 x 4 DP]						.1979 x .197 DP [5.027 x 5 DP]						.2372 x .236 DP [6.025 x 6 DP]						.3162 x .315 DP [8.031 x 8 DP]			
Y	0.925	23.5					1.416	36.0					1.437	36.5					1.634	41.5					2.008	51.0		
Z	10-32 PORT [M5 x 0.8 PORT]						10-32 PORT [M5 x 0.8 PORT]						10-32 PORT [M5 x 0.8 PORT]						1/8 NPT PORT [1/8 BSPP PORT]						1/8 NPT PORT [1/8 BSPP PORT]			

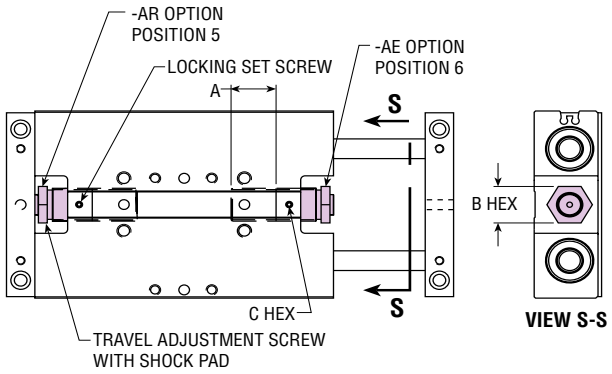
All dimensions are reference only unless specifically toleranced.

AE AR TRAVEL ADJUSTMENT AND SHOCK PAD IN POSITION 5 (RETRACT) OR POSITION 6 (EXTEND)

SMxx12- SMxx32

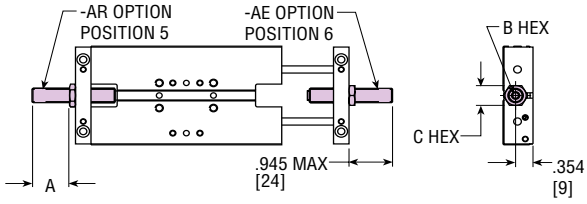
These options provide internal travel adjustment with a shock pad in position 5 (retract) or position 6 (extend). Shock pads provide excellent noise reduction and energy absorption capability. Travel can be reduced by a maximum of 'A' per end shown in the table. Adjust travel adjustment screw with 'B' hex wrench and lock into place using 'C' hex wrench. A urethane material is provided under the locking set screw to prevent damage to the travel adjustment screw.

UNIT SIZE	A in	A mm	B HEX in	B HEX mm	C HEX in	C HEX mm
08	.5	13	.118	3	.438	11
12	.75	19	.500	13	.079	2
16	1.0	25	.625	16	.079	2
25	1.0	25	.875	23	.079	2
32	1.5	38	1.0	26	.118	3



SMxx08 ONLY

These options provide external travel adjustment with a shock pad in position 5 (retract) or position 6 (extend). Shock pads provide excellent noise reduction and energy absorption capability. Travel can be reduced by a maximum of 'A' shown in the table. Adjust travel adjustment screw with 3 mm hex wrench and lock into place using 7/16" [11 mm] hex wrench.



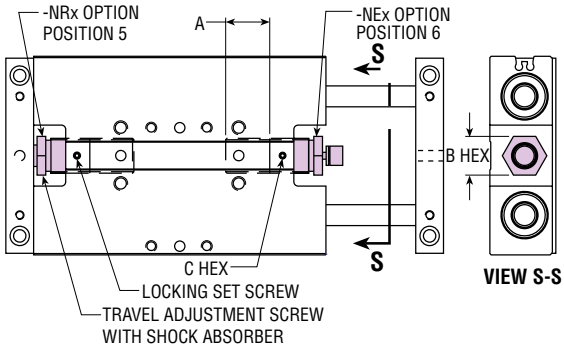
NEx NRx SHOCK ABSORBER INSTALLED IN POSITION 5 (RETRACT) OR POSITION 6 (EXTEND)

SMxx12- SMxx32

These options provide internal shock absorbers and travel adjustment in position 5 (retract) or position 6 (extend). Travel can be reduced by a maximum of 'A' shown in the table. Adjust travel with 'B' hex wrench and lock into place using 'C' hex wrench. A urethane material is provided under the locking set screw to prevent damage to the travel adjustment screw.

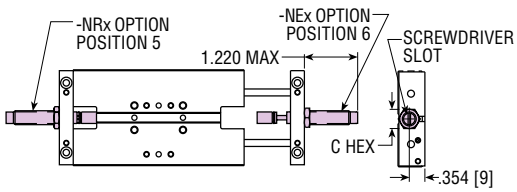
NOTE: The "X" indicates shock absorber damping constant which must be specified by customer–1, 2, 3, or 4. (See PHD product sizing catalog)

UNIT SIZE	A in	A mm	B HEX in	B HEX mm	C HEX in	C HEX mm
08	.5	13	.118	3	.438	11
12	.75	19	.500	13	.079	2
16	1.0	25	.625	16	.079	2
25	1.0	25	.875	23	.079	2
32	1.5	38	1.0	26	.118	3



SMxx08 ONLY

These options provide shock absorbers and travel adjustment in position 5 (retract) or position 6 (extend). Travel can be reduced by a maximum of 'A' shown in the table. Adjust travel to the required position using a large screwdriver and lock into place using 7/16" [11 mm] hex wrench.



J3 TRANSITIONAL FIT DOWEL PIN HOLES

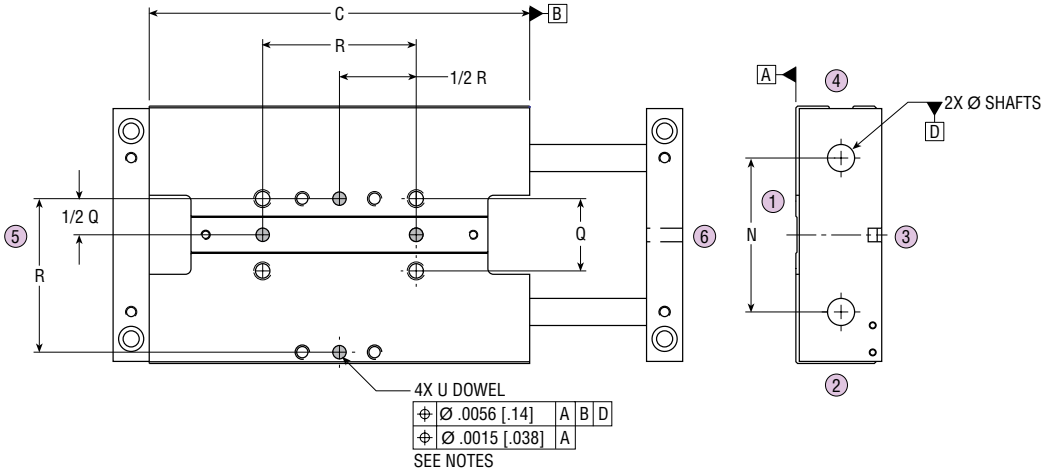
This option provides a compromise fit between clearance and interference. Transitional fits are used where accuracy of location is important, but a small amount of clearance is permissible.

J8 PRECISION FIT DOWEL PIN HOLES

This option provides H7 tolerance precision fit with dowel pins. Precision fits are used where accuracy of location is of prime importance and for parts requiring rigidity and alignment.

LETTER DIM	SIZE 08						SIZE 12						SIZE 16						SIZE 25						SIZE 32			
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
TRAVEL	1	25	2	50	3	75	1	25	2-1/2	60	4	150	1-1/2	38	3	75	5	125	2	50	4	100	6	150	3	100	6	150
C	3.878	98.5	4.882	124.0	5.866	149.0	4.803	122.0	6.299	160.0	7.815	198.5	5.630	143.0	7.126	181.0	9.134	232.0	6.634	168.5	8.642	219.5	10.630	270.0	8.110	206.0	11.102	282.0
N	1.142		29.0				1.496		38.0				1.969		50.0				2.684		68.2				3.466		88.0	
Q	0.551		14.0				0.670		17.0				0.905		23.0				1.260		32.0				1.575		40.0	
R	1.102		28.0				1.496		38.0				1.929		49.0				2.677		68.0				3.386		86.0	
U	3 mm x 3 mm DP						4 mm x 4 mm DP						5 mm x 5 mm DP						6 mm x 6 mm DP						8 mm x 8 mm DP			

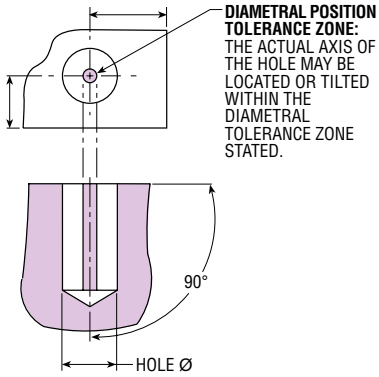
U DOWEL HOLE	TOLERANCE		
	STANDARD	J3 OPTION	J8 OPTION
3 mm	+.0004/-.0009 [+.010/-.024]	+.0013/+.0003 [+.033/+.008]	+.0004/-.0000 [+.010/-.000]
4 mm	+.0004/-.0009 [+.010/-.024]	+.0015/+.0005] [+.038/+.013]	+.0005/-.0000 [+.012/-.000]
5 mm	+.0004/-.0009 [+.010/-.024]	+.0015/+.0004] [+.038/+.010]	+.0005/-.0000 [+.012/-.000]
6 mm	+.0004/-.0009 [+.010/-.024]	+.0015/+.0005] [+.038/+.013]	+.0005/-.0000 [+.012/-.000]
8 mm	+.0004/-.0009 [+.010/-.024]	+.0016/+.0006] [+.041/+.015]	+.0006/-.0000 [+.015/-.000]



NOTES:

⌖ = POSITION TOLERANCE, THIS TOLERANCE DETERMINES THE LOCATION OF THE HOLES AND THE PERPENDICULARITY TO THE INDICATED DATUM FEATURES.

1) DATUM A REFERS TO THE MOUNTING SURFACE OF THE SLIDE BODY.
2) DATUM B REFERS TO THE THEORETICAL CENTERLINE OF THE LENGTH OF DIMENSION C.
3) DATUM D REFERS TO THE THEORETICAL CENTERLINE BETWEEN THE SHAFTS.
4) THE AXIS OF THESE DOWEL HOLES ARE LOCATED TO DATUM A, DATUM B, AND DATUM D WITHIN A .0056 [.14] DIAMETRAL TOLERANCE ZONE. (SEE FIGURE)
5) THE AXIS OF THESE DOWEL HOLES ARE FURTHER CONTROLLED TO EACH OTHER AND PERPENDICULAR TO DATUM A WITHIN A .0015 [.038] DIAMETRAL TOLERANCE ZONE.
6) CIRCLED NUMBERS INDICATE POSITION.
7) METRIC INFORMATION SHOWN IN [ ].



DIAMETRAL ZONE

All dimensions are reference only unless specifically toleranced.

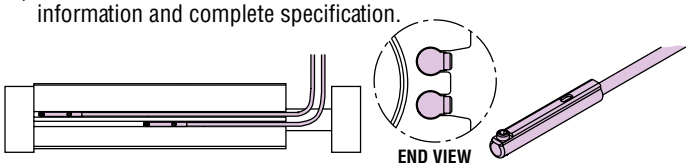
M MAGNET FOR PHD SERIES 6790 MINIATURE REED AND SOLID STATE SWITCHES

This option equips the unit with a magnetic piston for use with PHD's Series 6790 Switch. The switch housing is completely contained by the slide body and provides a very compact switch design. The switches mount easily into two small grooves located on the side of the slide body and are locked into place with a set screw. See Switches and Sensors section for additional switch information and complete specifications.

Switch set screw torque to 16 in-oz. max.

PART NO.	DESCRIPTION
67902-1-02	NPN (Sink) or PNP (Source) DC Reed, 2 m cable
67902-1-05	NPN (Sink) or PNP (Source) DC Reed, 5 m cable
67903-1-02	NPN (Sink) DC Solid State, 2 m cable
67903-1-05	NPN (Sink) DC Solid State, 5 m cable
67904-1-02	PNP (Source) DC Solid State, 2 m cable
67904-1-05	PNP (Source) DC Solid State, 5 m cable
67922-1	NPN (Sink) or PNP (Source) DC Reed, Quick Connect
67929-2	AC Reed, Current Limited, Quick Connect
67923-1	NPN (Sink) DC Solid State, Quick Connect
67924-1	PNP (Source) DC Solid State, Quick Connect
63549-02	2 m Cordset with Quick Connect
63549-05	5 m Cordset with Quick Connect

NOTES:
1) Switch set screw torque to 16 in-oz [.11 Nm] max.
2) See Switches and Sensors section for additional switch information and complete specification.



Q6 CORROSION RESISTANT COMPLETE SHAFTS

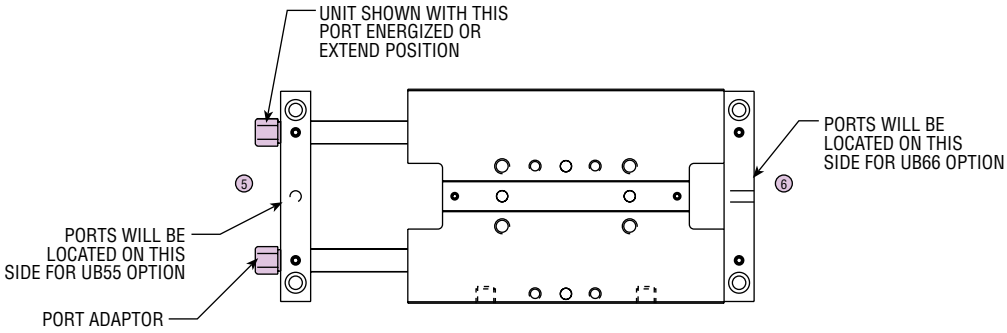
This option provides complete corrosion resistant coating on guide shafts for SMxx16, SMxx25 and SMxx32 units. This is for use in applications where the standard shaft ends may corrode. SMHx08 and SMHx12 units are completely corrosion resistant including the shafts as standard.

UB55 PORTS IN SHAFTS LOCATED IN POSITION 5

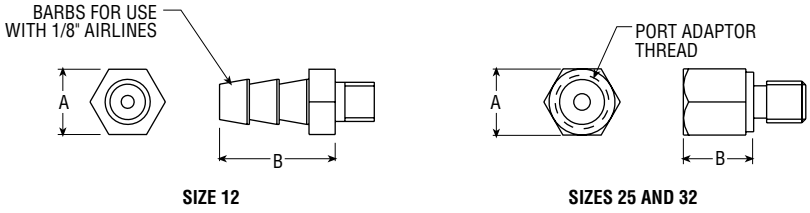
UB66 PORTS IN SHAFTS LOCATED IN POSITION 6

These options provide porting in the shafts located in the desired position. The shaft closest to the ports in the saddle will always be considered the retracted port. SMxx25 & SMxx32 units include port adaptors to allow the use of 1/8 NPT [1/8 BSPP] fittings. Not available on SMxx08.

UNIT SIZE	STANDARD PORT IN SADDLE	STANDARD THREAD IN SHAFT	PORT ADAPTOR THREAD	A HEX	B LENGTH
12	10-32 [M5 x 0.8]	M3 x 0.5	M3 BARB	.197 [5]	.394 [10]
16	10-32 [M5 x 0.8]	10-32 [M5 x 0.8]	—	—	—
25	1/8 NPT [1/8 BSPP]	M8 x 1.25	1/8 NPT [1/8 BSPP]	.50 [13]	.551 [14]
32	1/8 NPT [1/8 BSPP]	M12 x 1.75	1/8 NPT [1/8 BSPP]	.625 [16]	.551 [14]



PORT ADAPTOR INFORMATION



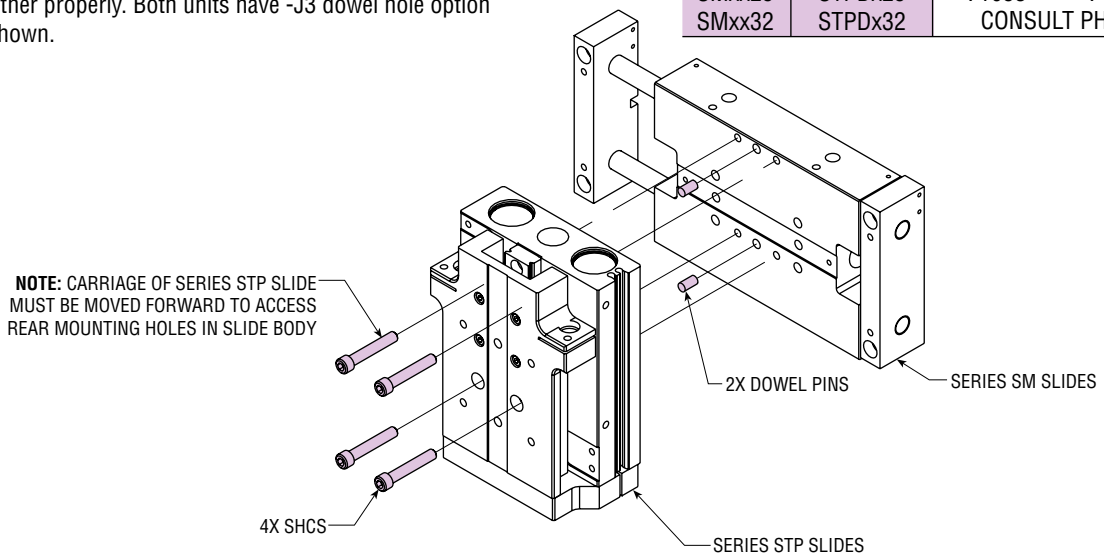
SIZE 12 **SIZES 25 AND 32**

All dimensions are reference only unless specifically toleranced.

MODULAR MOUNTING KITS

Modular design of the Series SM slide body allows Series STP Rail Slides to bolt and dowel together without the need for a transition plate. See chart for slide compatibility and hardware kits required. Each kit contains 2 dowel pins and 4 SHCS to mount the units together. PHD recommends that a -J3 option (transitional fit) be specified with the slide ordering data to allow the units to dowel together properly. Both units have -J3 dowel hole option as shown.

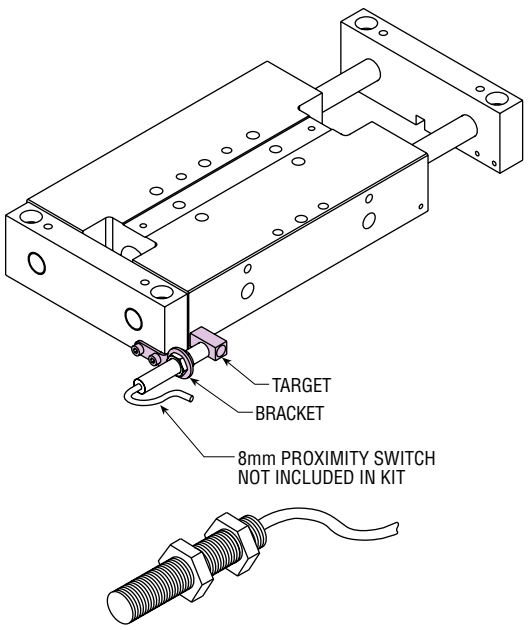
PRIMARY	SECONDARY	KIT NUMBERS IMPERIAL	KIT NUMBERS METRIC
SMxx08	STPDx08	71033	71034
SMxx12	STPDx12	71387	71388
SMxx16	STPDx16	71043	71044
SMxx25	STPDx25	71053	71054
SMxx32	STPDx32	CONSULT PHD	

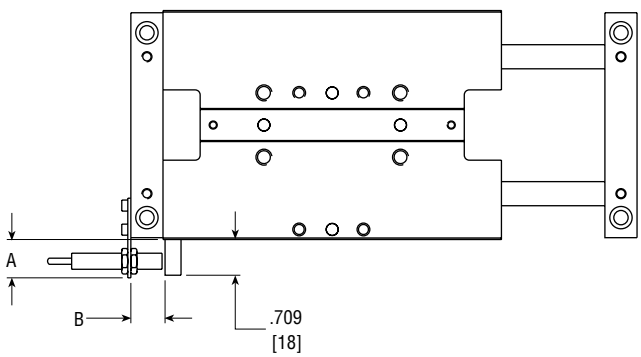


PROXIMITY SWITCH BRACKET & TARGET KIT (KIT #71032)

Each kit contains a bracket, target and hardware for mounting one 8 mm threaded proximity switch on an Series SMx Slide. Switches must be ordered separately. See Switches and Sensors section for detailed switch information.

UNIT SIZE	A in	A mm	B in	B mm
08	.827	21	.354	9
12	.866	22	.433	11
16	.748	19	.472	12
25	.748	19	.669	17
32	.630	16	.787	20



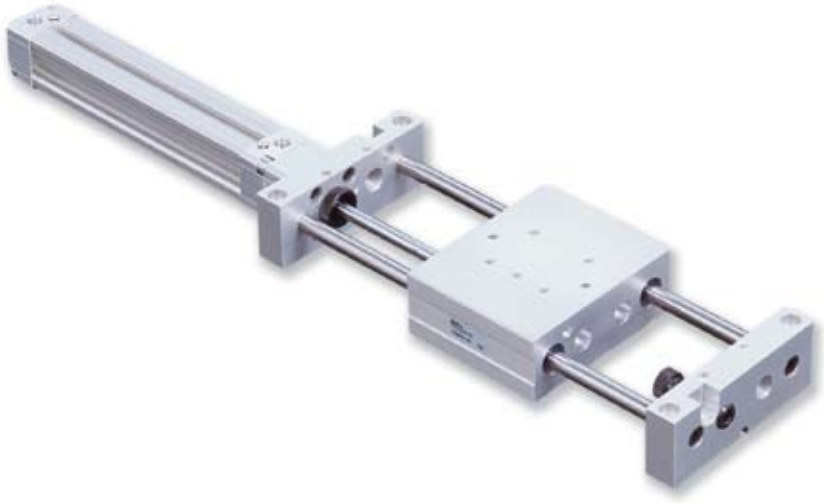


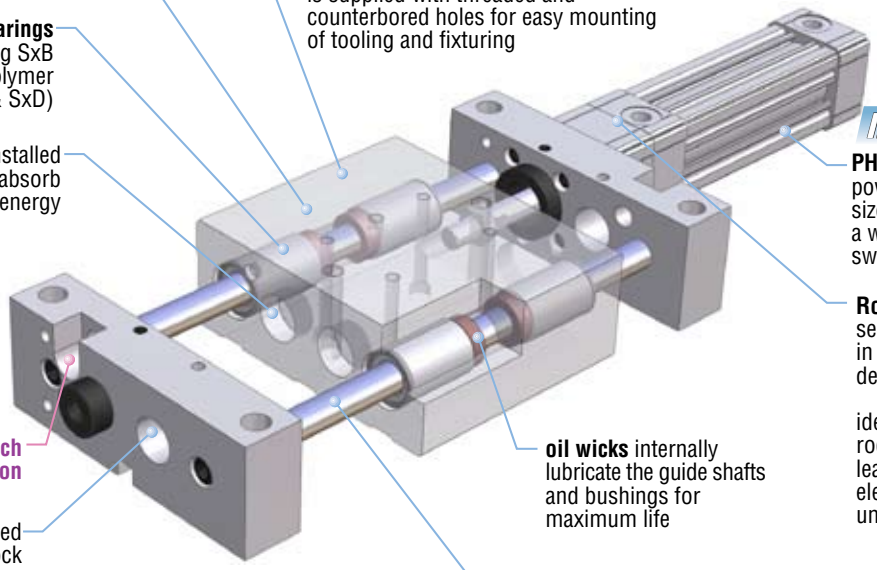
PART NO.	DESCRIPTION
51422-005-02	8 mm Inductive Proximity Switch NPN with 2 meter Cable
51422-006-02	8 mm Inductive Proximity Switch PNP with 2 meter Cable

See Switches and Sensors section for switch details.

SG

LONG TRAVEL, HIGH LOAD APPLICATIONS





modular saddle mounting allows Series SK/SL Slides to bolt and dowel directly to Series SG Slides without the need for transition plate

choice of bearings linear bushing SxB or TC Fluoropolymer composite (SxC & SxD)

shock pads can be installed to reduce noise and absorb more energy

8 mm proximity switch ready with -CB option

end blocks are designed to accommodate shock absorbers

anodized aluminum alloy saddle is supplied with threaded and counterbored holes for easy mounting of tooling and fixturing

IMPROVED

PHD's Series CV Cylinder powers this unit (except size 1) for extra long life with a wide range of control and switch accessories

Rodlok® can be added to securely hold a static saddle in place at any point of travel desired

ideal for applications where rod drift due to system leakage, air-line rupture, or electric power loss is unacceptable

oil wicks internally lubricate the guide shafts and bushings for maximum life

precision ground hardened guide shafts provide smooth, precise linear motion

oversize guide shafts are available with TC bushings for maximum rigidity and minimum deflection

Major Benefits

- Long travel, high load
- Standard travel to 36 inches
- Standard travel adjustments
- Units powered by PHD's rugged Series CV Cylinder, now with improved seal & bearing support
- 3 position cylinder available as standard option

Industry Uses

- Assembly machine builders
- Automotive
- Optical
- Material handling
- General automation

ORDERING DATA: SERIES SG SLIDES

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

PRODUCT
S - Slide

TYPE
B - Standard linear ball bushing, standard shaft
C - TC bushing, standard shaft
D - TC bushing, oversize shaft

SIZE
1 - 19 mm bore cylinder with 8 mm shaft standard, 10 mm shaft oversize
2 - 20 mm bore cylinder with 10 mm shaft standard, 12 mm shaft oversize
3 - 25 mm bore cylinder with 12 mm shaft standard, 16 mm shaft oversize
4 - 32 mm bore cylinder with 16 mm shaft standard, 20 mm shaft oversize
5 - 40 mm bore cylinder with 20 mm shaft standard, 25 mm shaft oversize
6 - 40 mm bore cylinder with 25 mm shaft standard, 30 mm shaft oversize

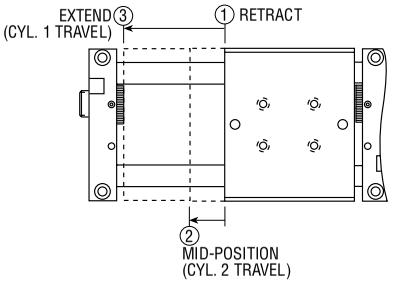
MID-POSITION TRAVEL
Specify for 3 position units. Travel from retract position 1 to mid-position 2.

WITH CYLINDER OPTIONS
DB - Cushion controls both direction (Standard in location 1 & 5) (See note 6)
DE - Cushion control extend only (Standard in location 1)
DR - Cushion control retract only (Standard in location 5)
H4 - Cylinder replacement only (See note 5)
H47- Rodlok® cylinder with locking device adaptor (Not available on size 1)
L9 - NPT ports (NPT-standard on imperial units BSPP-standard on metric units)
E - Series 1750 Solid State magnetic piston (Available on size 1 only)
M - Magnetic piston for Series 1750 Switches on size 41 and 81. Magnetic piston for Series 6250 Switches on sizes 42/82 through 46/86.
PB - Port controls both directions (Standard locations are 1 & 5, not available on size 1) (See note 6)
PE - Port control extend only (Standard in location 1, not available on size 1)
PR - Port control retract only (Standard in location 5, not available on size 1)
UBxx - Optional port locations (N/A on 3-position units)

Standard ports, cushion controls, and port controls are located in positions 1 & 5. Sizes 2 and 3 use 10-32 [M5] ports when combined with port controls on the same surface.

WITHOUT CYLINDER OPTIONS
H11 - VDMA/ISO cylinder ready 32 and 40 mm bore
H12 - ISO 6432 cylinder ready 16, 20, and 25 mm bore
-H11 and -H12 are available on design number 8 metric units only.

3 POSITION DETAIL



S G B E 4 3 x 6 x 3 – DB – M – PB – BB – Q1 – Z1

SERIES
G - Gantry

THREE POSITION UNIT
E - 3 position cylinder (specify only if needed)

DESIGN NO.
4 - Imperial
8 - Metric

SLIDE SIZE	SLIDE TRAVEL IMPERIAL UNITS
41 -	1" to 12"
42 -	1" to 12"
43 -	1" to 16"
44 -	1" to 20"
45 -	1" to 24"
46 -	1" to 36"

Available in 1/4" increments. Total slide travel from retract position 1 to extend position 3.

SLIDE SIZE	SLIDE TRAVEL METRIC UNITS
81 -	25 mm to 305 mm
82 -	25 mm to 305 mm
83 -	25 mm to 405 mm
84 -	25 mm to 510 mm
85 -	25 mm to 610 mm
86 -	25 mm to 915 mm

Available in 5 mm increments. Total slide travel from retract position 1 to extend position 3.

SLIDE OPTIONS
BB - Shock Pad both directions
BE - Shock Pad on extension
BR - Shock Pad on retraction
CB - Proximity Switch ready both ends*
GX - Saddle mounting in position number 4
GY - Saddle mounting in position number 1 (Not available on sizes 1, 2, 3 slides)
L4 - Lube fitting in saddle port position 2 and 4
L6 - Lube fitting in saddle port position 3
Q1 - Corrosion-resistant guide shafts (ends unplated)
Z1 - Electroless nickel plated ferrous metal parts
*Switches must be ordered separately.

NOTES:
1) All units are shock ready as standard. Shock absorber kits are ordered separately. See option page for complete ordering information.
2) Shock absorber on retraction is not available with UB2x option (port position 2).
3) Shock absorbers are not plated with -Z1 option.
4) Options -BB and -BR are not available with shock absorbers.
5) Rodlok® must be ordered separately when a replacement cylinder option -H4 is specified with -H47 unit. See option page for Rodlok® kits.
6) Cushions and port controls are available on -DB and -PB options only (locations 1 and 5) on 3-position units.

INDUCTIVE PROXIMITY SWITCHES

MODEL NUMBER	DESCRIPTION
51422-005-02	DC Inductive Proximity Switch 8 mm Threaded Current Sinking (NPN)
51422-006-02	DC Inductive Proximity Switch 8 mm Threaded Current Sourcing (PNP)

SHOCK ABSORBER KITS

SLIDE MODEL	PHD SHOCK ABSORBER NO.
SGxx1, SGxx2	57858-07-x
SGxx3	57858-01-x
SGxx4, SGxx5, SGxx6	57858-02-x

Options may affect unit length. See unit dimension and options pages for adders.

SPECIFICATIONS	SERIES SG
OPERATING PRESSURE	20 psi min to 150 psi max [1.4 bar min to 10 bar max] air
OPERATING TEMPERATURE	-20° to +180°F [-29° to +82°C]
TRAVEL	Minimum travel +.090/-.000 [+2.3 mm/-0 mm]
3 POSITION	mid location ±.039 [± 1 mm]
REPEATABILITY	±.001 in [±.025 mm]
VELOCITY	80 in/sec [2 m/sec] max., zero load at 87 psi [6 bar]
LUBRICATION	Factory lubricated for life

MODEL	SHAFT DIAMETER in	SHAFT DIAMETER mm	BORE DIAMETER in	BORE DIAMETER mm	DIRECTION	EFFECTIVE AREA in²	EFFECTIVE AREA mm²	BASE WEIGHT lb	BASE WEIGHT kg	TYPICAL DYNAMIC LOAD lb	TYPICAL DYNAMIC LOAD N
SGBx1	.315	8			EXTEND	.44	285	3.08+(.09xT)	1.40+(1.61xT)	40	178
SGCx1	.315	8	.750	19.1	RETRACT	.37	236	3.07+(.09xT)	1.39+(1.61xT)	30	134
SGDx1	.394	10						3.19+(.10xT)	1.45+(1.79xT)	35	156
SGBx2	.394	10			EXTEND	.49	314	4.96+(.14xT)	2.25+(2.50xT)	50	222
SGCx2	.394	10	.787	20	RETRACT	.41	264	4.95+(.14xT)	2.24+(2.50xT)	25	111
SGDx2	.472	12						5.13+(.15xT)	2.33+(2.68xT)	50	222
SGBx3	.472	12			EXTEND	.76	491	6.47+(.21xT)	2.94+(3.75xT)	65	289
SGCx3	.472	12	.984	25	RETRACT	.64	412	6.41+(.21xT)	2.91+(3.75xT)	60	267
SGDx3	.630	16						6.76+(.29xT)	3.07+(5.13xT)	80	356
SGBx4	.630	16			EXTEND	1.25	804	11.15+(.38xT)	5.06+(6.80xT)	160	712
SGCx4	.630	16	1.260	32	RETRACT	1.07	691	10.96+(.38xT)	4.97+(6.80xT)	90	401
SGDx4	.787	20						11.47+(.48xT)	5.20+(8.59xT)	110	490
SGBx5	.787	20			EXTEND	1.95	1257	15.58+(.48xT)	7.07+(8.59xT)	300	1334
SGCx5	.787	20	1.575	40	RETRACT	1.64	1056	15.33+(.48xT)	6.95+(8.59xT)	140	623
SGDx5	.984	25						16.30+(.64xT)	7.39+(11.36xT)	175	779
SGBx6	.984	25			EXTEND	1.95	1257	21.38+(.66xT)	9.70+(11.70xT)	500	2224
SGCx6	.984	25	1.575	40	RETRACT	1.64	1056	20.91+(.66xT)	9.48+(11.70xT)	225	1001
SGDx6	1.181	30						22.18+(.84xT)	10.06+(15.07xT)	275	1224

NOTES:

1) T= travel length inches [m]
2) Refer to Sizing Catalog or sizing software for stopping capacity of units.
3) Thrust capacity, allowable mass and dynamic moment capacity must be considered when selecting a slide. Refer to sizing software or the Sizing Catalog for complete sizing and selection information.

SLIDE MODEL	ISO CYLINDER SPECIFICATIONS (OPTION -H11 OR -H12)
SGx81	Ø 16 mm per ISO/6432 Standard
SGx82	Ø 20 mm per ISO/6432 Standard
SGx83	Ø 25 mm per ISO/6432 Standard
SGx84	Ø 32 mm per VDMA 24562/ISO 6431
SGx85	Ø 40 mm per VDMA 24562/ISO 6431
SGx86	Ø 40 mm per VDMA 24562/ISO 6431

NOTES:

1) ISO cylinder per above chart is to be supplied by customer.
2) Cylinder rod extensions are not required. Slide units have an alignment coupler and spacer for each specific unit.

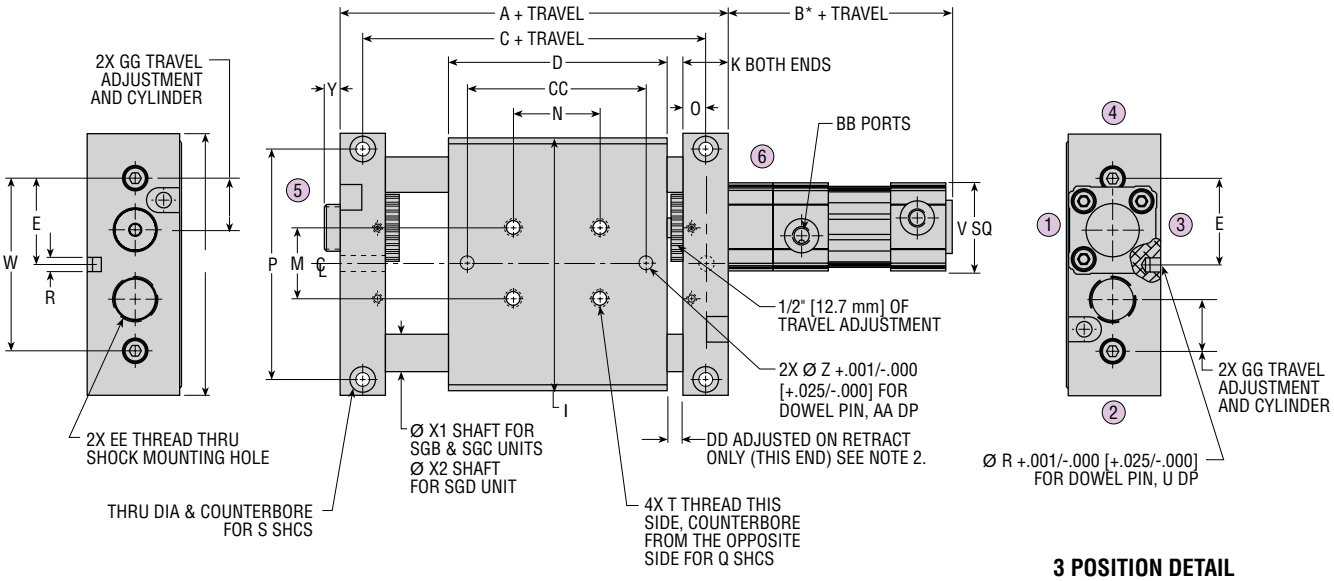
CYLINDER FORCE CALCULATIONS

		IMPERIAL F = P x A	METRIC F = 0.1 x P x A
F =	Cylinder Force	lbs	N
P =	Operating Pressure	psi	bar
A =	Effective Area (Extend or Retract)	in²	mm²

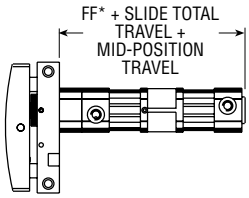
SIZING AND APPLICATION ASSISTANCE

See PHD Product Sizing Catalog for specific and complete sizing information.
Online sizing assistance is available at:
www.phdinc.com/apps/sizing

DIMENSIONS: SERIES SG SLIDES



3 POSITION DETAIL



NOTES:
1) *ADD .500 [12.7 mm] TO DIMENSION "B" & "FF" FOR EACH CUSHION ON THE SGx41, 81 ONLY
2) DUE TO TRAVEL TOLERANCE ALLOWANCES, DIMENSION "DD" WILL NOT BE THE SAME ON BOTH ENDS OF UNIT.
3) ALL DIMENSIONS ARE CENTERED ON THE CENTERLINE OF THE SLIDE UNLESS OTHERWISE SPECIFIED.
4) CIRCLED NUMBERS INDICATE POSITION.
5) METRIC INFORMATION SHOWN IN [ ].

IMPERIAL [METRIC]	PHD BORE [ISO BORE]	LETTER DIMENSION																	
		A	B*	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
SGx41	3/4	5.729	3.622	4.981	3.543	1.2106	3.661	.688	1.259	3.543	.039	.748	1.220	1.358	1.516	.374	3.130	#6
[SGx81]	[19]	[145.5]	[92]	[126.5]	[90]	[30.75]	[93]	[17.5]	[32]	[90]	[1]	[19]	[31]	[34.5]	[38.5]	[9.5]	[79.5]	[M4]
SGx42	.787	5.729	3.366	4.981	3.543	1.4960	4.331	.866	1.615	4.213	.039	.748	1.575	1.358	1.516	.374	3.780	#6
[SGx82]	[20]	[145.5]	[85.5]	[126.5]	[90]	[38]	[110]	[22]	[41]	[107]	[1]	[19]	[40]	[34.5]	[38.5]	[9.5]	[96]	[M4]
SGx43	.984	6.693	3.720	5.709	3.996	1.5945	4.960	.965	1.811	4.803	.039	.984	1.772	1.378	1.968	.492	4.252	#10
[SGx83]	[25]	[170]	[94.5]	[145]	[101.5]	[40.5]	[126]	[24.5]	[46]	[122]	[1]	[25]	[45]	[35]	[50]	[12.5]	[108]	[M5]
SGx44	1.260	7.441	4.843	6.457	4.744	1.9095	5.787	1.063	2.046	5.630	.039	.984	2.008	1.535	1.870	.492	4.960	1/4
[SGx84]	[32]	[189]	[123]	[164]	[120.5]	[48.5]	[147]	[27]	[52]	[143]	[1]	[25]	[51]	[39]	[47.5]	[12.5]	[126]	[M6]
SGx45	1.575	8.445	5.217	7.461	5.748	2.0960	6.536	1.220	2.323	6.338	.039	.984	2.283	1.417	2.284	.492	5.790	5/16
[SGx85]	[40]	[214.5]	[132.5]	[189.5]	[146]	[53.25]	[166]	[31]	[59]	[161]	[1]	[25]	[58]	[36]	[58]	[12.5]	[147]	[M8]
SGx46	1.575	9.449	5.217	8.465	6.752	2.3030	7.046	1.299	2.480	6.811	.039	.984	2.441	1.594	2.559	.492	6.300	3/8
[SGx86]	[40]	[240]	[132.5]	[215]	[171.5]	[58.5]	[179]	[33]	[63]	[173]	[1]	[25]	[62]	[40.5]	[65]	[12.5]	[160]	[M10]

IMPERIAL [METRIC]	PHD BORE [ISO BORE]	LETTER DIMENSION																
		R	S	T	U	V	W	X1	X2	Y	Z	AA	BB	CC	DD	EE	FF*	GG
SGx41	3/4	.1879	1/4	10-24 x .63	.199	1.000	2.421	.315	.394	.672	.1879	.45	1/8 NPT	2.598	.335	M14 x 1.5	5.653	.758
[SGx81]	[19]	[5]	[M6]	[M5 x 0.8 x 16]	[5]	[25.5]	[61.5]	[8]	[10]	[17]	[5]	[11.5]	[1/8 BSP]	[66]	[8.5]		[144.5]	[19.3]
SGx42	.787	.1879	1/4	10-24 x .63	.199	1.457	2.992	.394	.472	.672	.1879	.45	1/8 NPT	2.598	.335	M14 x 1.5	6.870	.885
[SGx82]	[20]	[5]	[M6]	[M5 x 0.8 x 16]	[5]	[37]	[76]	[10]	[12]	[17]	[5]	[11.5]	[G 1/8 BSPP]	[66]	[8.5]		[174.5]	[22.5]
SGx43	.984	.3129	1/4	1/4-20 x .63	.236	1.575	3.189	.472	.630	.354	.3129	.49	1/8 NPT	3.012	.335	M20 x 1.5	7.343	.984
[SGx83]	[25]	[8]	[M6]	[M6 x 1.0 x 16]	[6]	[40]	[81]	[12]	[16]	[9]	[8]	[12.5]	[G 1/8 BSPP]	[76.5]	[8.5]		[186.5]	[25.0]
SGx44	1.260	.3129	5/16	5/16-18 x 1	.236	1.949	3.819	.630	.787	.354	.3129	.49	1/8 NPT	3.956	.335	M25 x 1.5	9.213	1.142
[SGx84]	[32]	[8]	[M8]	[M8 x 1.25 x 25]	[6]	[49.5]	[97]	[16]	[20]	[9]	[8]	[12.5]	[G 1/8 BSPP]	[100.5]	[8.5]		[234]	[29.0]
SGx45	1.575	.3129	3/8	3/8-16 x 1	.236	2.205	4.192	.787	.984	.354	.3129	.49	1/4 NPT	4.488	.335	M25 x 1.5	10.000	1.226
[SGx85]	[40]	[8]	[M10]	[M10 x 1.5 x 25]	[6]	[56]	[106.5]	[20]	[25]	[9]	[8]	[12.5]	[G 1/4 BSPP]	[114]	[8.5]		[254]	[31.2]
SGx46	1.575	.3129	3/8	1/2-13 x 1	.236	2.205	4.606	.984	1.181	.354	.3129	.49	1/4 NPT	5.492	.335	M25 x 1.5	10.000	1.371
[SGx86]	[40]	[8]	[M10]	[M12 x 1.75 x 25]	[6]	[56]	[117]	[25]	[30]	[9]	[8]	[12.5]	[G 1/4 BSPP]	[139.5]	[8.5]		[254]	[34.8]

All dimensions are reference only unless specifically toleranced.

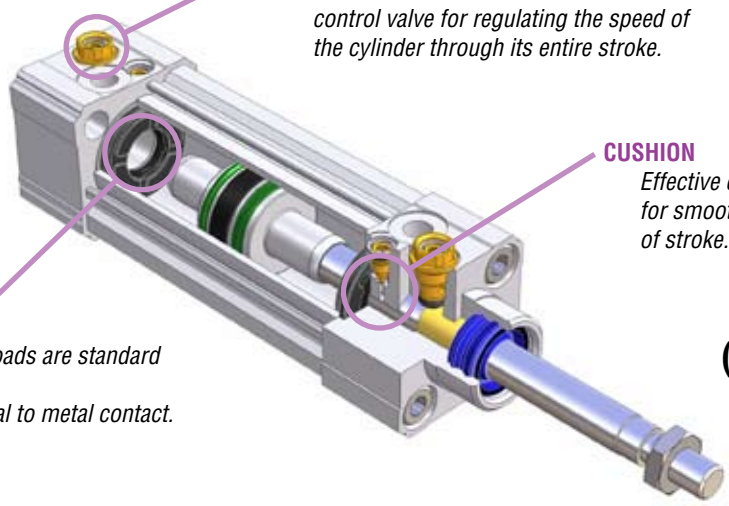
The cylinder features...

The HUSHCONTROL® Advantage

Only PHD Series CV Cylinders are offered with the Hushcontrol® Advantage. Hushcontrol® is achieved when optional cushions and Port Controls® are ordered with the standard shock pads. This combination provides:

- Superior speed and deceleration control of piston rod and attached loads.
- Significantly lowers noise levels even at high cycle speeds.

PORT CONTROL®
PHD's Port Control® is a built-in flow control valve for regulating the speed of the cylinder through its entire stroke.



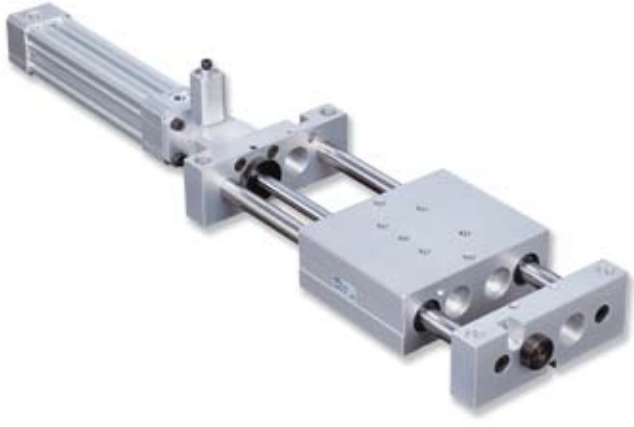
CUSHION
Effective cushion up to 22 mm for smooth deceleration at end of stroke.

SHOCK PAD
Built-in shock pads are standard on all sizes.
Eliminates metal to metal contact.

(Option -PB,-DB)

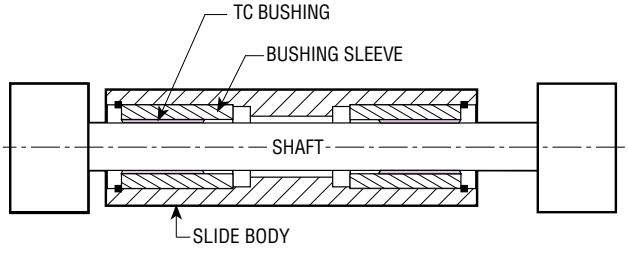
Rodlok®

Optional Rodlok® securely holds a static piston rod in place at any point of stroke desired. Ideal for applications where rod drift is unacceptable due to system leakage, line rupture, or power loss.



THE TC BUSHING ADVANTAGE

- PHD's **TC** fluoropolymer composite bushing has a thin housing allowing the use of larger diameter guide shafts than would be possible with linear ball bushings.
- **TC** bushings have internal lubrication and are virtually impervious to contamination.
- Field applications and testing have proven slide static load and shock load capability to be superior to that of units with traditional ball bushings.
- Together with cost benefits, slide performance with **TC** bushings is enhanced by reduced deflection of the large diameter shafts.



DB CUSHION CONTROL IN BOTH DIRECTIONS

(standard location 1 & 5)

DE CUSHION CONTROL ON EXTEND ONLY

(standard location 1) (N/A on 3-position units)

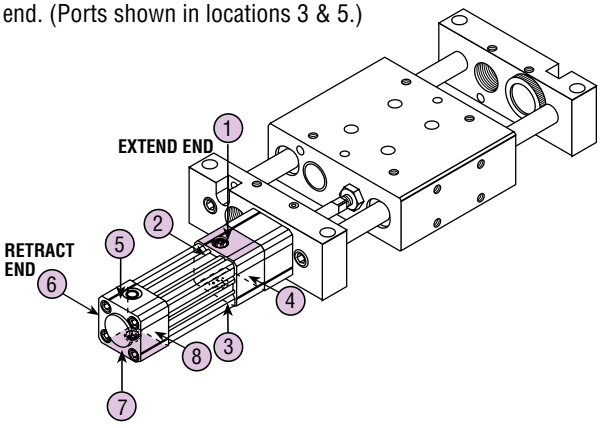
DR CUSHION CONTROL ON RETRACT ONLY

(standard location 5) (N/A on 3-position units)

PHD cushions are designed for smooth deceleration at the ends of cylinder stroke. When the cushion is activated, the remaining volume in the cylinder must exhaust past an adjustable needle valve which controls the amount of deceleration. The effective cushion length for each bore size is shown in the table below. To specify alternative cushion control locations on the head or cap, see the option code at right.

Note: Cushions add .500 in [12.7 mm] to the cylinder length for each direction ordered on size 1 slide only.

Unit shown is -DB17, cushion in location 1 (standard) on extend end and cushion in location 7 on retract end. (Ports shown in locations 3 & 5.)

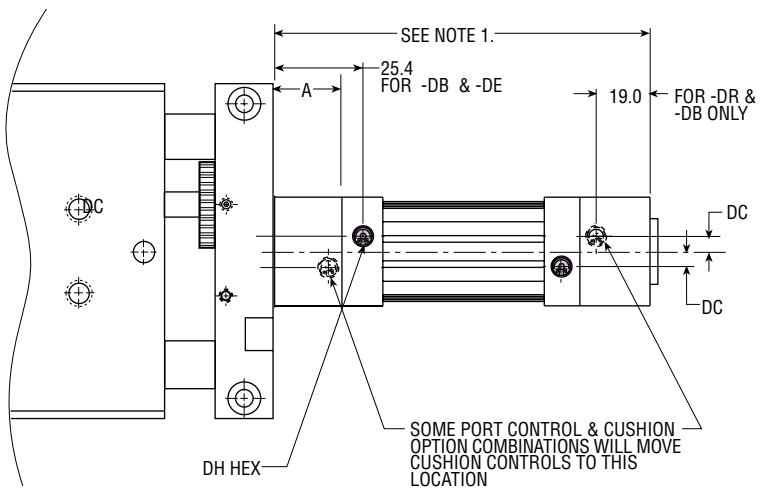


CUSHION CONTROL OPTIONS

-D x x x

- Cushion Control Locations: B - Both ends; E - Extend end only; R - Retract end only
- Retract Location (5, 6, 7, 8) **Omit if -DEx**
- Extend Location (1, 2, 3, 4) **Omit if -DRx**

SIZES 2 - 6



LETTER DIMENSION	MODEL NUMBER					
	SGxx1	SGxx2	SGxx3	SGxx4	SGxx5	SGxx6
A	.642 [16.3]	.650 [16.5]	.878 [22.3]	.984 [25.0]	.906 [23.0]	.906 [23.0]
DC	— —	.190 [4.8]	.226 [5.7]	.276 [7.0]	.394 [10.0]	.374 [9.5]
DG	— —	.581 [14.8]	.561 [14.2]	.965 [24.5]	1.083 [27.5]	1.083 [27.5]
DH	— —	.098 [2.5]	.098 [2.5]	.098 [2.5]	.098 [2.5]	.098 [2.5]
EFFECTIVE CUSHION LENGTH	.787 [20.0]	.441 [11.2]	.469 [11.9]	.598 [15.2]	.807 [20.5]	.870 [22.1]

NOTES:

1) For -DE & -DR, add 12.7 mm to standard length and for -DB, add 25.4 to standard length on size 81 only.
2) Use of travel adjustment screws may decrease effective cushion length.
3) Numbers in [ ] are for metric units and are in mm.

All dimensions are reference only unless specifically toleranced.

FOR SIZES 2 TO 6 (NOT AVAILABLE ON SIZE 1)

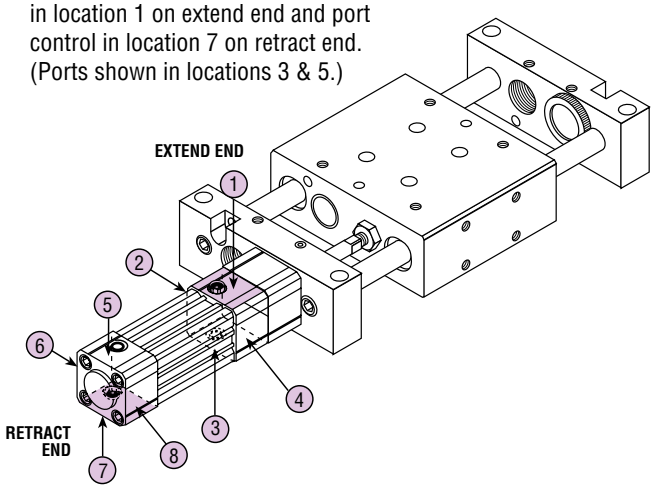
PB PORT CONTROLS® ON BOTH ENDS
(standard location 1 & 5)

PE PORT CONTROLS® ON EXTEND ONLY (standard location 1) (N/A on 3-position units)

PR PORT CONTROLS® ON RETRACT ONLY
(standard location 5) (N/A on 3-position units)

PHD's Port Control® is a built-in flow control for regulating the speed of the slide through its entire stroke. The Port Control operates on the "meter-out" principle and features an adjustable needle in a cartridge with a check seal. The self-locking needle has micrometer threads and is adjustable under pressure. The needle determines the orifice size which controls the exhaust flow rate of the actuator. The check seal expands while air is exhausting from the actuator, forcing the air to exhaust past the adjustable needle. The check seal collapses to allow a free flow of incoming air. The PHD Port Control saves space and eliminates the cost of fittings and installation for external flow control valves. Refer to option code at right to specify port control locations.

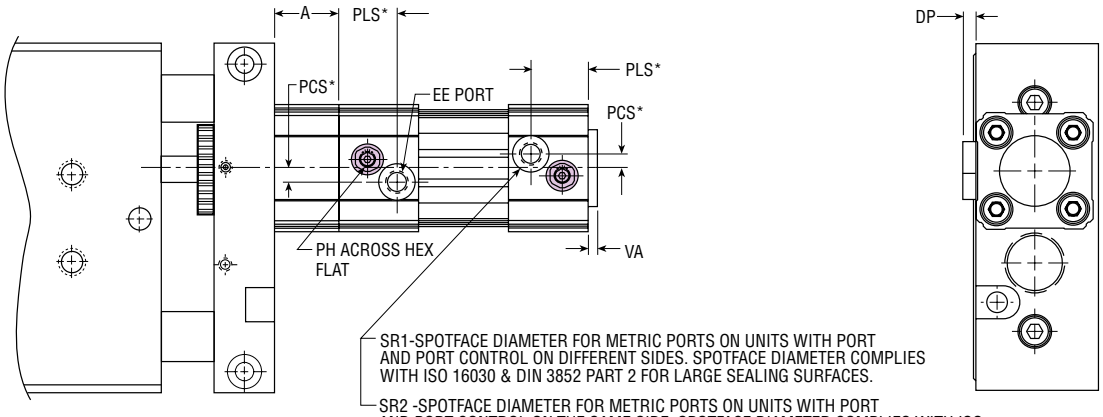
Unit shown is -PB17, port control in location 1 on extend end and port control in location 7 on retract end. (Ports shown in locations 3 & 5.)



PORT CONTROL OPTIONS

-P x x x

- Port Control Locations: B - Both ends; E - Extend end only; R - Retract end only
- Retract Location (5, 6, 7, 8) **Omit if -PEx**
- Extend Location (1, 2, 3, 4) **Omit if -PRx**



SR1-SPOTFACE DIAMETER FOR METRIC PORTS ON UNITS WITH PORT AND PORT CONTROL ON DIFFERENT SIDES. SPOTFACE DIAMETER COMPLIES WITH ISO 16030 & DIN 3852 PART 2 FOR LARGE SEALING SURFACES.

SR2 -SPOTFACE DIAMETER FOR METRIC PORTS ON UNITS WITH PORT AND PORT CONTROL ON THE SAME SIDE. SPOTFACE DIAMETER COMPLIES WITH ISO 16030 & DIN 3852 PART 2 FOR SMALL SEALING SURFACES.

LETTER DIM.	MODEL NUMBER SGxx2 in	SGxx2 mm	SGxx3 in	SGxx3 mm	SGxx4 in	SGxx4 mm	SGxx5 in	SGxx5 mm	SGxx6 in	SGxx6 mm
A	.650	16.5	.878	22.3	.984	25.0	.906	23.0	.906	23.0
EE*	10-32	M5	10-32	M5	1/8 NPT	G1/8	1/4 NPT	G 1/4	1/4 NPT	G 1/4
PCS*	.276	7.0	.276	7.0	.197	5.0	.236	6.0	.236	6.0
PH	.098	2.5	.098	2.5	.098	2.5	.098	2.5	.098	2.5
PLS*	.571	14.5	.571	14.5	.866	22.0	.925	23.5	.925	23.5
SR1*	—	16.5	—	16.5	—	19.0	—	25.0	—	25.0
SR2*	.354	9.0	.354	9.0	—	16.5	—	19.0	—	19.0
DP	.067	1.7	.055	1.4	.130	3.3	.201	5.1	.122	3.1

*Dimensions shown are for units with port and port control in the same location. For units with other port and port control combinations, standard port location dimensions apply. Ports may be located on either side of the slide centerline depending on port control and cushion option combinations.
in = Table information for imperial units mm = Table information for metric units

FOR SIZE 1 ONLY

E MAGNET FOR PHD SOLID STATE SWITCHES

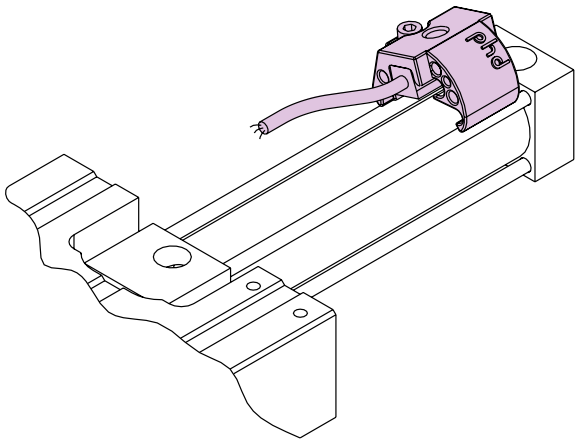
This option equips the cylinder with a magnetic band on the piston for use with PHD Solid State Switches.

M MAGNET FOR PHD REED SWITCHES

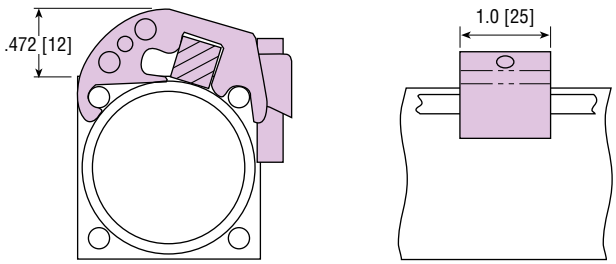
This option equips the cylinder with a magnetic band on the piston for use with PHD 1750 Reed Switches.

Cylinder-mounted switches are an easy and convenient way of interfacing the slide to various programmable controllers or logic systems. See Switches and Sensors section for specific Hall Effect and Reed Switches information.

OPTION	PART NO.	DESCRIPTION
-E HALL	17503-2-06	Sink Type 10-30 VDC
	17504-2-06	Source Type 10-30 VDC
	17523-2	Sink Type 10-30 VDC, Quick Connect
	17524-2	Source Type 10-30 VDC, Quick Connect
-M REED	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



SERIES 1750 COMPACT PROXIMITY SWITCH BRACKET



Unit SGx1 uses switch bracket part no. 17000-31-5.

FOR SIZES 2 TO 6

M MAGNET FOR PHD SERIES 6250 REED AND SOLID STATE SWITCHES

This option equips the cylinder with a magnetic band on the piston for use with PHD Reed and Solid State Switches listed below. These switches mount easily to the cylinder using "T" slots in the body. See Switches and Sensors section for complete switch information.

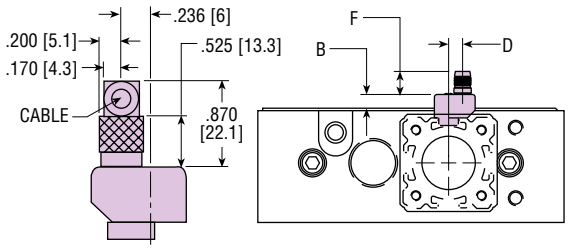
SERIES 6250 SOLID STATE SWITCHES

PART NO.	DESCRIPTION	COLOR
62505-1-02	NPN (Sink) DC Solid State, 2 m cable	Brown
62506-1-02	PNP (Source) DC Solid State, 2 m cable	Tan
62515-1	NPN (Sink) DC Solid State, Quick Connect	Brown
62516-1	PNP (Source) DC Solid State, Quick Connect	Tan

SERIES 6250 REED SWITCHES

PART NO.	DESCRIPTION	COLOR
62507-1-02	AC/DC Reed, 2 m cable	Silver
62517-1	AC/DC Reed, Quick Connect	Silver

Connector Detail



LETTER DIM.	SIZE 2	3	4	5	6
B	.236 [6.0]	.236 [6.0]	.236 [6.0]	.276 [7.0]	.197 [5.0]
D	.228 [5.8]	.228 [5.8]	.228 [5.8]	.228 [5.8]	.228 [5.8]
F	.374 [9.5]	.374 [9.5]	.374 [9.5]	.374 [9.5]	.374 [9.5]

Numbers in [ ] are for metric units and are in mm.

All dimensions are reference only unless specifically toleranced.

FOR SIZES 2 TO 6 (NOT AVAILABLE ON SIZE 1)

H47 RODLOK® SLIDE & RODLOK®

PHD's Rodlok® is ideal for locking the housing while in a static/stationary position. When the pressure is removed from the port of the Rodlok, the mechanism will grip the piston rod of the cylinder and prevent it from moving. The loads are held indefinitely without power. Rodlok performance is application and environment sensitive (cleanliness of rod or Rodlok will also affect performance). THE RODLOK IS NOT DESIGNED TO BE USED AS A PERSONNEL SAFETY DEVICE.

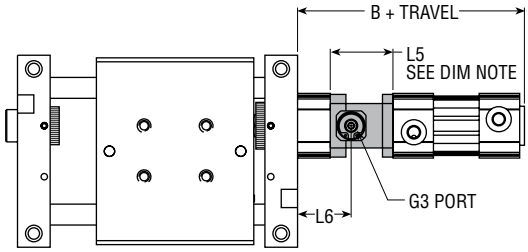
SIZE	STATIC LOCKING FORCE* in	STATIC LOCKING FORCE* mm
2	79	350
3	90	400
4	135	600
5	225	1000
6	337	1500

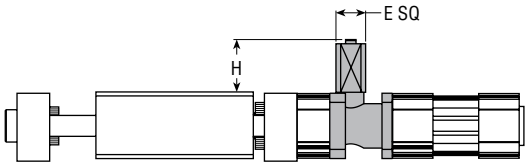
NOTE: *Locking force given in table above is the actual locking force with a dry clean rod and does not include any safety factor.

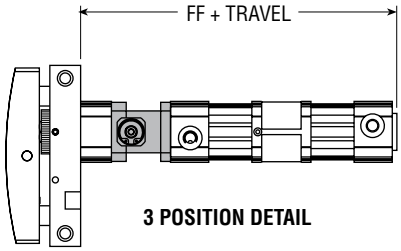
OPERATING PRESSURE

The operating pressure for the locking device is different than the operating pressure for the slide to which it is attached. The locking device of the Rodlok is designed with an operating pressure range of 60 psi minimum to 150 psi maximum [4 to 10 bar]. The Series SG Slide with a Rodlok attached has an operating pressure range of 45 psi minimum to 150 psi maximum [3 to 10 bar].

The Rodlok locking device and adaptor can be purchased separately as kits. See Rodlok kits chart. The locking device and adaptor are not available with a corrosion resistant (-Z1 option) finish.

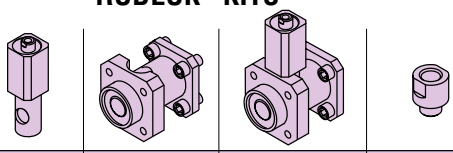






3 POSITION DETAIL

RODLOK® KITS



SIZE	LOCKING DEVICE KIT	ADAPTOR KIT	COMPLETE RODLOK*	IMPERIAL PORT ADAPTOR**
2	63459-07-1	63460-07-1	63461-07-1	—
3	63459-08-1	63460-08-1	63461-08-1	—
4	63459-01-1	63460-01-1	63461-01-1	63465-1
5	63459-02-1	63460-02-1	63461-02-1	63465-1
6	63459-02-1	63460-02-1	63461-02-1	63465-1

NOTES:
1) *Kits ship with cylinder mounting hardware.
2) Part numbers listed above are intended for replacement purposes only and are to be used specifically on slides with the -H47 option.
3) **Adaptor must be ordered separately. Required to convert to imperial port.

SIZE	DEVICE WEIGHT lb	DEVICE WEIGHT kg	ADAPTOR WEIGHT lb	ADAPTOR WEIGHT kg	TOTAL WEIGHT lb	TOTAL WEIGHT kg
2	0.14	0.06	0.14	0.06	0.31	0.14
3	0.14	0.06	0.16	0.07	0.36	0.16
4	0.20	0.09	0.28	0.13	0.57	0.26
5	0.30	0.14	0.44	0.20	0.93	0.42
6	0.54	0.24	0.84	0.38	1.76	0.80

NOTE: Total weight includes rod adder for -H47 cylinder.

LETTER DIM	MODEL NUMBER SGx42	SGx43	SGx44	SGx45	SGx46
PHD BORE	0.787 [20]	0.984 [25]	1.260 [32]	1.575 [40]	1.575 [40]
B	4.941 [125.5]	5.453 [138.5]	6.732 [171]	7.382 [187.5]	7.382 [187.5]
E	0.807 [20.5]	0.807 [20.5]	0.984 [25.0]	1.083 [27.5]	1.083 [27.5]
G3	[M5 x 0.8]*	[M5 x 0.8]*	[G 1/8]*	[G 1/8]*	[G 1/8]*
H	1.555 [39.5]	1.457 [37]	1.791 [45.5]	1.811 [46]	1.732 [44]
L5	1.575 [40]	1.732 [44]	1.890 [48]	2.165 [55]	2.165 [55]
L6	1.083 [27.5]	1.398 [35.5]	1.614 [41]	1.673 [42.5]	1.673 [42.5]
FF	8.445 [214.5]	9.075 [230.5]	11.102 [282]	12.165 [309]	12.165 [309]

NOTES:
1) L5 Dim is the amount added to the standard unit for the -H47 option
2) Numbers in [ ] are for metric units and are in mm.
3) *Port supplied on Rodlok® device requires port adaptor to convert to 1/8 M5 may be used with 10-32 THD NPT.

L9 NPT PORTS

This option provides NPT ports on metric units instead of the standard BSPP ports. The NPT ports are located in the same location as the BSPP ports.

NOTE: NPT ports are standard on imperial units.

METRIC SIZES	OPTIONAL NPT PORT	STANDARD BSPP PORT
1	1/8	G 1/8
2, 3	1/8*	G 1/8*
4	1/8	G 1/8
5	1/4	G 1/4
6	1/4	G 1/4

*When port controls are specified on the same face as ports, the standard metric port is M5 and the -L9 option provides a 10-32 port.

UB ALTERNATE PORT LOCATION

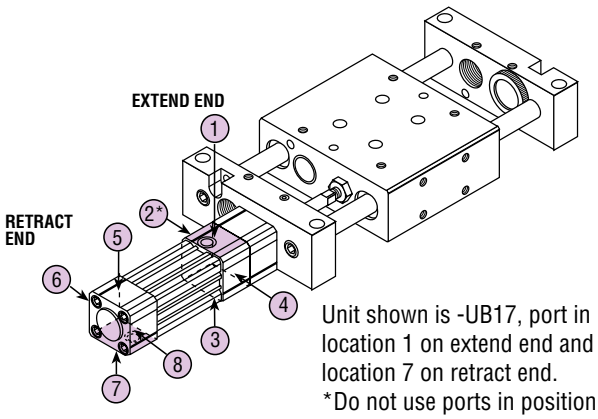
(N/A on 3-position units)

With this option, alternate port locations can be specified, providing increased flexibility and customer convenience. See option code below to specify port locations.

PORT LOCATION OPTIONS

-UB x x

- Extend Location (Head) (1,2,3,4)
- Retract Location (Cap) (5,6,7,8)



Unit shown is -UB17, port in location 1 on extend end and port in location 7 on retract end.
*Do not use ports in position 2 with shock absorber options.

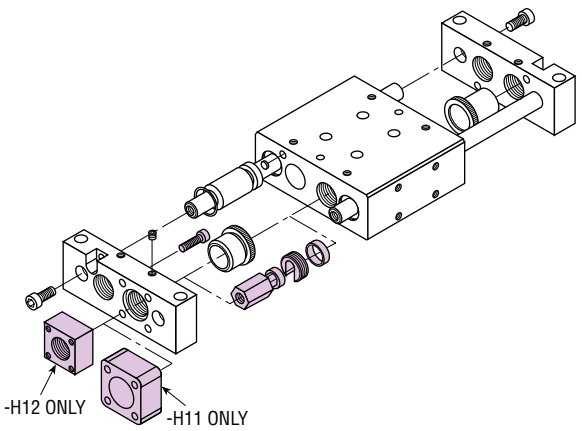
H11 SLIDE ONLY (WITHOUT CYLINDER) 84, 85, AND 86 SLIDE SIZES ONLY

SLIDE FOR VDMA/ISO CYLINDERS 32 mm AND 40 mm BORES

H12 SLIDE ONLY (WITHOUT CYLINDER) 81, 82, AND 83 SLIDE SIZES ONLY

SLIDE FOR ISO/VDMA 6432 CYLINDER 16, 20, AND 25 mm BORES

These options provide the slide mechanism only without a cylinder. Included with options -H11 and -H12 is all the hardware required for mounting standard VDMA/ISO cylinders to the slide. A self-aligning rod coupling is also provided, making it easy to attach the appropriate VDMA/ISO cylinder. (No extra rod extension required.)



BB SHOCK PAD BOTH DIRECTIONS

BE SHOCK PAD ON EXTENSION

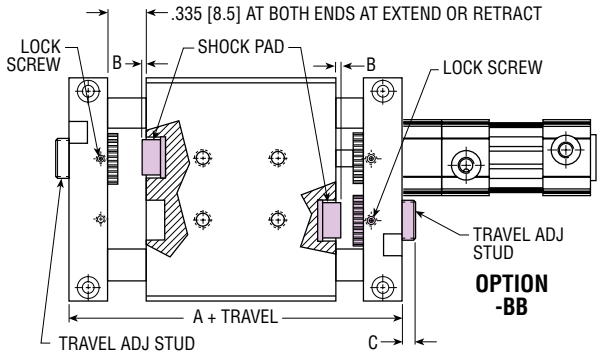
BR SHOCK PAD ON RETRACTION

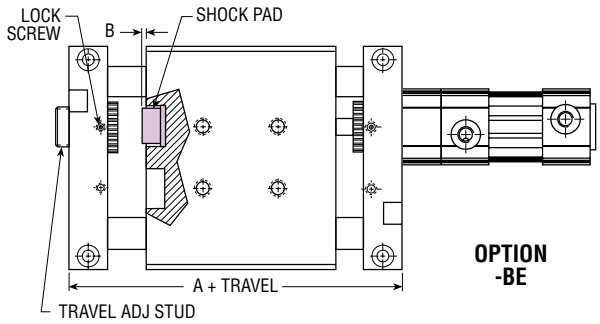
This option provides urethane pads for absorption of shock and noise reduction on the slide saddle. Reducing shock permits higher slide velocities or higher kinetic shock loads. This option actually eliminates metal-to-metal contact at the end of slide travel. Shock pads do not affect the overall slide length.

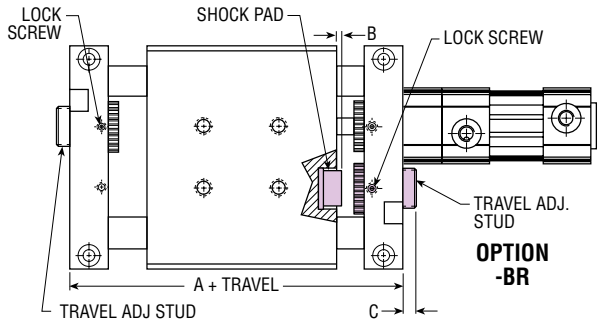
NOTE: Lock screw torque is 30 in-lb [3.39 Nm].

IMPERIAL [METRIC]	A	B	C
SGx41 [SGx81]	5.729 [145.5]	.217 [5.5]	.672 [17]
SGx42 [SGx82]	5.729 [145.5]	.217 [5.5]	.672 [17]
SGx43 [SGx83]	6.693 [170]	.217 [5.5]	.354 [9]
SGx44 [SGx84]	7.441 [189.5]	.118 [3]	.354 [9]
SGx45 [SGx85]	8.445 [214.5]	.118 [3]	.354 [9]
SGx46 [SGx86]	9.449 [240]	.118 [3]	.354 [9]

Numbers in [ ] are for metric units or in mm.





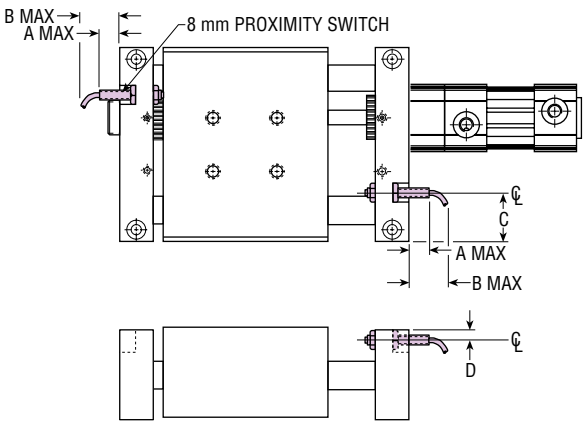


CB PROXIMITY SWITCH READY BOTH ENDS

This option provides targets in the slide saddle for use with 8 mm inductive proximity switches. The end plates of the slide come standard with provisions for mounting the 8 mm proximity switches on both ends. Proximity switches must be ordered separately. See page 2-130 for switch information.

IMPERIAL [METRIC]	A	B	C	D
SGx41 [SGx81]	.81 [20.5]	1.34 [34]	.906 [23]	.967 [24.5]
SGx42 [SGx82]	.81 [20.5]	1.34 [34]	1.083 [27.5]	.295 [7.5]
SGx43 [SGx83]	.57 [14.5]	1.10 [28]	1.260 [32]	.354 [9]
SGx44 [SGx84]	.57 [14.5]	1.10 [28]	1.476 [37.5]	.354 [9]
SGx45 [SGx85]	.57 [14.5]	1.10 [28]	1.693 [43]	.315 [8]
SGx46 [SGx86]	.57 [14.5]	1.10 [28]	2.008 [51]	.315 [8]

Numbers in [ ] are for metric units or in mm.



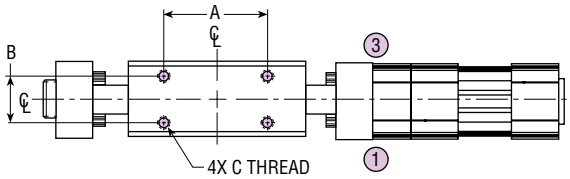
GX SADDLE MOUNTING IN POSITION 4

This option provides an additional mounting pattern on one side (position 4) of the slide saddle. These four threaded holes can be used for mounting a variety of fixturing or tooling.

NOTE: Mounting holes are centered on centerline of saddle.

IMPERIAL [METRIC]	A	B	C
SGx41 [SGx81]	2.913 [74]	.689 [17.5]	M5 x 0.8 x 6 [M5 x 0.8 x 6]
SGx42 [SGx82]	2.913 [74]	.689 [17.5]	M5 x 0.8 x 6 [M5 x 0.8 x 6]
SGx43 [SGx83]	2.756 [70]	1.161 [29.5]	M6 x 1.0 x 9 [M6 x 1.0 x 9]
SGx44 [SGx84]	1.988 [50.5]	1.339 [34]	M6 x 1.0 x 9 [M6 x 1.0 x 9]
SGx45 [SGx85]	2.992 [76]	1.437 [36.5]	M6 x 1.0 x 9 [M6 x 1.0 x 9]
SGx46 [SGx86]	3.996 [101.5]	1.437 [36.5]	M6 x 1.0 x 9 [M6 x 1.0 x 9]

Numbers in [ ] are for metric units or in mm.



View from position 4

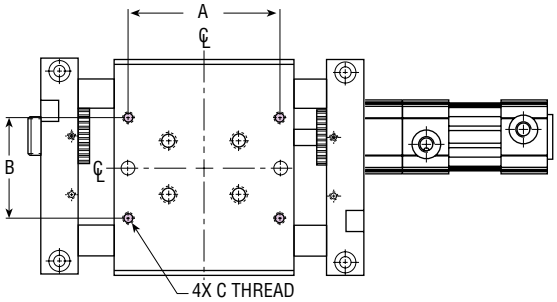
GY SADDLE MOUNTING IN POSITION 1

This option provides an additional wide spread mounting pattern on the top surface (position 1) of the slide saddle. These four threaded holes are farther apart than the standard hole pattern for added mounting stability. (Not available on sizes 1, 2, and 3 slides.)

NOTE: Mounting holes are centered on centerline of saddle.

IMPERIAL [METRIC]	A	B	C
SGx44 [SGx84]	3.956 [100.5 mm]	2.658 [67.5 mm]	1/4-20 x .50 [M6 x 1.0 x 12 mm]
SGx45 [SGx85]	4.488 [114 mm]	2.795 [71 mm]	5/16-18 x .50 [M8 x 1.25 x 12 mm]
SGx46 [SGx86]	5.492 [139.5 mm]	2.834 [72 mm]	3/8-16 x .59 [M10 x 1.50 x 15 mm]

Numbers in [ ] are for metric units or in mm.



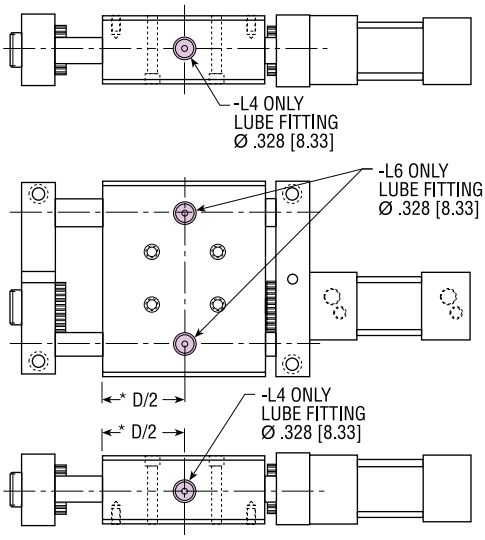
All dimensions are reference only unless specifically toleranced.

L4 LUBE FITTING IN SADDLE PORT POSITION 2 AND 4

L6 LUBE FITTING IN SADDLE PORT POSITION 3

Lube fittings provide an easy efficient method for lubricating the bearings and shafts for extended life beyond the normal catalog specifications. Periodic lubrication (every 25 million inches of travel [.6 million meters]) is recommended for applications where heat, dust, or other conditions will tend to dry out the bearings and shafts. PHD suggests a lightweight oil. Silicon-based lubricants should **NOT** be used on units with PHD's **TC** bushings.

NOTE: *See catalog dimension page 2-120 for dimension "D."



Q1 CORROSION RESISTANT GUIDE SHAFTS

Extremely hard corrosion-resistant coating on the guide shafts for use in applications where moisture may corrode untreated hardened ground shafts. End faces of the shafts remain uncoated. Consult PHD for fully coated shafts.

Z1 ELECTROLESS NICKEL PLATING

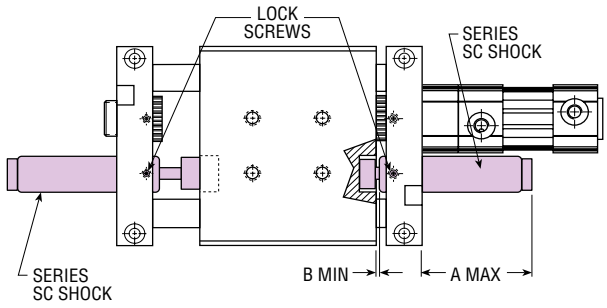
This option provides electroless nickel plating on all externally exposed ferrous parts except the guide shafts and cylinder rod end. This optional plating can be used for protecting the slide from severe or corrosive environments. The guide shafts can be made corrosion-resistant by specifying the -Q1 shaft option.

NOTE: Shock absorbers are not plated with -Z1 option.

SHOCK ABSORBERS

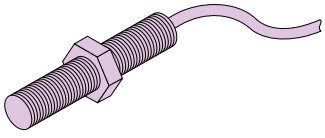
Shock absorbers provide the optimum means for decelerating loads at the end of travel and absorbing the kinetic energy associated with decelerating the load. PHD offers nine different shock absorbers to cover a wide range of applications.

NOTE: Lock screw torque is 30 in-lb [3.39 Nm]. Do not allow shock absorber to bottom out. Take care to properly adjust dimension B.



SHOCK ABSORBER KIT SPECIFICATIONS

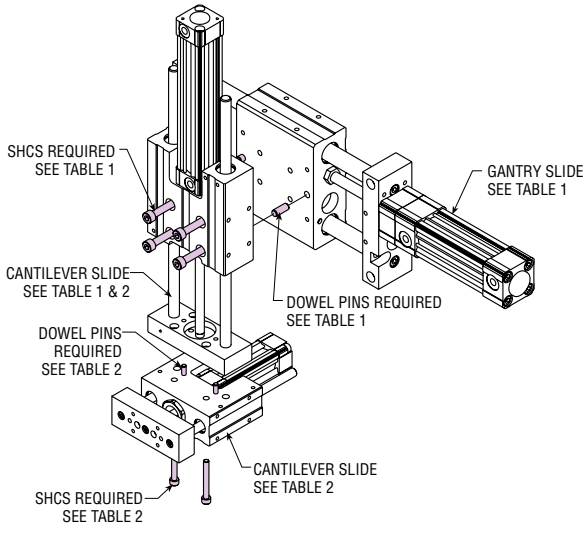
SLIDE MODEL	PHD SHOCK ABSORBER NUMBER	TRAVEL in	TRAVEL mm	THREAD TYPE	SHOCK ABSORBER WEIGHT lb	SHOCK ABSORBER WEIGHT kg	DIMENSION A SC SHOCK in	DIMENSION A SC SHOCK mm	DIMENSION B in	DIMENSION B mm
SGxx1 SGxx2	-1 57858-07-2 -3	.63	16	M14 x 1.5	.18	.08	3.07	78	.079	2
SGxx3	-1 57858-01-2 -3	.75	19	M20 x 1.5	.25	.11	2.34	59.5	.079	2
SGxx4 SGxx5 SGxx6	-1 57858-02-2 -3	1.00	25	M25 x 1.5	.67	.30	2.99	76	.079	2
	-5 57858-02-6 -7	1.58	40	M25 x 1.5	.87	.39	4.23	107.5	.079	2



INDUCTIVE PROXIMITY SWITCHES

Two models of inductive proximity switches are available for use with PHD Series SG Slides (with option -CB). See Switches section for switch details.

MODEL NUMBER	DESCRIPTION
51422-005-02	DC Inductive Proximity Switch 8 mm Threaded Current Sinking (NPN)
51422-006-02	DC Inductive Proximity Switch 8 mm Threaded Current Sourcing (PNP)



NOTE: Series SK/SL Slide tool plate may retract past edge of Series SG Slide saddle without tool plate extension or -AR options.

Modular design of the SK/SL housing allows the unit to bolt and dowel directly to the saddle of the metric Series SG gantry slide without the need for a transition plate. See the chart below for slide compatibility and hardware required. Each kit includes 4 SHCS and 2 dowel pins.

TABLE 1: SERIES SK/SL SLIDE TO SERIES SG SERIES SLIDE

MODULAR DESIGN		HARDWARE KITS	
CANTILEVER	GANTRY	STANDARD	-Z1 OPTION
SK/SLxx81	SGxx82	65578-01-1	65578-01-2
SK/SLxx82	SGxx83	65578-02-1	65578-02-2
SK/SLxx83	SGxx84	65578-03-1	65578-03-2
SK/SLxx84	SGxx85	65578-04-1	65578-04-2
SK/SLxx85	SGxx86	65578-05-1	65578-05-2

TABLE 2: SERIES SK/SL SLIDE TO SERIES SK/SL SERIES SLIDE

MODULAR DESIGN		HARDWARE KITS	
CANTILEVER HOUSING	CANTILEVER TOOL PLATE	STANDARD	-Z1 OPTION
SK/SLxx81	SK/SLxx82	65547-01-1	65547-01-2
SK/SLxx82	SK/SLxx83	65547-02-1	65547-02-2
SK/SLxx83	SK/SLxx84	65547-03-1	65547-03-2
SK/SLxx84	SK/SLxx85	65547-04-1	65547-04-2
SK/SLxx85	SK/SLxx86	65547-05-1	65547-05-2

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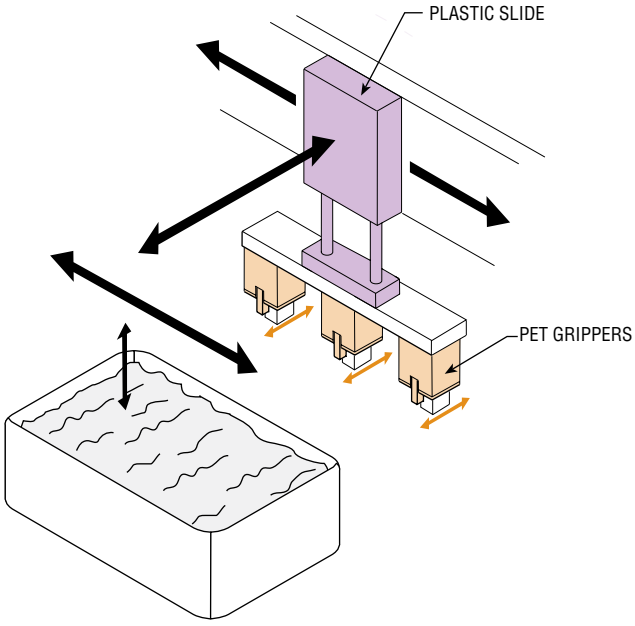
CORROSION RESISTANT PLASTIC SLIDE MODEL# ML305733



UNIT FEATURES

Bore Size:	2X 32 mm DIA
Stroke:	2.000 +.080/-.000 in [50 mm]
Body:	PET
Tool Plate:	PET
Guide Shafts:	Stainless steel with scrapers
Retaining Rings:	Stainless steel
Fasteners:	Stainless steel
	(OTHER CONFIGURATIONS ARE AVAILABLE)

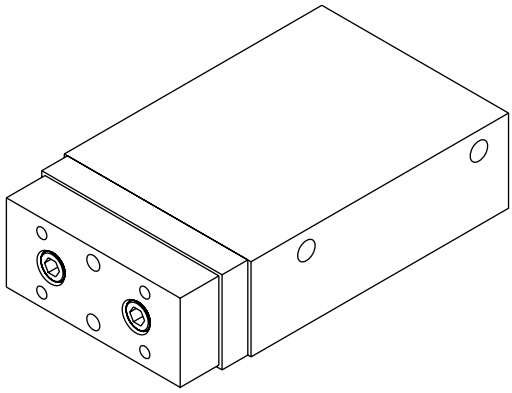
Major Benefits

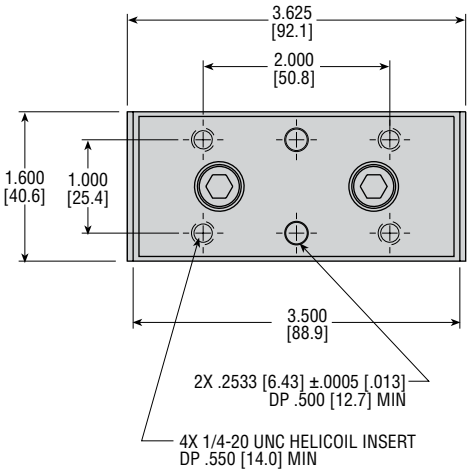
- 100% corrosion resistant
- Material used - PET & stainless steel
- Purge / Vacuum port
- Rod scrapers
- No grooves in body
- Stainless steel mounting insert
- Lightweight
- Large guide shafts
- Dual bore slide

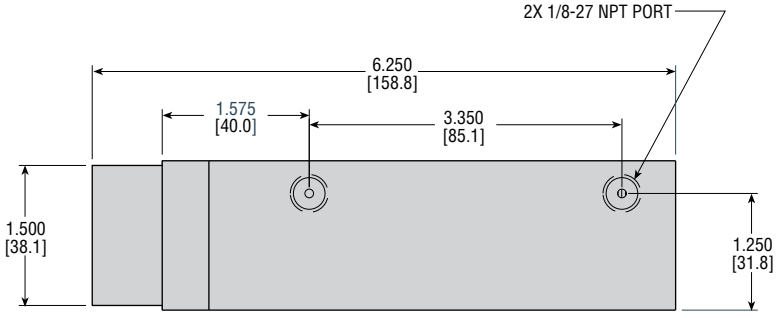
Industry Uses

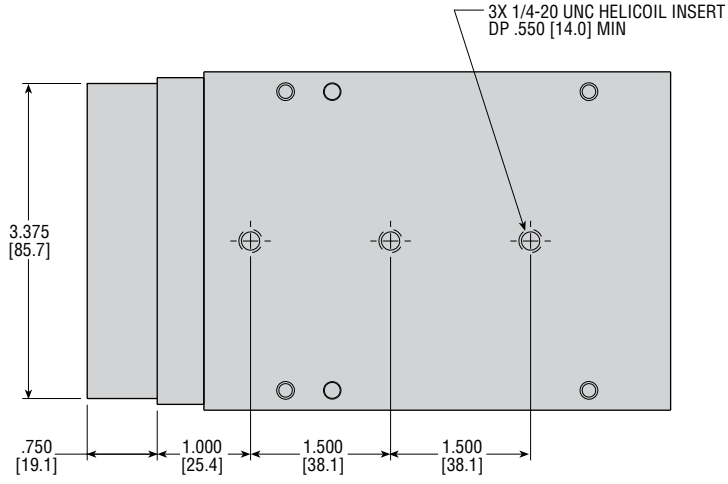
- Medical industry
- Semiconductor industry

DIMENSIONS: CORROSION RESISTANT PLASTIC SLIDE MODEL# ML305733









NOTES:
1) ALL DIMENSIONS ARE REFERENCE UNLESS SPECIFICALLY TOLERANCED
2) DIMENSION UNITS ARE INCHES [mm]

All dimensions are reference only unless specifically toleranced.

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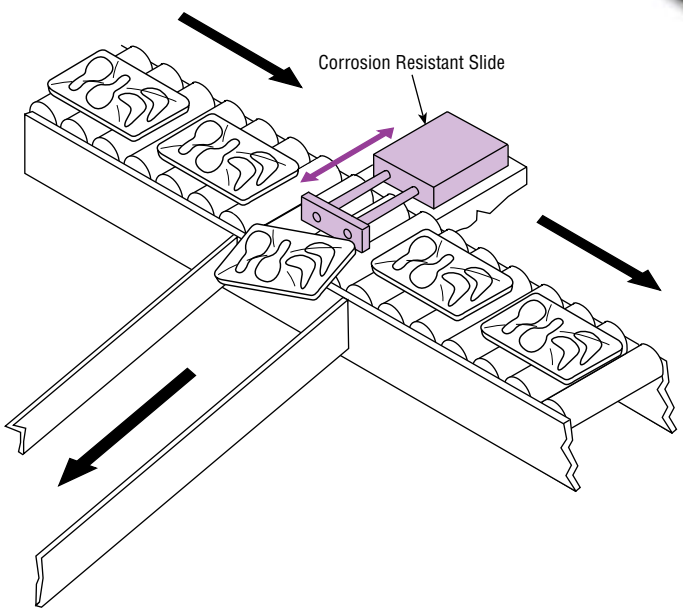
CORROSION RESISTANT COMPACT HEAVY DUTY SLIDE MODEL# ML307246



UNIT FEATURES

Bore Size:	25 mm
Stroke:	2.000 +.080/-.000 in [25 mm]
Body:	hardcoat aluminum
Tool Plate:	hardcoat aluminum
Guide Shafts:	Chrome-plated stainless steel with scrapers
Retaining Rings:	hardcoated
Fasteners:	Stainless steel
	(OTHER CONFIGURATIONS ARE AVAILABLE)

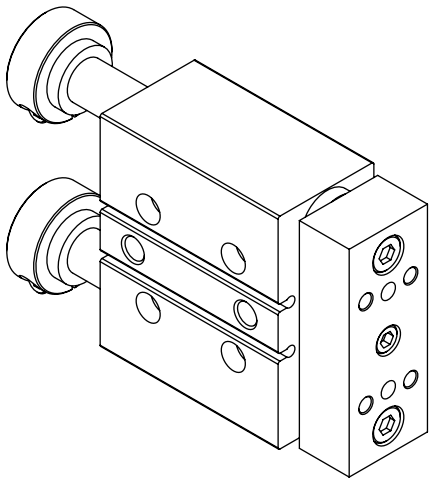
Major Benefits

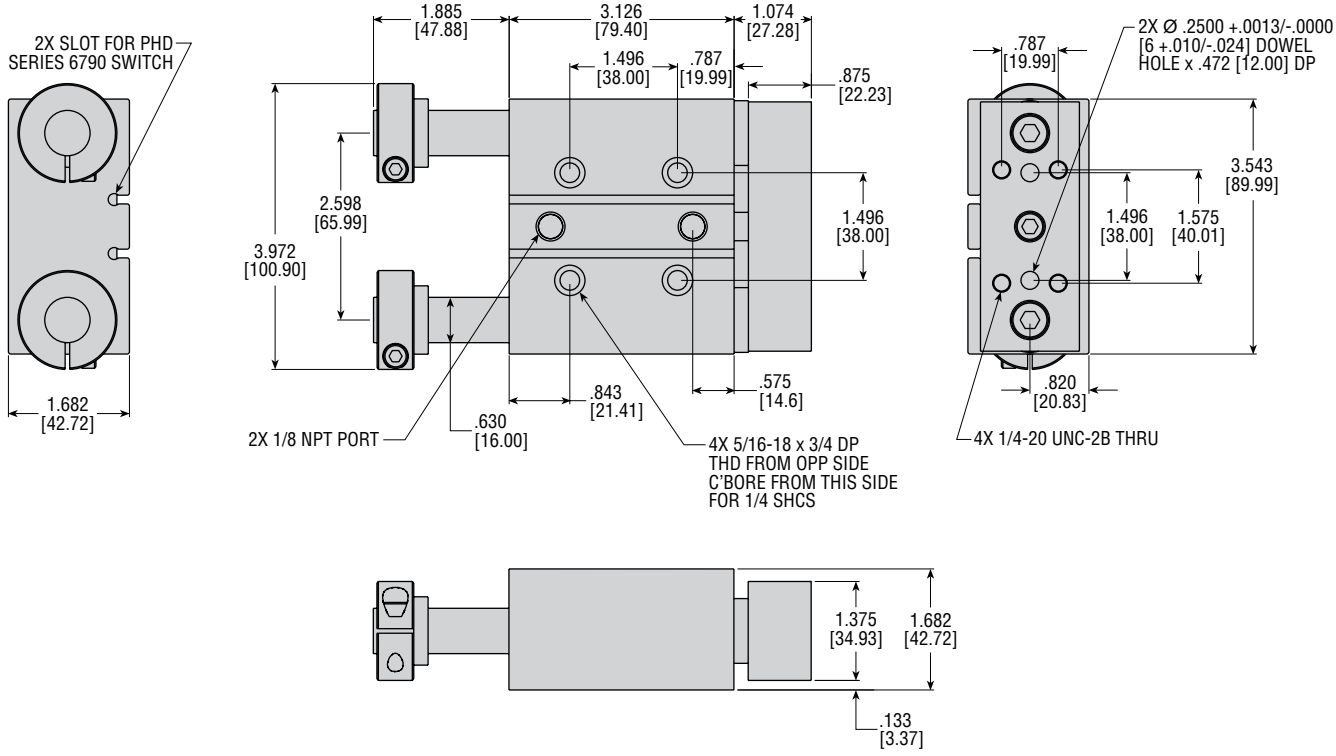
- 100% corrosion resistant
- Material used - hardcoat aluminum for maximum corrosion resistance
- Long life
- Field repairable
- Large guide shafts
- Heavy duty, rugged
- Stainless steel stop collars
- Shock pads

Industry Uses

- Medical industry
- Semiconductor industry
- Food industry

DIMENSIONS: CORROSION RESISTANT COMPACT HEAVY DUTY SLIDE MODEL# ML307246





All dimensions are reference only unless specifically toleranced.

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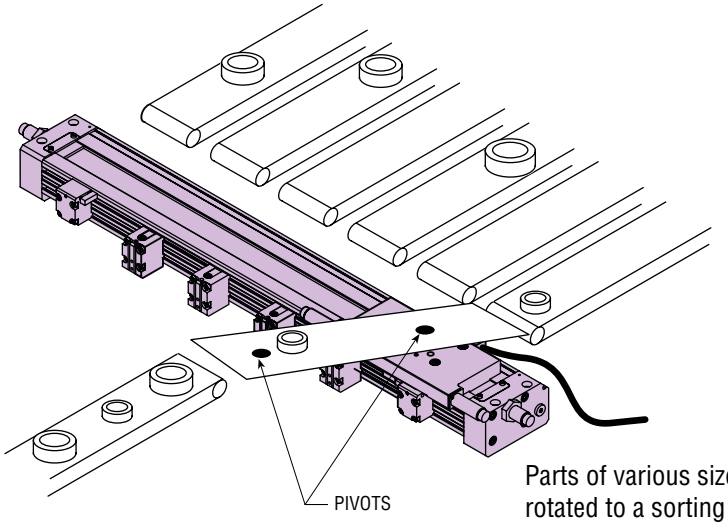
SERIES SFM5 SLIDE WITH BALLUFF TRANSDUCER MODEL# ML309003



Parts of various sizes are rotated to a sorting line.

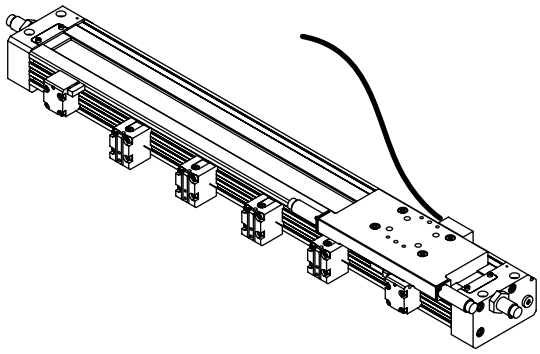
Major Benefits

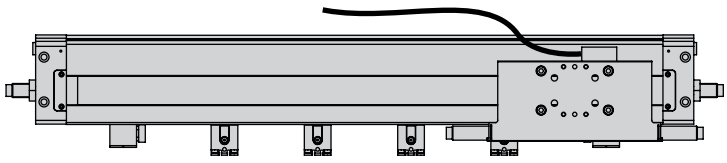
- Uses BML Balluff transducer
- 1 micron = 1 pulse
- Can adapt to different types of feedback devices
- Simple configuration
- See Slides Section for Series SFM5 dimensions
- Other configurations available

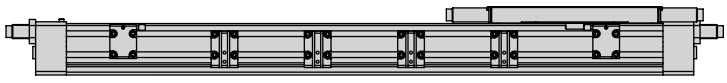
Industry Uses

- Material processes
- Conveyor

DIMENSIONS: SERIES SFM5 SLIDE WITH FEEDBACK MODEL# ML309003







See Slide Section for Series SFM5 dimensions

All dimensions are reference only unless specifically toleranced.

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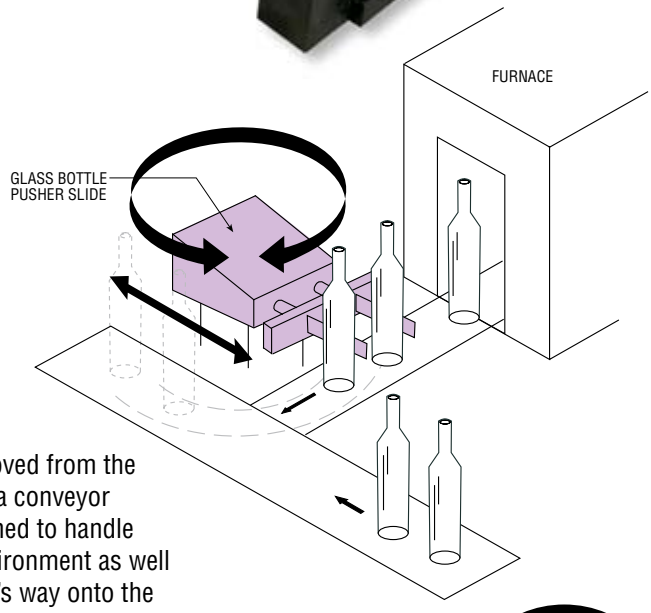
GLASS BOTTLE PUSHER SLIDE MODEL# ML305605

UNIT FEATURES

Twin Bore: Ø 50 mm
Stroke: 4.160 ±.028 in
Guideshafts: Ø 25 mm Hardened, Ground Steel
Body: PTFE Hardcoat Aluminum
Toolplate: Steel
Fluoroelastomer seals and polymer bushings
Built-in quick exhaust valve on retract
Cycle Speeds
Extend: 100 m/sec
Retract: 230 m/sec



Hot wine bottles are being removed from the molding furnace and moved to a conveyor system. The PHD slide is designed to handle the high temperature of the environment as well as the molten glass that finds it's way onto the unit's moving parts.

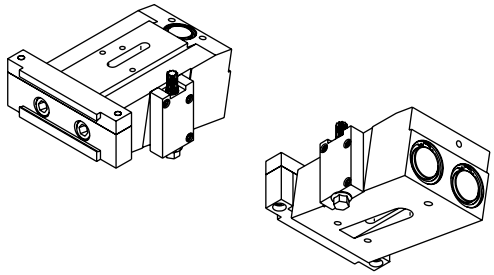
Major Benefits

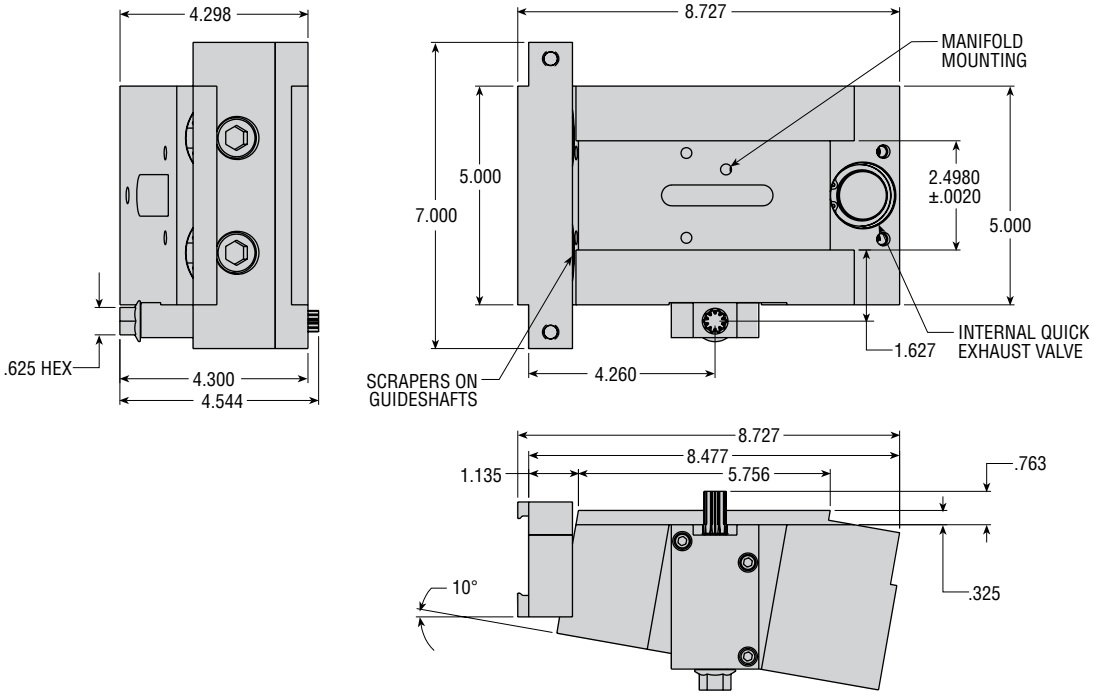
- Direct replacement for existing angle slides
- Faster retract speed
- Longer life design
- Built for high temperature environments

Industry Uses

- Glass bottle manufacturing

DIMENSIONS: GLASS BOTTLE PUSHER SLIDE MODEL# ML305605





All dimensions are reference only unless specifically toleranced.

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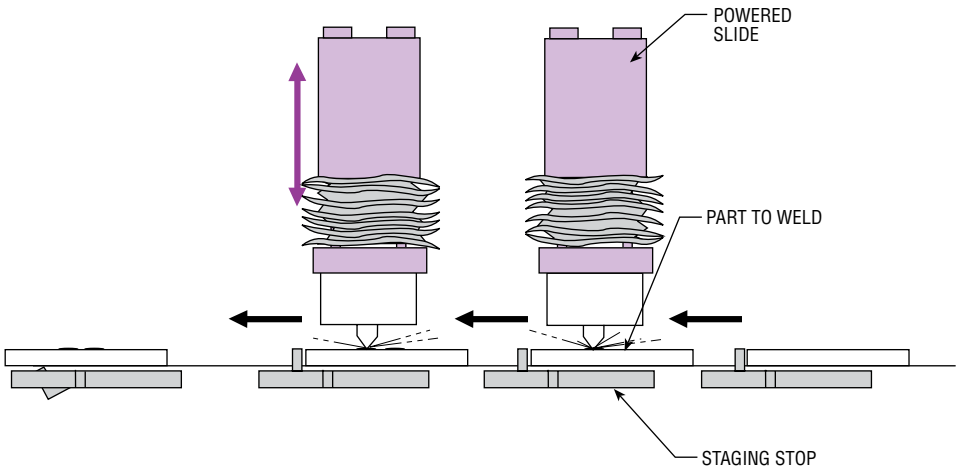
UNIQUE SOLUTIONS

SERIES SAH SLIDE WITH BELLOWS MODEL# ML307248



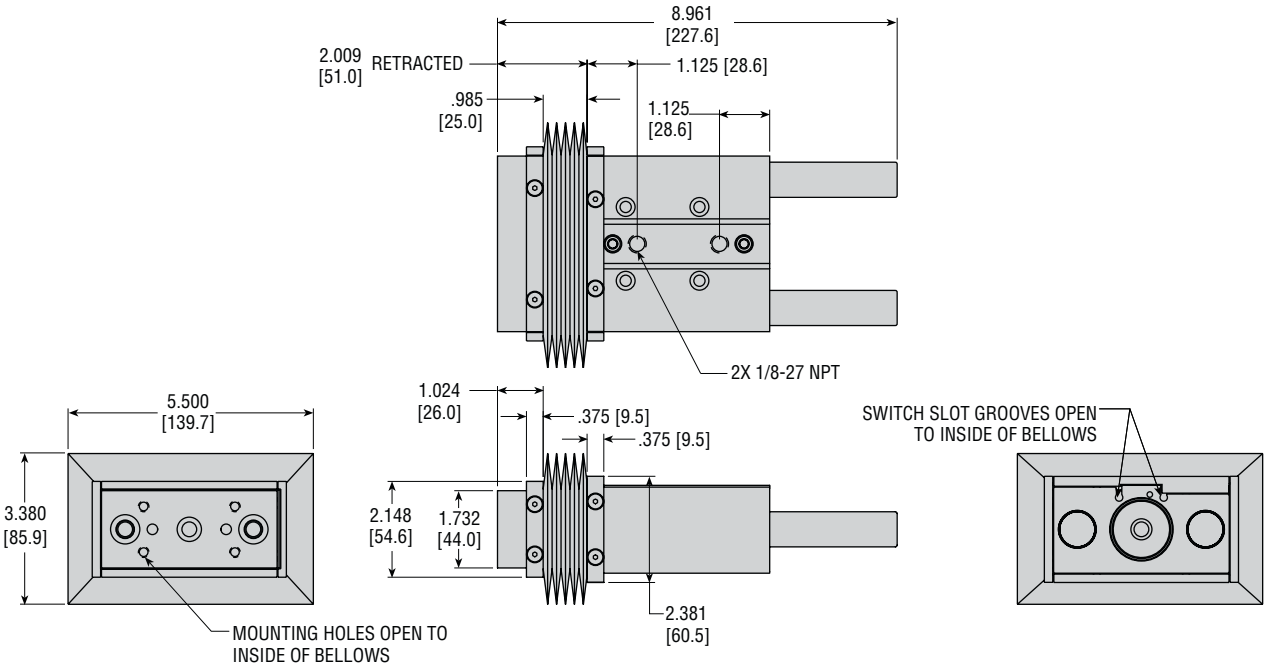
Major Benefits

- Modified for protection against weld slag
- Uses standard PHD components
- Can be used on other PHD slides

Industry Uses

- Welding
- Assembly machines

DIMENSIONS: SERIES SAH SLIDE WITH BELLOWS MODEL# ML307248

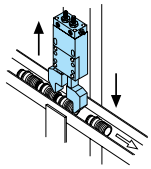
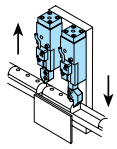


NOTES:

1) ALL DIMENSIONS ARE FOR REFERENCE ONLY UNLESS NOTED
2) DIMENSIONS NOT NOTED ARE STD PER UNIT DESCRIPTION
3) BELLOWS INCLUDED IN QUOTATION AND ARE SHOWN FOR REPRESENTATION PURPOSE. ACTUAL BELLOWS MAY VARY
4) DIMENSIONS MAY VARY DURING FINAL DESIGN / CHECKING OF UNIT

All dimensions are reference only unless specifically toleranced.

escapements

SERIES		MODEL	MAXIMUM STROKE in	[mm]	TYPICAL LOAD lb	[N]	MAJOR BENEFIT	APPLICATION TYPE	INDUSTRY USE
160 (Double Rod) **pages 3-3 to 3-10**		02	.375	[10]	.5	[2.2]	• Ideal for isolating and feeding individual parts from vibrating feeders, magazines, hoppers or conveyors		• Material handling/ conveyors • Automotive • Light bulb manufacturing • Optical
		12	.500	[12]	1.0	[4.4]			
		10, 14	.500	[12]	1.5	[6.7]			
		22	.750	[20]	2.5	[11.1]			
		20, 24	.750	[20]	4.0	[17.8]			
		42	1.250	[32]	35	[155]			
LC (Single Rod) **pages 3-11 to 3-16**		10	.394	[10]	.5	[2.2]	• Ideal for shot pin applications • Shock pad options reduce noise and minimize end of stroke shock		• Compact • Assembly machine builders • Automotive • Medical • Optical
		12	.472	[12]	1.0	[4.4]			
		20	.787	[20]	2.5	[11.1]			
		32	1.260	[32]	35	[155]			

phd Unlimited™
UNIQUE SOLUTIONS

unique solutions

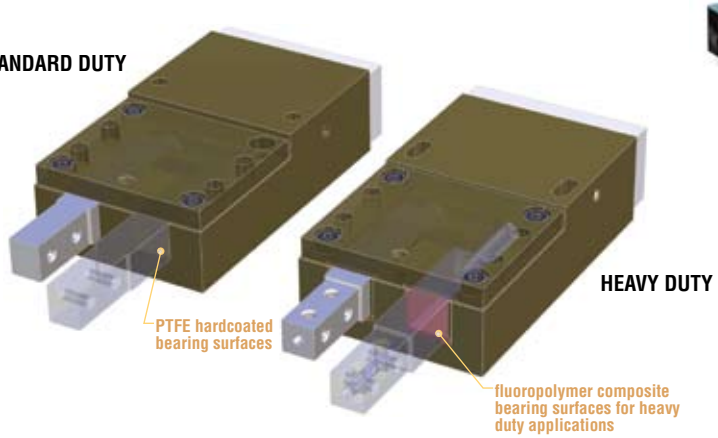
Heavy Duty Escapement
Model# ML187550
35 mm bore heavy duty design for large loads
PHD LitStore CP020
page 3-17

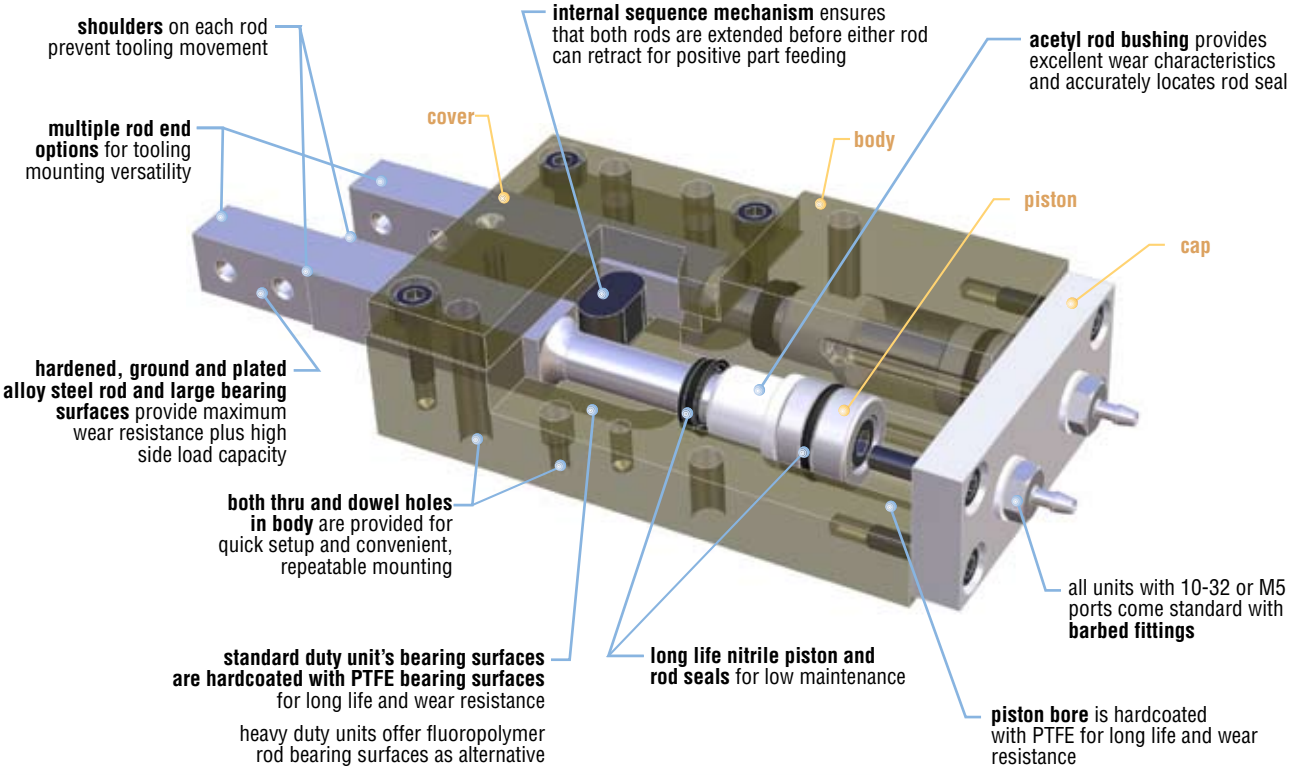
Long Travel 3 Position Escapement
Model# ML307421
100 mm travel with 25 mm mid-position
page 3-19

Staging Stop
Model# ML307537
8 mm bore
Locks when extended
page 3-21

160

SERIES 160 DOUBLE ROD ESCAPEMENTS





Major Benefits

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

Industry Uses

- Material handling/conveyors
- Automotive
- Light bulb manufacturing
- Optical
- Medical

STANDARD DUTY

TO ORDER SPECIFY:
Series, Model, Design No., Rod End Option, Cap Option, Switch Ready Option, and Seals.

SERIES | **DESIGN NO.** | **CAP OPTIONS** | **SEALS**

CAP OPTIONS
0 - Standard Cap
1 - Cap with flow controls and stroke adjustment
2 - Cap with stroke adjustment only
Cap with flow controls and/or stroke adjustments not available on Model 02 or 03.

SEALS
1 - Buna-N
2 - Fluoro-Elastomer

160 12 - 2 - 1 1 1 2

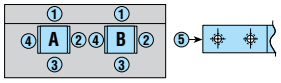
MODEL
IMPERIAL
02 - 3/8" Bore & Stroke
12 - 1/2" Bore & Stroke
22 - 3/4" Bore & Stroke
42 - 1-1/4" Bore & Stroke
METRIC
03 - 10 mm Bore & Stroke
13 - 12 mm Bore & Stroke
23 - 20 mm Bore & Stroke
43 - 32 mm Bore & Stroke

ROD END OPTIONS
1 - Flats and threaded holes on sides 1 and 3 on both rods
2 - Flats and threaded holes on sides 2 and 4 on both rods
3 - Flats and threaded holes on sides 1 and 3 of rod A, and on sides 2 and 4 of rod B
4 - Flats and threaded holes on sides 2 and 4 of rod A, and on sides 1 and 3 of rod B

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

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

ROD END POSITIONS



Options may affect unit length. See unit dimension and options pages for adders.

HEAVY DUTY

TO ORDER SPECIFY:
Series, Model, Design No., Rod End Option, Cap Option, Switch Ready Option, and Seals.

SERIES | **DESIGN NO.** | **CAP OPTIONS** | **SEALS**

CAP OPTIONS
0 - Standard Cap
1 - Cap with flow controls and stroke adjustment
2 - Cap with stroke adjustment only

SEALS
1 - Buna-N
2 - Fluoro-Elastomer

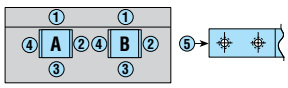
160 10 - 2 - 0 1 1 1

MODEL
IMPERIAL
10 - 1/2" Bore & Stroke with slotted mounting hole
20 - 3/4" Bore & Stroke with slotted mounting hole
14 - 1/2" Bore & Stroke with standard mounting hole
24 - 3/4" Bore & Stroke with standard mounting hole
METRIC
11 - 12 mm Bore & Stroke with slotted mounting hole
21 - 20 mm Bore & Stroke with slotted mounting hole
15 - 12 mm Bore & Stroke with standard mounting hole
25 - 20 mm Bore & Stroke with standard mounting hole

ROD END OPTIONS
0 - Flats and threaded holes on all four sides with a threaded hole in the end on both rods
1 - Flats and threaded holes on sides 1 and 3 on both rods
2 - Flats and threaded holes on sides 2 and 4 on both rods
3 - Flats and threaded holes on sides 1 and 3 of rod A, and on sides 2 and 4 of rod B
4 - Flats and threaded holes on sides 2 and 4 of rod A, and on sides 1 and 3 of rod B

SWITCH READY OPTIONS
0 - None
1 - Series 5360 Hall Effect Switch Ready
Switches must be ordered separately.

ROD END POSITIONS



Options may affect unit length. See unit dimension and options pages for adders.

UNIQUE ESCAPEMENTS ARE AVAILABLE. SEE PAGES 3-17 TO 3-20

SERIES 5360
MINIATURE HALL EFFECT SWITCHES

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

See Switches and Sensors section for additional switch information and complete specifications.

6mm SQUARE
INDUCTIVE PROXIMITY SWITCHES

PART NO.	DESCRIPTION
18431-001-02	NPN (Sink) 10-30 VDC, 2 meter cable
18431-002-02	PNP (Source) 10-30 VDC, 2 meter cable

4mm ROUND
INDUCTIVE PROXIMITY SWITCHES

PART NO.	DESCRIPTION
18430-001-02	NPN (Sink) 10-30 VDC, 2 meter cable
18430-002-02	PNP (Source) 10-30 VDC, 2 meter cable

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

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

CYLINDER THRUST CALCULATION

	IMPERIAL F = P x A	METRIC F = 0.1 x P x A
F = Cylinder Force	lb	N
P = Operating Pressure	psi	bar

RESPONSE TIME

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

TOTAL CYCLE TIME = 2T + DWELL TIMES

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

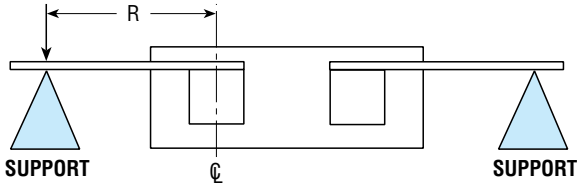
EQUATION	CONSTANT	STANDARD DUTY 1600x	STANDARD DUTY 1601x	STANDARD DUTY 1602x	STANDARD DUTY 1604x	HEAVY DUTY 1601x	HEAVY DUTY 1602x
RESPONSE TIME	U	0.125 [0.125]	0.200 [0.200]	0.250 [0.250]	0.350 [0.350]	0.200 [0.200]	0.250 [0.250]
	S	6500 [448]	1250 [86]	1000 [69]	1000 [69]	1250 [86]	1000 [69]
	X	1500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

MAXIMUM ROD TORQUE

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

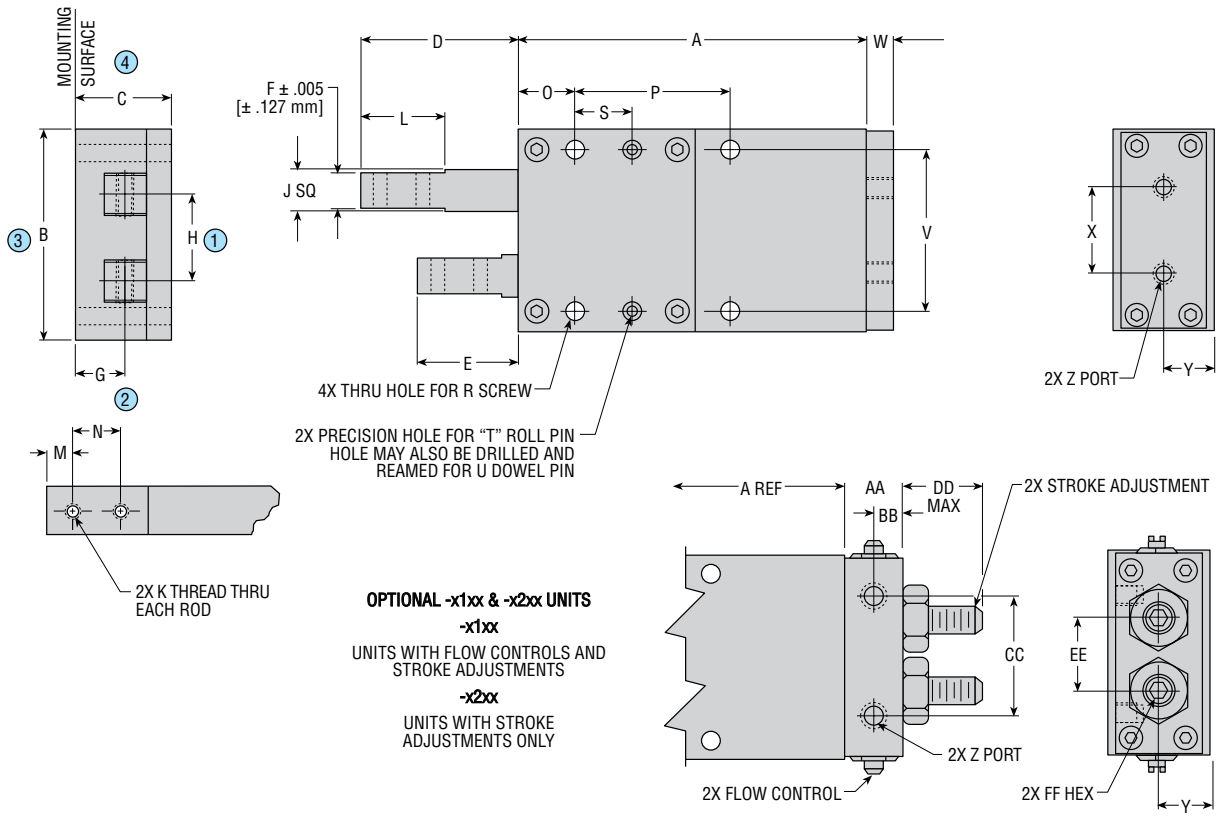
For applications which exceed the maximum allowable rod torque, the tooling should be supported as shown.
Calculation without the support:
Max. Rod Load Torque = (Load) x R

MAX. ROD LOAD TORQUE = (LOAD) x R



SIZING AND APPLICATION ASSISTANCE
See PHD Product Sizing Catalog for specific and complete sizing information.
Online sizing assistance is available at: ***www.phdinc.com/apps/sizing***

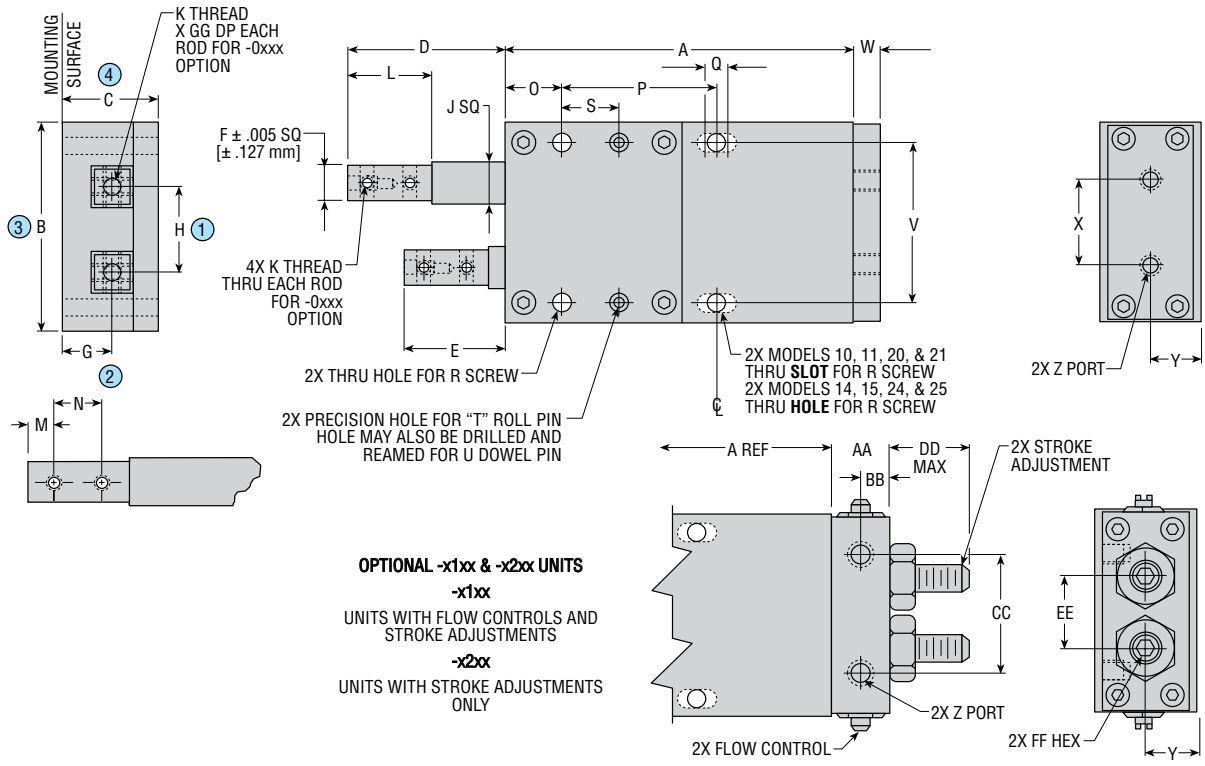
DIMENSIONS: SERIES 160 DOUBLE ROD ESCAPEMENTS STANDARD DUTY



LETTER	IMPERIAL MODEL NO.				METRIC MODEL NO.			
DIM.	16002-2	16012-2	16022-2	16042-2	16003-2	16013-2	16023-2	16043-2
A	2.510	3.000	3.880	6.140	63.8	76.2	98.6	156.0
B	1.500	1.781	2.539	3.740	38.1	45.2	64.5	95.0
C	.750	.875	1.188	1.969	19.1	22.2	30.2	50.0
D	.986	1.358	1.885	3.385	25.0	34.5	47.9	86.0
E	.593	.875	1.135	2.125	15.1	22.2	28.8	54.0
F	.259	.310	.435	.768	6.6	7.9	11.0	19.5
G	.374	.438	.593	.983	9.5	11.1	15.1	25.0
H	.551	.748	1.123	1.752	14.0	19.0	28.5	44.5
J	.300	.364	.490	.860	7.6	9.2	12.4	21.8
K	4-40 UNC	6-32 UNC	10-32 UNF	5/16-18 UNC	M3 x 0.5	M3 x 0.5	M5 x 0.8	M8 x 1.25
L	.500	.750	1.000	2.000	12.7	19.1	25.4	50.8
M	.125	.187	.250	.500	3.2	4.7	6.4	12.7
N	.250	.375	.500	.875	6.4	9.5	12.7	22.2
O	.431	.500	.687	1.004	10.9	12.7	17.4	25.5
P	1.095	1.344	1.709	2.875	27.8	34.1	43.4	73.0
R	#6	#6	#10	5/16	M3	M3	M5	M8
S	.408	.500	.750	1.250	10.4	12.7	19.1	31.8
T	3/32	3/32	5/32	3/16	3/32	3/32	5/32	3/16
U	1/8	1/8	3/16	1/4	3.0	3.0	5.0	6.0
V	1.166	1.468	2.125	3.147	29.6	37.3	54.0	79.9
W	.250	.250	.380	.380	6.4	6.4	9.7	9.7
X	.551	.750	1.125	1.752	14.0	19.1	28.6	44.5
Y	.374	.438	.593	.983	9.5	11.1	15.1	25.0
Z	10-32 UNF	10-32 UNF	1/8 NPT	1/8 NPT	M5 x 0.8	M5 x 0.8	1/8 BSP	1/8 BSP
AA	—	.500	.625	.625	—	12.7	15.9	15.9
BB	—	.250	.312	.312	—	6.4	7.9	7.9
CC	—	1.032	1.406	2.276	—	26.2	35.7	57.8
DD	—	.817	1.010	2.020	—	20.8	25.7	51.3
EE	—	.625	.876	1.421	—	15.9	22.3	36.1
FF	—	1/8	3/16	8 mm	—	1/8	3/16	8 mm

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

All dimensions are reference only unless specifically toleranced.



OPTIONAL -x1xx & -x2xx UNITS

-x1xx

UNITS WITH FLOW CONTROLS AND STROKE ADJUSTMENTS

-x2xx

UNITS WITH STROKE ADJUSTMENTS ONLY

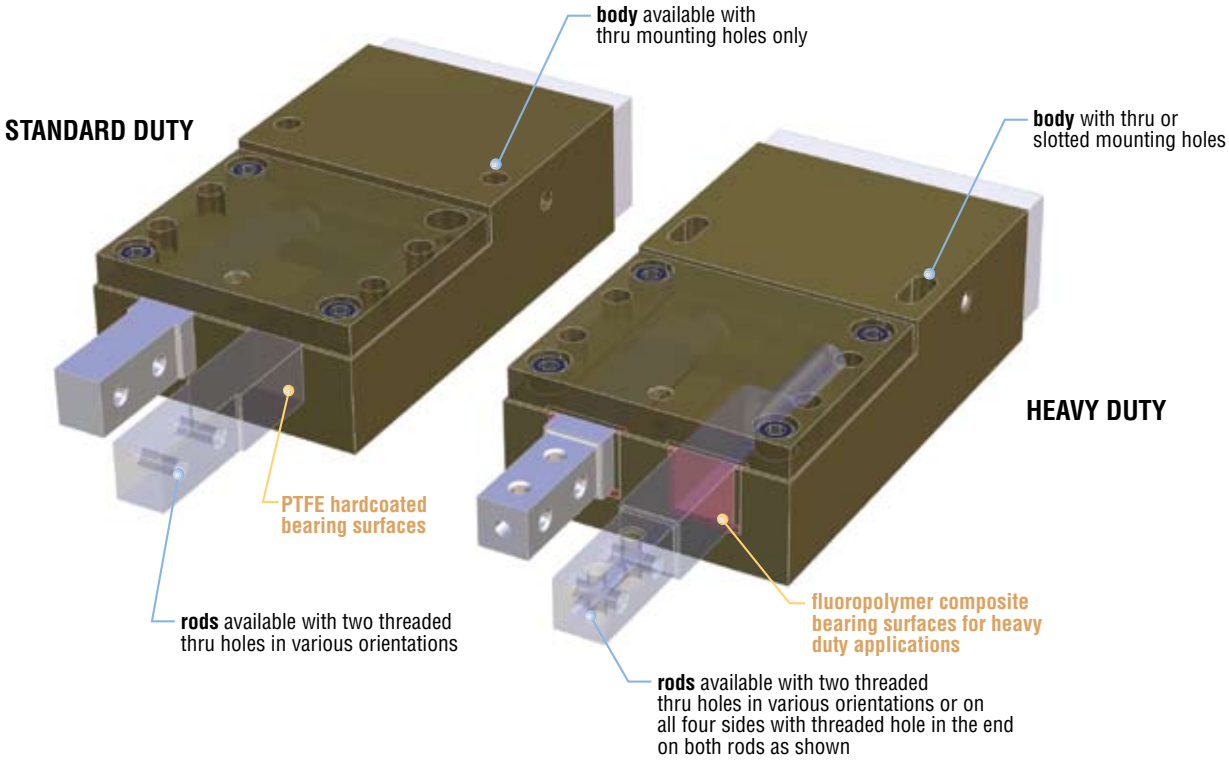
LETTER DIM.	IMPERIAL MODEL NO.		METRIC MODEL NO.	
	16010 & 16014	16020 & 16024	16011 & 16015	16021 & 16025
A	3.000	3.880	76.2	98.6
B	1.781	2.539	45.2	64.5
C	.875	1.188	22.2	30.2
D	1.358	1.885	34.5	47.9
E	.875	1.135	22.2	28.8
F	.310	.435	7.9	11.0
G	.471	.594	12.0	15.1
H	.746	1.121	18.9	28.5
J	.364	.490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

NOTES:

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

HEAVY DUTY VS. STANDARD DUTY

PHD Escapements are available in heavy and standard duty models. The heavy duty model is offered in two sizes and uses fluoropolymer composite rod bearings which allow higher static and impact loads on the stroke rods. The standard duty model is offered in four sizes. It utilizes PTFE impregnated hardcoat rod bearings for applications requiring moderate static and impact loads on the stroke rods.

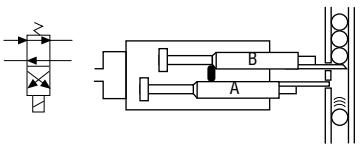


TYPICAL OPERATION

WORKING PRINCIPLE

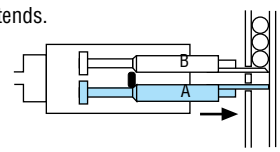
PHD Escapements are internally ported allowing both double acting stroke rods to be operated by a single 4 port, 2 position valve. The sequence of rod motions allows parts being fed continuously from a magazine or feeder to be separated or grouped for subsequent processing.

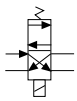
INITIAL VALVE POSITION



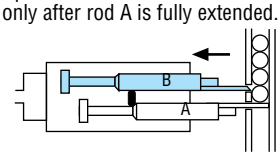
ACTIVATED VALVE POSITION

Rod A extends.



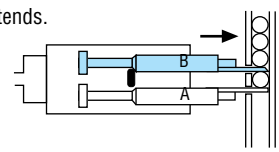


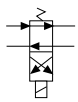
Internal sequence mechanism allows rod B to retract only after rod A is fully extended.



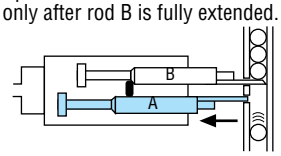
RETURN TO INITIAL VALVE POSITION

Rod B extends.





Internal sequence mechanism allows rod A to retract only after rod B is fully extended.



All dimensions are reference only unless specifically toleranced.

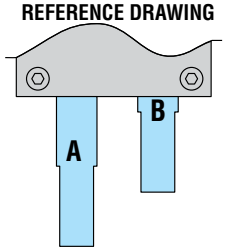
-Xxxx ROD END OPTIONS

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

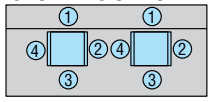
The most cost effective rod end options are -1, -2, -3, and -4. These options provide mounting holes and flats on two sides only of each rod.

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

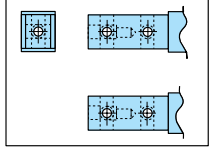
OPTIONS -1 THROUGH -4 REFERENCE DRAWING



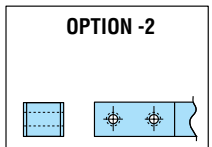
SHOWN AS OPTION -2



OPTION -0



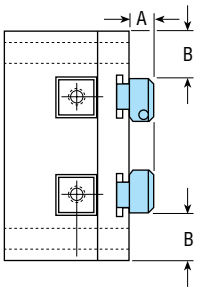
OPTION -2



160

1 HALL EFFECT SWITCH READY -xx1x

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



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

Numbers shown in [ ] are mm.

SERIES 5360 MINIATURE HALL EFFECT SWITCHES

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

See Switches and Sensors section for additional switch information and complete specifications.

2 SWITCH READY -xx2x 16002 AND 16003 UNITS ONLY

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

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

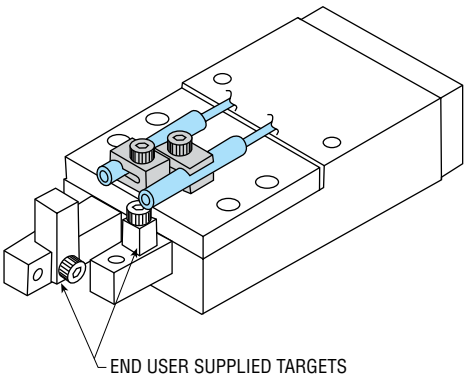
PROXIMITY SWITCH MOUNTING KITS

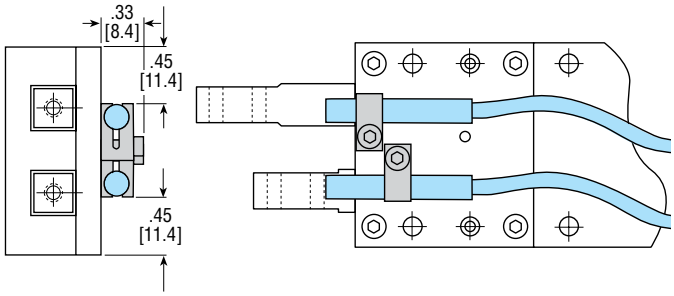
PROXIMITY SWITCH	KIT NUMBER
4 mm Round Inductive	57879
6 mm Square Inductive	57880

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

4 mm ROUND

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



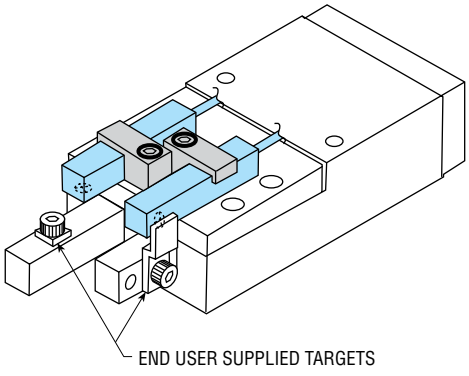


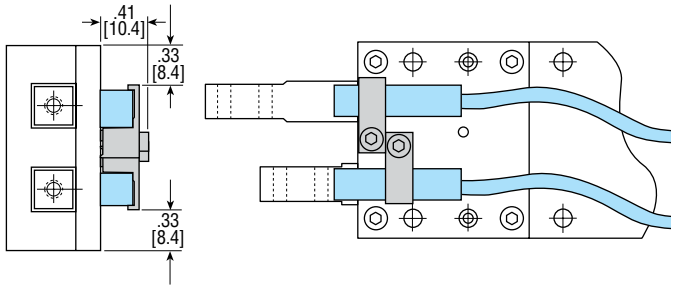
4 mm ROUND INDUCTIVE PROXIMITY SWITCHES

PART NO.	DESCRIPTION
18430-001-02	NPN (Sink) 10-30 VDC, 2 meter cable
18430-002-02	PNP (Source) 10-30 VDC, 2 meter cable

6 mm SQUARE

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





6 mm SQUARE INDUCTIVE PROXIMITY SWITCHES

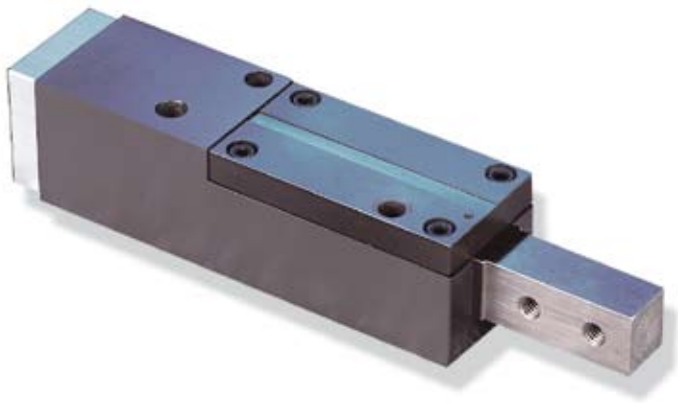
PART NO.	DESCRIPTION
18431-001-02	NPN (Sink) 10-30 VDC, 2 meter cable
18431-002-02	PNP (Source) 10-30 VDC, 2 meter cable

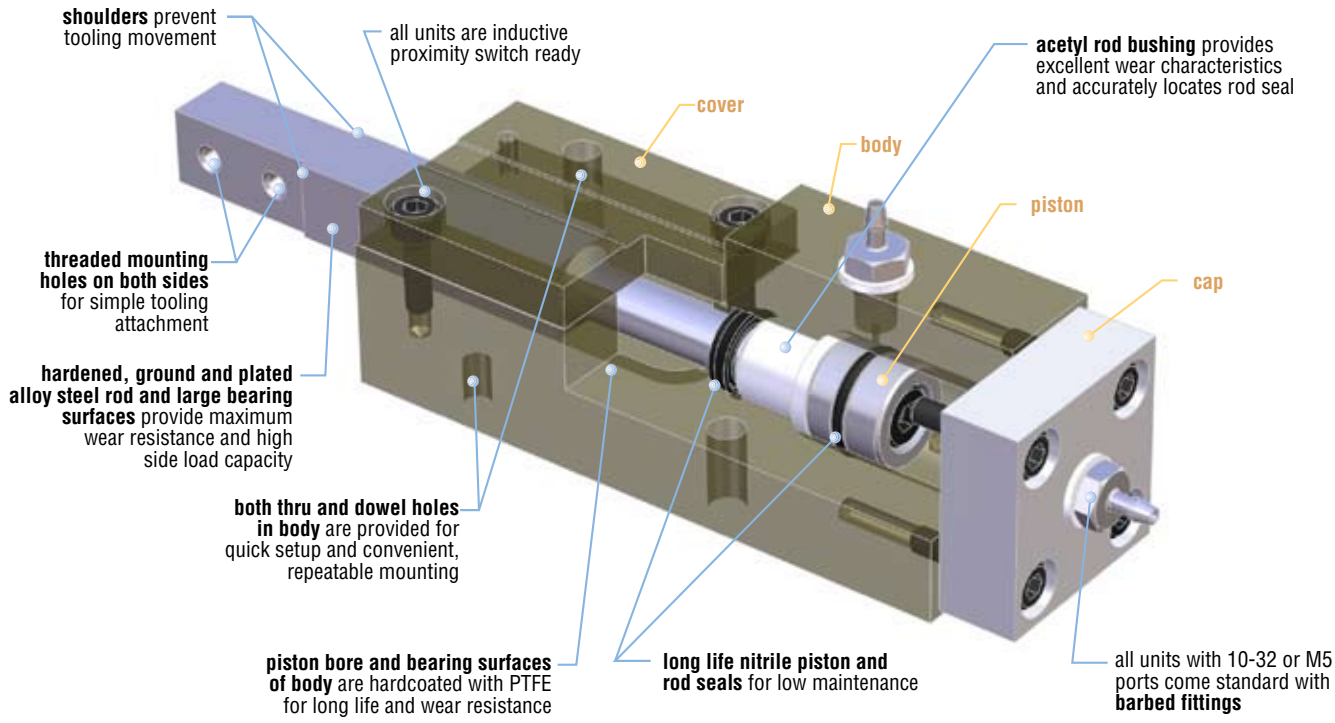
Numbers in [ ] are for metric units.

All dimensions are reference only unless specifically toleranced.

LC

SERIES LC SINGLE ROD ESCAPEMENTS





Major Benefits

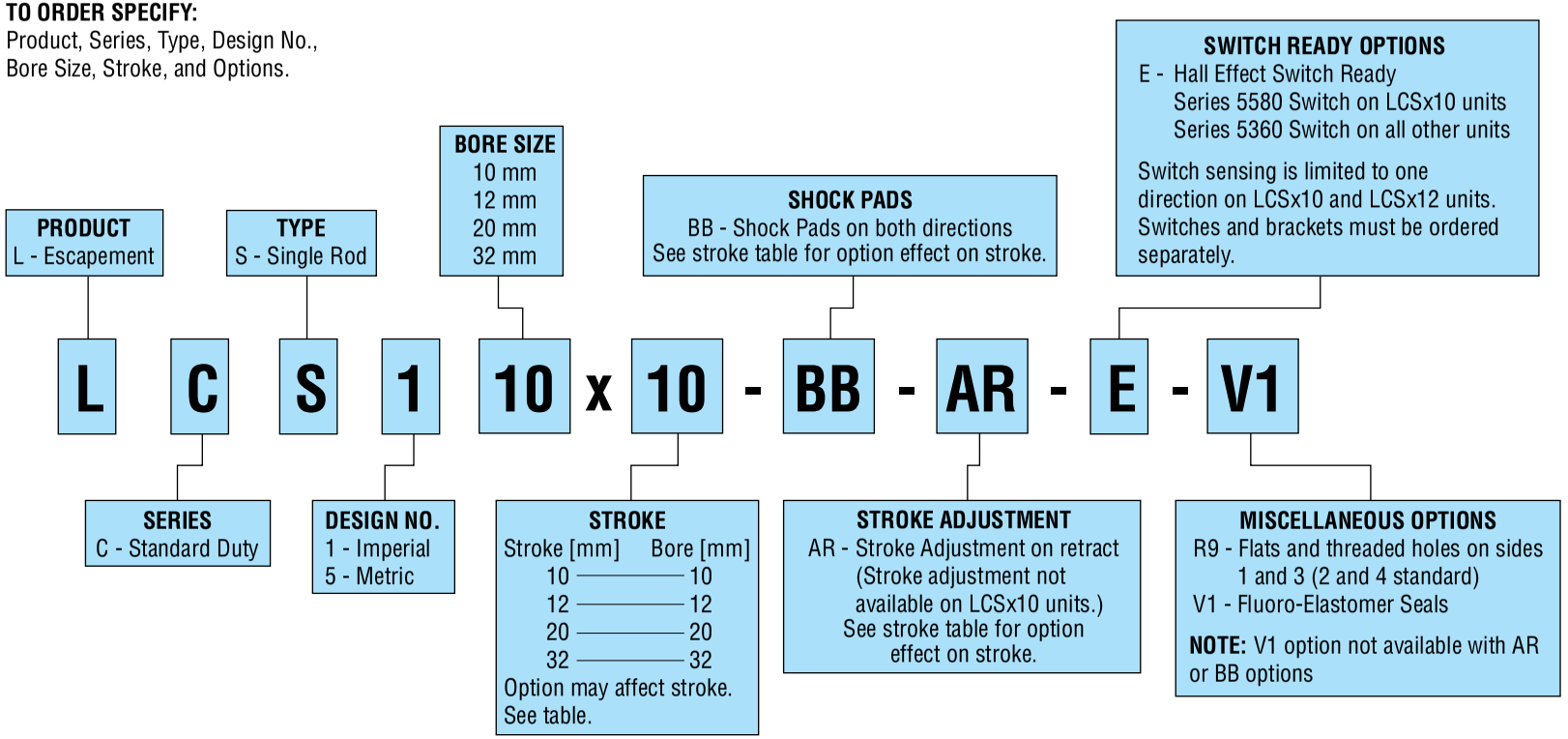
- Ideal for shot pin applications
- Shock pad options reduce noise and minimize end of stroke shock
- Imperial or metric versions available
- Simple construction for easy field maintenance
- Large rod bearing area ensures high side load capacity
- Next day delivery

Industry Uses

- Material handling/conveyors
- Assembly machine builders
- Automotive
- Medical
- Optical

ORDERING DATA: SERIES LC SINGLE ROD ESCAPEMENTS

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



SERIES 5360
MINIATURE HALL EFFECT SWITCHES

PART NO.	DESCRIPTION
53603-1-02	NPN 4.5 - 24 VDC with 2 meter cable
53604-1-02	PNP 4.5 - 24 VDC with 2 meter cable
53623-1	NPN 4.5 - 24 VDC with quick connect
53624-1	PNP 4.5 - 24 VDC with quick connect

See Switches and Sensors section for additional switch information and complete specifications.

SERIES 5580
HALL EFFECT SWITCHES

PART NO.	DESCRIPTION
55803-1-02	NPN 4.5 - 24 VDC with 2 meter cable
55804-1-02	PNP 4.5 - 24 VDC with 2 meter cable
55823-1	NPN 4.5 - 24 VDC with quick connect
55824-1	PNP 4.5 - 24 VDC with quick connect

Mounting Kit Number - 57880

6mm SQUARE
INDUCTIVE PROXIMITY SWITCHES

PART NO.	DESCRIPTION
18431-001-02	NPN (Sink) 10-30 VDC, 2 meter cable
18431-002-02	PNP (Source) 10-30 VDC, 2 meter cable

Mounting Kit Number - 57880

4mm ROUND
INDUCTIVE PROXIMITY SWITCHES

PART NO.	DESCRIPTION
18430-001-02	NPN (Sink) 10-30 VDC, 2 meter cable
18430-002-02	PNP (Source) 10-30 VDC, 2 meter cable

Mounting Kit Number - 57879

STROKE TABLE

OPTION	LCSx10	LCSx12	LCSx20	LCSx32
STANDARD UNIT	.394 [10]	.472 [12]	.787 [20]	1.26 [32]
SHOCK PAD (-BB)	.354 [9]	.433 [11]	.787 [20]	1.26 [32]
STROKE ADJ (-AR)	— —	.413 [10.5]	.728 [18.5]	1.20 [30.5]
-AR -BB	— —	.374 [9.5]	.728 [18.5]	1.20 [30.5]

Options may affect unit length. See unit dimension and options pages for adders.

UNIQUE ESCAPEMENTS ARE AVAILABLE. SEE PAGES 3-17 TO 3-20.

SPECIFICATIONS	SERIES LC
OPERATING PRESSURE	20 to 150 psi [1.4 to 10 bar] air
OPERATING TEMPERATURE	-20° to 180°F [-28° to 82°C]
STANDARD TOLERANCE	+.031/-.000 [+.08/-.00]
RATED LIFE	5 million cycles*
VELOCITY	20 in/sec [0.5 m/sec] typical min, zero load at 100 psi [7 bar]
LUBRICATION	Factory lubricated for rated life
MAINTENANCE	Field repairable

*-V1 option may reduce life.

UNIT	BORE in	BORE mm	ROD DIRECTION	EFFECTIVE AREA in²	EFFECTIVE AREA mm²	WEIGHT TABLE STANDARD lb	STANDARD kg	STROKE ADJUSTMENT lb	STROKE ADJUSTMENT kg
LCSx10	.394	10	EXTEND	.122	78.5	.22	.1	–	–
			RETRACT	.094	60.5				
LCSx12	.472	12	EXTEND	.175	112.6	.45	.21	.51	.24
			RETRACT	.126	81.1				
LCSx20	.787	20	EXTEND	.487	313.4	.90	.42	1.1	.51
			RETRACT	.410	263.8				
LCSx32	1.260	32	EXTEND	1.247	802.4	2.80	1.3	3.4	1.6
			RETRACT	1.050	675.6				

CYLINDER THRUST CALCULATION

	IMPERIAL F = P x A	METRIC F = 0.1 x P x A
F = Cylinder Force	lb	N
P = Operating Pressure	psi	bar
A = Effective Area	in²	mm²

STROKE TABLE

OPTION	LCSx10	LCSx12	LCSx20	LCSx32
STANDARD UNIT	.394 [10]	.472 [12]	.787 [20]	1.26 [32]
SHOCK PAD (-BB)	.354 [9]	.433 [11]	.787 [20]	1.26 [32]
STROKE ADJ (-AR)	— —	.413 [10.5]	.728 [18.5]	1.20 [30.5]
-AR -BB	— —	.374 [9.5]	.728 [18.5]	1.20 [30.5]

RESPONSE TIME

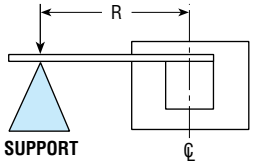
Following is a reference guide to response times of the piston rod for extend and retract based on a typical load at 87 psi [6 bar]. The response time for rod extension will be less than the response time for retraction. Varying the operating pressure, air line diameter, and the applied load will affect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

UNIT	TYPICAL LOAD lb	TYPICAL LOAD kg	RETRACT TIME sec	EXTEND TIME sec
LCSx10	1	.45	.03	.02
LCSx12	2	.91	.04	.03
LCSx20	5	2.3	.06	.04
LCSx32	10	4.5	.08	.06

MAXIMUM ROD TORQUE

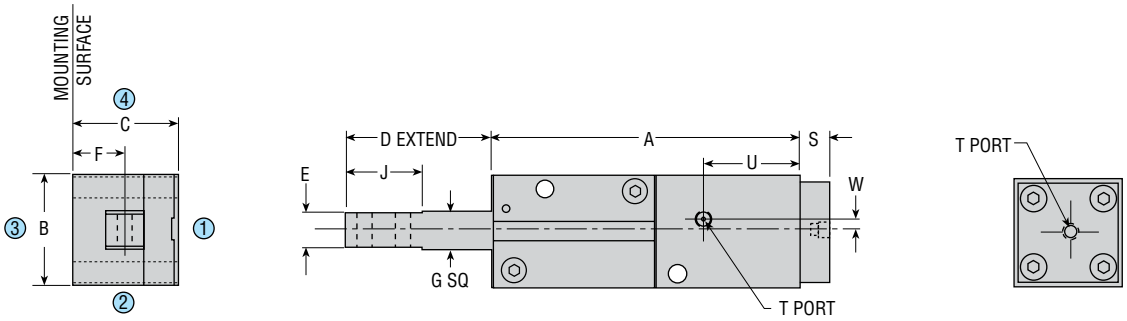
MODEL NO.	STANDARD DUTY in-lb	STANDARD DUTY Nm
LCSx10	1.2	0.14
LCSx12	2.0	0.25
LCSx20	5.0	0.6
LCSx32	9.0	1.1

MAX. ROD LOAD TORQUE = (LOAD) x R

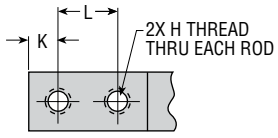


For applications which exceed the maximum allowable rod torque, the tooling should be supported as shown.
Calculation without the support:
Max. Rod Load Torque = (Load) x R

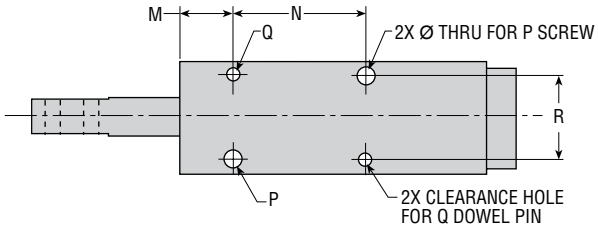
SIZING AND APPLICATION ASSISTANCE
See PHD Product Sizing Catalog for specific and complete sizing information.
Online sizing assistance is available at: ***www.phdinc.com/apps/sizing***



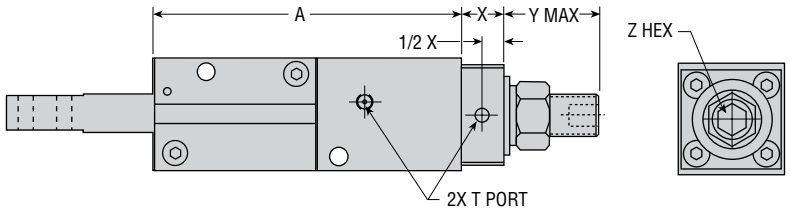
TOP VIEW



ROD MOUNTING DETAIL



BOTTOM VIEW



TOP VIEW WITH OPTIONAL STROKE ADJUSTMENT

(Not available on LCSx10 units)

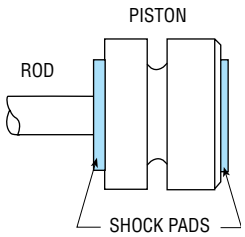
LETTER DIM.	IMPERIAL MODEL NO.				METRIC MODEL NO.			
	LCS110x10	LCS112x12	LCS120x20	LCS132x32	LCS510x10	LCS512x12	LCS520x20	LCS532x32
PHD BORE	.394	.472	.787	1.260	10 mm	12 mm	20 mm	32 mm
A	2.480	3.012	3.937	6.142	63.0	76.5	100.0	156.0
B	.964	1.082	1.417	1.850	24.5	27.5	36.0	47.0
C	.807	1.024	1.339	1.811	20.5	26.0	34.0	46.0
D	1.043	1.358	1.890	3.406	26.5	34.5	48.0	86.5
E	.259	.310	.435	.768	6.6	7.9	11.0	19.5
F	.354	.512	.668	.904	9.0	13.0	17.0	23.0
G	.300	.364	.490	.860	7.6	9.2	12.4	21.8
H	4-40 UNC	6-32 UNC	10-32 UNC	5/16-18 UNC	M3 x 0.5	M3 x 0.5	M5 x 0.8	M8 x 1.25
J	.500	.750	1.000	2.000	12.7	19.0	25.4	50.8
K	.125	.187	.250	.500	3.2	4.7	6.4	12.7
L	.250	.375	.500	.875	6.4	9.5	12.7	22.2
M	.512	.512	.669	1.004	13.0	13.0	17.0	25.5
N	.984	1.339	1.713	2.874	25.0	34.0	43.5	73.0
P	#6	#6	#10	5/16	M3	M3	M5	M8
Q	3 mm	3 mm	4 mm	5 mm	3 mm	3 mm	4 mm	5 mm
R	.591	.748	1.063	1.338	15.0	19.0	27.0	34.0
S	.374	.374	.374	.472	9.5	9.5	9.5	12.0
T	10-32 THD	10-32 THD	10-32 THD	1/8 NPT	M5 x 0.8	M5 x 0.8	M5 x 0.8	1/8 BSP
U	.767	.787	1.220	1.792	19.5	20.0	31.0	45.5
W	.157	.157	.157	.472	4.0	4.0	4.0	12.0
X	—	.552	.552	.827	—	14.0	14.0	21.0
Y	—	.787	1.26	1.831	—	20.0	32.0	46.5
Z	—	4 mm	6 mm	8 mm	—	4 mm	6 mm	8 mm

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

BB SHOCK PADS INSTALLED BOTH DIRECTIONS

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

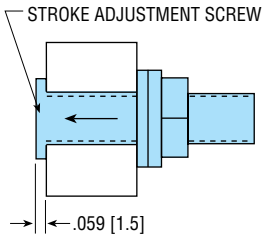
NOTE: Shock pads reduce standard stroke by .039 [1 mm] on LCSx10 and LCSx12 units.



AR STROKE ADJUSTMENT ON RETRACT

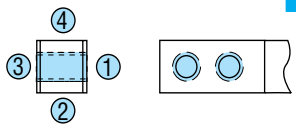
Stroke adjustment screws can be set for precise adjustment of the retracted position from 0" to full stroke. Stroke adjustment option reduces the standard stroke by .059 [1.5 mm].

NOTE: Not available on LCSx10 unit.



R9 ROD END OPTION

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



E SWITCH READY

Series 5580 on LCSx10 units
Series 5360 on all other units

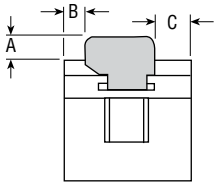
Switch Ready option includes magnets on the rod for PHD solid state switches. Units are equipped to sense in two directions, both extend and retract. Switches must be ordered separately. See chart below.

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

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

PART NO.	DESCRIPTION
55803-1-02	NPN (Sink) 4.5-24 VDC, 2 meter cable
55804-1-02	PNP (Source) 4.5-24 VDC, 2 meter cable
55823-1	NPN (Sink) 4.5-24 VDC, Quick Connect
55824-1	PNP (Source) 4.5-24 VDC, Quick Connect

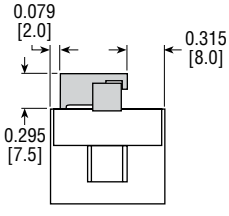
SERIES 5360 HALL EFFECT DIMENSIONS



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

Switch information is continued on page 3-16.
Numbers in [ ] are for metric units and are in millimeters.

SERIES 5580 HALL EFFECT DIMENSIONS



SWITCH BRACKET KIT (NUMBER 57880) MUST BE ORDERED SEPARATELY.

SERIES 5580 IS AVAILABLE ON LCSx10 UNITS ONLY.

INDUCTIVE PROXIMITY SWITCH READY

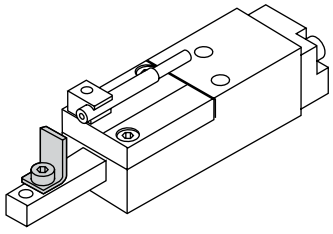
All units are inductive proximity switch ready as standard. A threaded hole is provided in the body cover to allow attachment of PHD bracket kits for 4 mm round or 6 mm square inductive proximity switches.

NOTE: Switch targets mounted on the rod end or on the rod tooling are to be provided by the end user. For more details, see Switches and Sensors section.

Illustrated below are examples (showing the extended rod position) of how 4 mm round and 6 mm square inductive proximity switches are installed. The suggested maximum gap between target and switch is .032 [0.8].

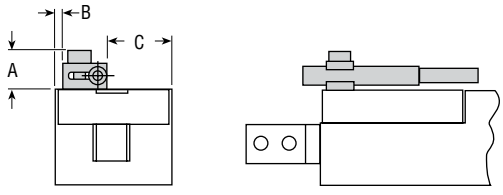
PROXIMITY SWITCH	KIT NUMBER
4 mm Round Inductive	57879
6 mm Square Inductive	57880

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

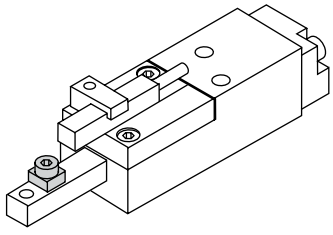


4 mm ROUND INDUCTIVE PROXIMITY SWITCHES

PART NO.	DESCRIPTION
18430-001-02	NPN (Sink) 10-30 VDC, 2 meter cable
18430-002-02	PNP (Source) 10-30 VDC, 2 meter cable

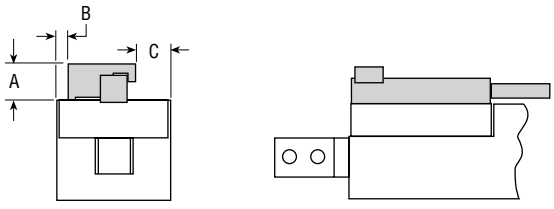


MODEL NO.	DIM A	DIM B	DIM C
LCSx10	0.335 [8.5]	0.059 [1.5]	0.524 [13.3]
LCSx12	0.21 [5.3]	0.118 [3.0]	0.583 [14.8]
LCSx20	0.315 [8.0]	0.283 [7.2]	0.748 [19.0]
LCSx32	0.315 [8.0]	0.500 [12.7]	0.966 [24.5]



6 mm SQUARE INDUCTIVE PROXIMITY SWITCHES

PART NO.	DESCRIPTION
18431-001-02	NPN (Sink) 10-30 VDC, 2 meter cable
18431-002-02	PNP (Source) 10-30 VDC, 2 meter cable



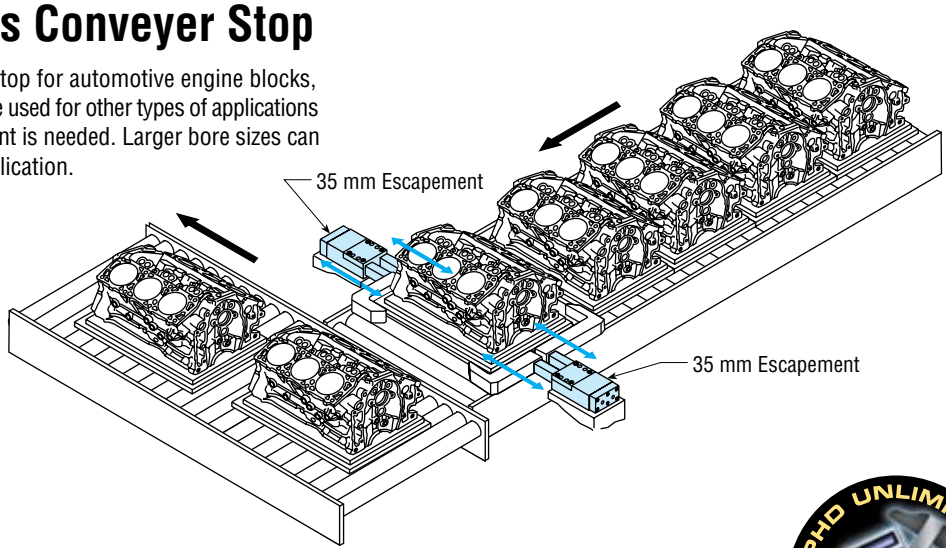
MODEL NO.	DIM A	DIM B	DIM C
LCSx10	0.295 [7.5]	0.079 [2.0]	0.315 [8.0]
LCSx12	0.177 [4.5]	0.138 [3.5]	0.374 [9.5]
LCSx20	0.268 [6.8]	0.305 [7.7]	0.541 [13.7]
LCSx32	0.268 [6.8]	0.522 [13.3]	0.757 [19.2]

All dimensions are reference only unless specifically toleranced.

HEAVY DUTY ESCAPEMENT MODEL# ML187550

Escapements as Conveyer Stop

Originally used as a conveyor stop for automotive engine blocks, this oversized escapement can be used for other types of applications where a more robust escapement is needed. Larger bore sizes can be quoted for your specific application.



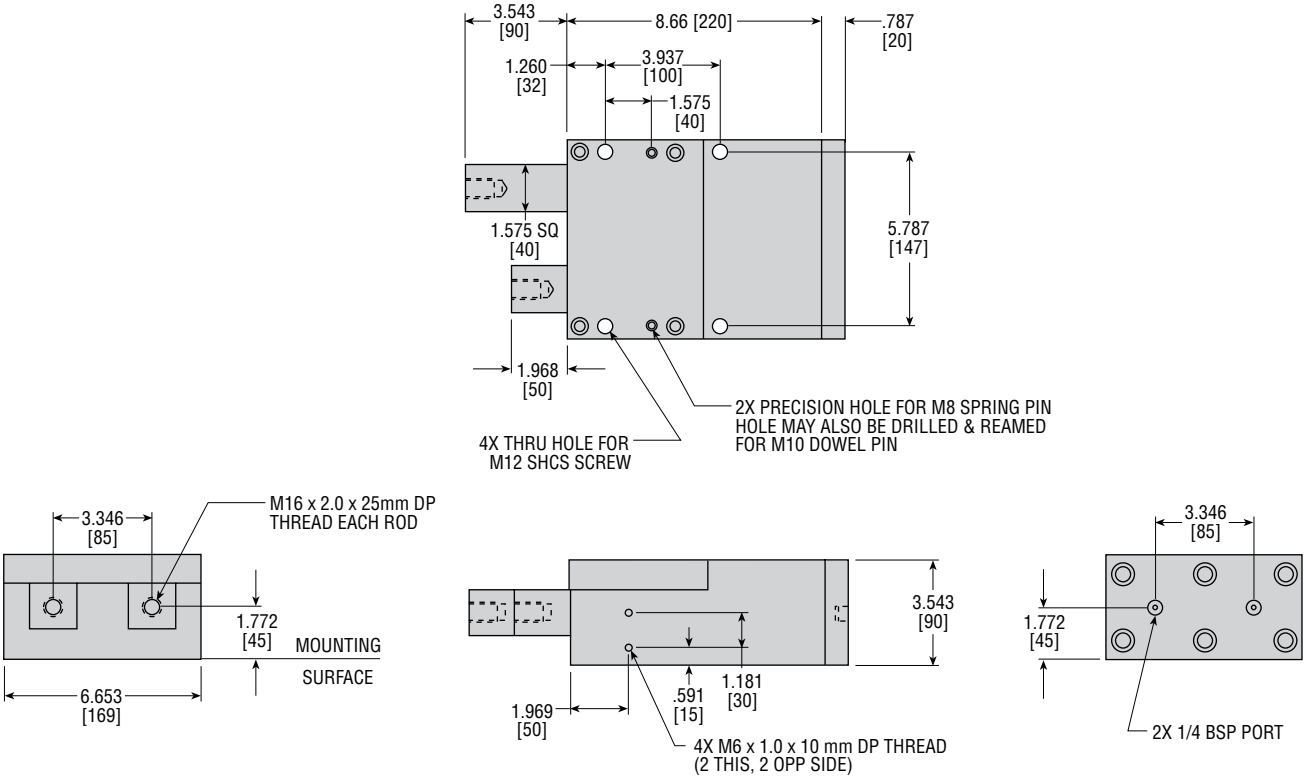
Major Benefits

- 35 mm bore heavy duty design for large loads
- Class 5
- Field repairable
- Oversized shafts
- Other configurations available

Industry Uses

- Material Handling
- Automotive

DIMENSIONS: HEAVY DUTY ESCAPEMENT MODEL# ML187550



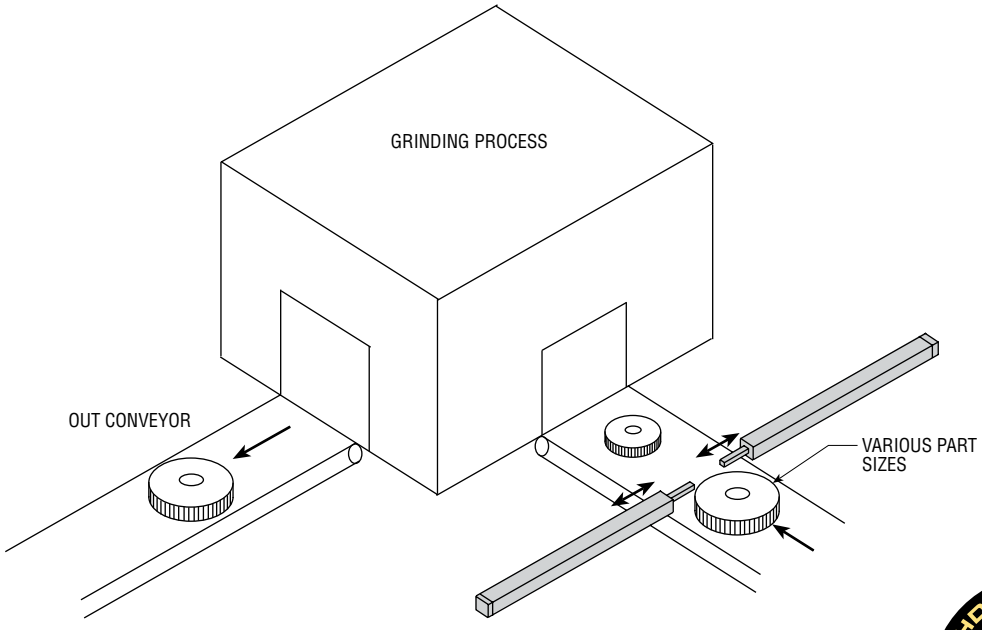
NOTES:
1) ALL DIMENSIONS ARE REFERENCE ONLY UNLESS SPECIFICALLY TOLERANCED
2) NUMBERS IN [ ] ARE IN mm
3) BORE SIZE IS Ø 1-3/8 [35 mm]
4) STROKE OF EACH ROD IS 1.575 [40 mm]

All dimensions are reference only unless specifically toleranced.

LONG TRAVEL 3 POSITION ESCAPEMENT

(100 mm FULL X 25 mm MID-POSITION)

MODEL# ML307421



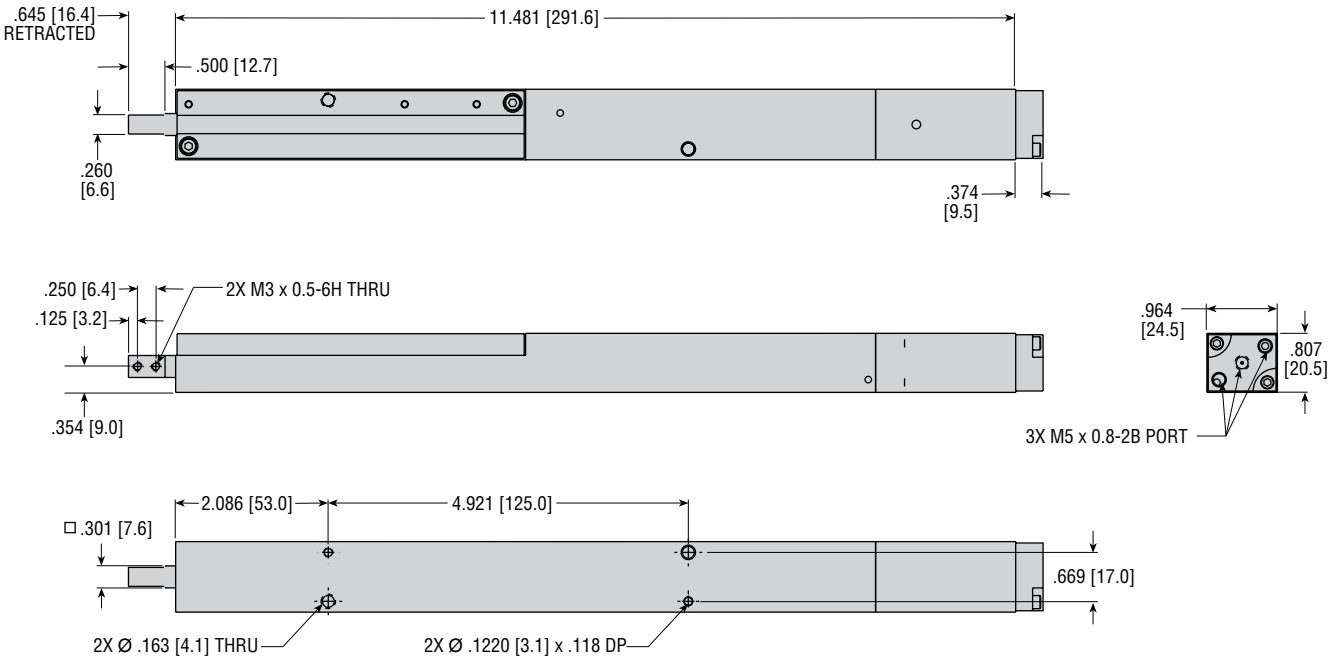
Major Benefits

- 100 mm travel with 25 mm mid-position
- Used when space is limited
- Other positions available

Industry Uses

- Semiconductor
- Specialty machine builders
- Auto parts manufacturers

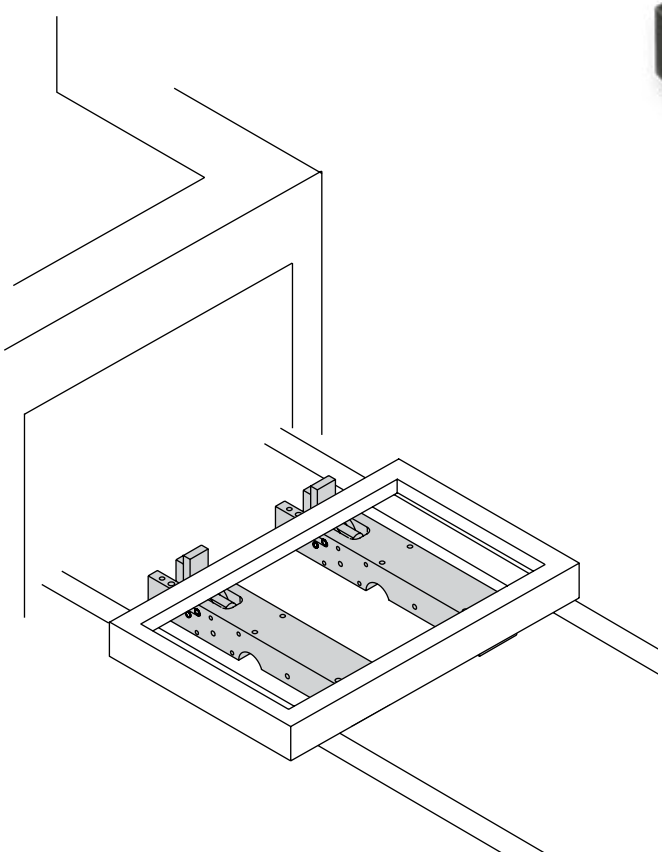
DIMENSIONS: LONG TRAVEL 3 POSITION ESCAPEMENT MODEL# ML307421



NOTES:
1) ALL DIMENSIONS ARE FOR REFERENCE ONLY
2) DIMENSIONS NOT NOTED ARE STANDARD PER DESCRIPTION
3) ORDER PART NUMBER: ML307421

All dimensions are reference only unless specifically toleranced.

STAGING STOP
MODEL# ML307537



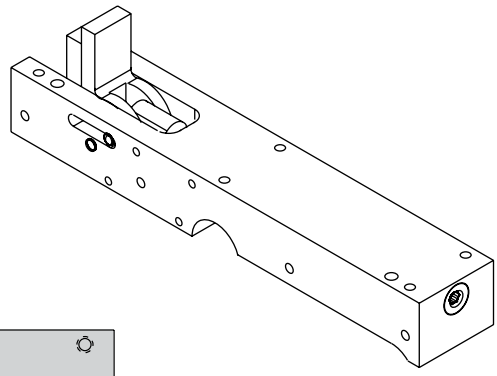
Major Benefits

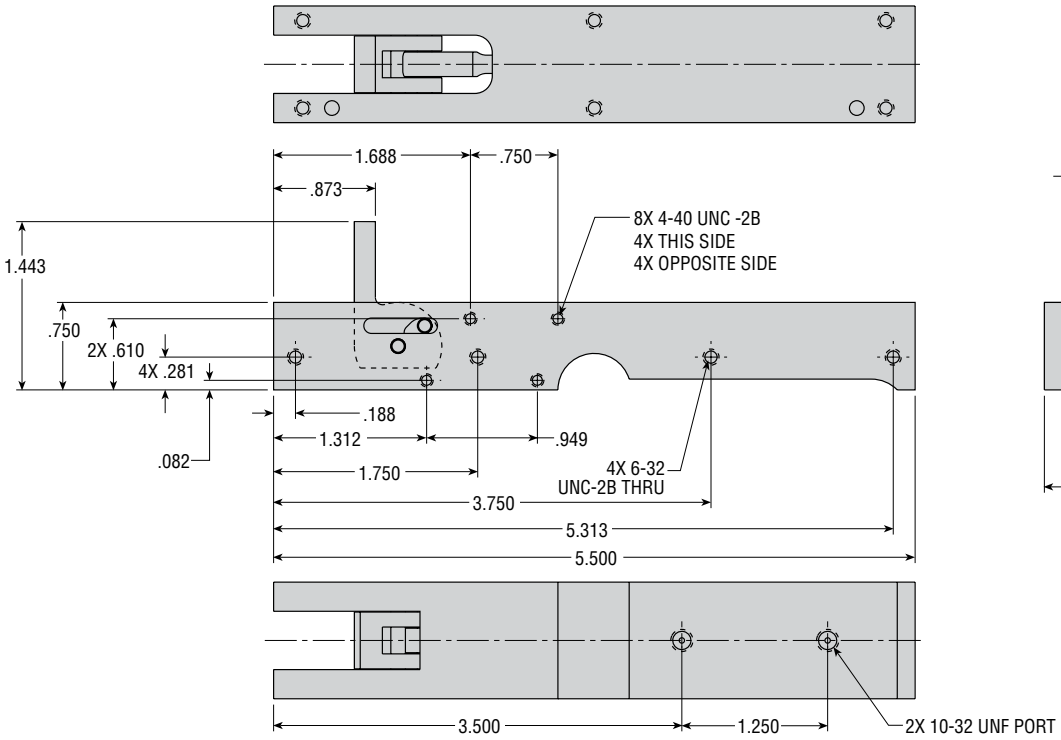
- Compact design
- Two sets of external switch mounting locations
- Pawl locks in up position\
- Double acting
- 8 mm bore - larger bore and sizes are available

Industry Uses

- Conveyor manufacturing
- Assembly machine

DIMENSIONS: STAGING STOP MODEL# ML307537





NOTES:
1) ALL DIMENSIONS ARE FOR REFERENCE ONLY. TITLE BLOCK TOLERANCES DO NOT APPLY.
2) CYLINDER BORE Ø 8 mm DOUBLE ACTING.
3) CYLINDER RETRACT RESULTS IN STOP EXTEND. CYLINDER EXTEND RESULTS IN STOP RETRACTED

All dimensions are reference only unless specifically toleranced.

SERIES		SIZE	GRIP FORCE* lb	[N]	NOMINAL TOTAL JAW TRAVEL in	[mm]	MAJOR BENEFITS	INDUSTRY USE
GRS **pages 4-11**		27x4.5	68	[302]	.177	[4.5]	• low profile • high grip force • pneumatic service • switches • five sizes • spring assist	• Assembly machine builders • Robotics • Cosmetics • Plumbing fixtures • Vehicle lighting equipment
		27x7	48	[213]	.276	[7]		
		28x6	77	[341]	.250	[6]		
		28x10	48	[213]	.394	[10]		
		32x8	109	[485]	.315	[8]		
		32x13	70	[310]	.512	[13]		
		50x19	235	[1045]	.750	[19]		
		50x28	157	[697]	1.102	[28]		
		63x32	398	[1770]	1.260	[32]		
		63x44	289	[1287]	1.732	[44]		
GRD **pages 4-21**			SHORT JAW TRAVEL:				• small size • pneumatic service • high grip force • two jaw travels • spring assist • switches • low cost	• Assembly machine builders • Cosmetics • Batteries • Light bulb manufacturing • Plumbing fixtures
		3	33	[147]	.187	[4.75]		
		4	40	[178]	.335	[8.5]		
		5	87	[387]	.315	[8.0]		
		6	136	[604]	.423	[10.75]		
			LONG JAW TRAVEL:					
		5	54	[240]	.502	[12.75]		
		6	91	[406]	.699	[17.75]		
GRW **pages 4-31**		16	36	[160]	0.79	[20]	• long travel • superior jaw stability • high performance • long tooling lengths • simple to use	• Assembly machine builders • Powdered metal • Bearing manufacturing • Automotive
		25	90	[400]	2.09	[53]		
		32	170	[756]	2.56	[65]		
		40	207	[921]	3.58	[91]		
		50	429	[1908]	4.61	[117]		
GRC (with SHURGRIP option) **pages 4-39**		3	96	[427]	1.00	[25.5]	• long travel • pneumatic service • high grip force • locking feature • spring assist • switches	• Assembly machine builders • Automotive • Batteries • Robotics
		4	209	[930]	1.53	[39]		
		5	383	[1704]	2.00	[51]		
		6	870	[3870]	3.07	[78]		
GRT (3 Jaw) **pages 4-51**		1	44	[196]	▲ 0.236	[6]	• very low profile • pneumatic service • eight sizes • high grip force • switches	• Assembly machine builders • Light bulb manufacturing • Packaging • Automotive • Golf equipment • Robotics
		2	112	[499]	▲ 0.315	[8]		
		3	168	[747]	▲ 0.472	[12]		
		4	218	[971]	▲ 0.630	[16]		
		5	378	[1683]	▲ 0.787	[20]		
		6	569	[2531]	▲ 1.024	[26]		
		7	880	[3912]	▲ 1.260	[32]		
		8	1452	[6459]	▲ 1.575	[40]		
▲ Represents the change in jaw movement as a diameter change.								
GRL **pages 4-61**		14x7	28	[124]	0.28	[7]	• long travel • pneumatic service • slim profile • switches	• Assembly machine builders • Light bulb manufacturing • Packaging
		14x13	30	[132]	0.51	[13]		
		16x20	41	[182]	0.79	[20]		
		16x26	41	[182]	1.02	[26]		
GRF **pages 4-69**		19x4.5	30	[135]	.177	[4.5]	• low profile • high grip force • pneumatic service • four sizes • two jaw travels • three jaw styles	• Assembly machine builders • Light bulb manufacturing • Robotics
		25x6.5	35	[156]	.256	[6.5]		
		28x6	77	[341]	.250	[6]		
		28x10	48	[213]	.394	[10]		
		32x8	116	[516]	.315	[8]		
		32x13	85	[378]	.512	[13]		
190, 191 **pages 4-77**			SHORT JAW TRAVEL: STYLE 1 & 2				• small size • pneumatic service • two jaw travels • two jaw styles • spring assist • switches	• Assembly machine builders • Light bulb manufacturing • Vehicle lighting equipment • Medical • Batteries • Bearing manufacturing
		6	5.3	[24]	.157	[4]		
		7	10.6	[47]	.276	[7]		
		8	21.8	[97]	.394	[10]		
		9	42.6	[190]	.512	[13]		
			LONG JAW TRAVEL: STYLE 2					
		6	3.2	[14]	.315	[8]		
		7	8.1	[36]	.433	[11]		
		8	13.1	[58]	.630	[16]		
		9	23.5	[105]	.866	[22]		
5300 **pages 4-87**		6	128	[570]	.62	[15.8]	• heavy duty construction • pneumatic service • high grip force • spring assist • switches	• Automotive • Robotics • Material handling
		7	261	[1164]	1.00	[25.4]		
		8	488	[2172]	1.31	[33.3]		
		9	980	[4356]	1.80	[45.8]		
GRR **pages 4-91**	 GUARDIAN GRIPPER	63x150	704	[3131]	5.906	[150]	• wide range of jaw travel • high capacity • narrow width • rugged design • low jaw deflection	• Assembly machine builders • Robotics • Material handling
		63x200			7.874	[200]		
		63x250			9.843	[250]		
		63x250			13.780	[350]		

SEE NEXT PAGE FOR ANGULAR GRIPPERS AND NOTES

SERIES		SIZE	GRIP FORCE** lb [N]	MINIMUM DISTANCE** in [mm]	MAJOR BENEFITS	INDUSTRY USE
8400 **pages 4-107**		0 1 2 3	11.7 [52] 19.7 [88] 55 [244] 81 [359]	.20 [5.1] .30 [7.6] .40 [10] .62 [16]	• small size • pneumatic service • spring assist • switches • low cost	• Assembly machine builders • Light bulb manufacturing • Batteries
GRB (180°) **pages 4-113**		12 16 20 32 40 50	13 [57] 28 [124] 79 [353] 179 [797] 265 [1180] 549 [2443]	.44 [11.3] .56 [14.3] .67 [17.0] .92 [23.4] 1.21 [30.8] 1.90 [48.3]	• robust cam design • pneumatic service • three jaw rotations available • compatible with PHD solid state, reed & proximity switches	• Assembly machine builders • Light bulb manufacturing • Medical • Batteries • Bearing manufacturing • Semiconductor
5300 **pages 4-123**		2 3 4 5	201 [894] 499 [2220] 1025 [4559] 2167 [9639]	.81 [21] .97 [25] 1.20 [30] 1.68 [43]	• heavy duty construction • pneumatic service • high grip force • spring assist • switches	• Assembly machine builders • Material handling • Robotics
PFC **pages 4-129**		L W	11250 [50040] 7200 [32027]	3.93 [100.0] 3.93 [100.0]	• ideal for heavy parts • rugged cam design with consistent clamping force • wide jaw throat	• Automotive • Appliances • Sheet metal handling

* Gripping force shown on previous pages is at zero tooling length and 87 psi [6 bar] (pneumatic). The values shown are minimum produced. Optional spring assist can increase the gripping force shown or can be a safety device on the following types: Series 190/191, GRD, 5300, GRC, and GRT. The spring option can also be used to allow single acting operation of Series GRC, GRD, 5300, most 190/191, and GRT Grippers.

** Above gripping force is at the corresponding minimum distance (from the jaw pivot) at 87 psi [6 bar] (pneumatic). Optional spring assist can increase the gripping force or be a safety device on the Series 5300.

SEE THE PHD CLASSICS CATALOG FOR THE FOLLOWING PHD GRIPPERS:

PARALLEL

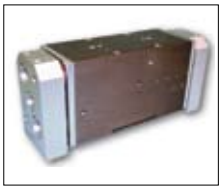
Series 7900
Series 8600

ANGULAR

Series 7900 2 & 3 Jaw
Series 8600 2 Jaw
Series 190
Series 8600 3 Jaw

phd Unlimited™
UNIQUE SOLUTIONS

heavy duty



GRW 80 mm Bore Foundry
Model# ML301651
page 4-139

Steel Hydraulic/ Forging
Model# ML221538
page 4-141

long jaw travel

Series GRW with Long Jaw Travel
Model# ML301025
Longer than standard jaw travel
page 4-156

low profile

Mono/Fixed Jaw
Model# ML219177
page 4-144

Low Profile
Model# ML212539
page 4-147

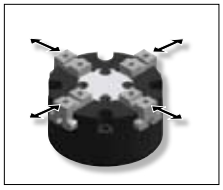
Series GRS/GRL with Balluff BIL Transducer
Model# ML304024
Model# ML306735
Transducer feedback based on jaw position
page 4-148

parallel

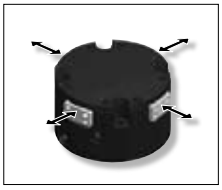
Parallel with Through Hole
Model# ML300016
1" dia. hole thru center
page 4-142

190 Parallel with Centralized Manifold Port
Model# ML301284
page 4-154

multiple jaw



Compact 2, 3, and 4 Jaw
Model# ML306111
page 4-146



Compact 2, 3, and 4 Jaw
Model# ML227501
page 4-146

GUARDIAN® STAR series

3 Jaw Parallel Heavy Duty 3 Jaw
Model# ML305843
page 4-158

Series GHT
Large 3 jaw gripper-long jaw travel
page 4-159

phd Unlimited™
UNIQUE SOLUTIONS

harsh environments

Polymer (PET)
Model# ML213853
page 4-150

PET Replacement
Model# ML303025
page 4-152

Polymer Series GRW with Stainless Steel Jaws
Model# ML302657
PET plastic body & stainless steel jaws
page 4-153

Polymer Long Jaw Travel
Model# ML307562
page 4-162

replacements

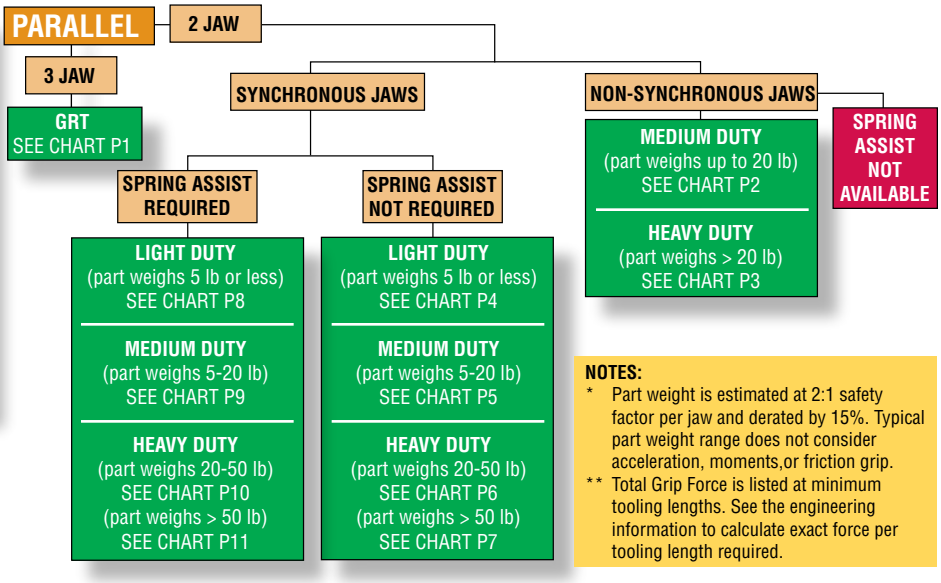
Angular Replacement
Model# ML304302
Direct replacement with low profile jaws
page 4-163

Angular Replacement
Model# ML307584
Direct replacement with unique jaws
page 4-164

PARALLEL GRIPPER SELECTION/COMPARISON GUIDE

The intent of this guide is to provide a quick visual comparison of grippers that are categorized by application criteria.

It is recommended that you use PHD's online sizing software or the sizing catalog for exact gripper sizing. Consult PHD Application Engineering for assistance.



NOTES:

* Part weight is estimated at 2:1 safety factor per jaw and derated by 15%. Typical part weight range does not consider acceleration, moments,or friction grip.

** Total Grip Force is listed at minimum tooling lengths. See the engineering information to calculate exact force per tooling length required.

P1: Parallel/3 Jaws

GRIPPER MODEL #	*TYPICAL PART WEIGHT RANGE lb [kg] (5 [2.3] 10 [4.5] 15 [7] 20 [9] 50 [23] 75 [34] 100 [45] 150 [68] 200 [91] 250 [113])	TOTAL DIAMETRAL JAW TRAVEL in	mm	TOOLING LENGTH MAXIMUM in	mm	**TOTAL CLOSE GRIP FORCE AT 87 psi [6 bar] lb	N	OPTIONS: Internal Proximity Switch Ready	Spring Assist: Heavy Force Closed	Spring Assist: Heavy Force Open	Part Ejector	Seals: Buna-N (Standard)	Seals: Fluoro-Elastomer
GRTx11	5 [2.3]	0.236	6	1.5	40	44	196	●	●	●	●	●	●
GRTx12	13 [5.8]	0.315	8	1.97	50	112	499	●	●	●	●	●	●
GRTx13	19 [8.6]	0.472	12	2.56	65	168	747	●	●	●	●	●	●
GRTx14	25 [11.2]	0.630	16	2.95	75	218	971	●	●	●	●	●	●
GRTx15	43 [19.4]	0.787	20	3.94	100	378	1683	●	●	●	●	●	●
GRTx16	64 [29.3]	1.024	26	4.92	125	569	2531	●	●	●	●	●	●
GRTx17	100 [45.2]	1.260	32	5.91	150	880	3912	●	●	●	●	●	●
GRTx18	164 [74.6]	1.575	40	7.87	200	1452	6459	●	●	●	●	●	●

P2: Parallel/2 Jaws/Non-Synchronous Jaws/Medium Duty

GRIPPER MODEL #	*TYPICAL PART WEIGHT RANGE lb [kg] (2 [0.9] 4 [1.8] 6 [2.7] 8 [3.6] 10 [4.6] 12 [5.4] 15 [7] 20 [9] 25 [11] 30 [14])	TOTAL JAW TRAVEL in	mm	TOOLING LENGTH MAXIMUM in	mm	**TOTAL CLOSE GRIP FORCE AT 87 psi [6 bar] lb	N	OPTIONS: Proximity Switches	Hall Switch Ready	Manifold
GRL 14x7	4.8 [2.2]	0.28	7	3	75	28	124	●	●	●
GRL 14x13	5.1 [2.3]	0.51	13	3	75	30	132	●	●	●
GRL 16x20	7 [3.2]	0.79	20	4	100	41	182	●	●	●
GRL 16x25	7 [3.2]	1.02	26	5	125	41	182	●	●	●
GRW03-x-16	6.1 [2.8]	0.79	20	4.5	114	36	160	●	●	●
GRW03-x-25	15.3 [6.9]	2.09	53	8	200	90	400	●	●	●

P3: Parallel/2 Jaws/Non-Synchronous Jaws/Heavy Duty

GRIPPER MODEL #	*TYPICAL PART WEIGHT RANGE lb [kg] (10 [4.5] 20 [9] 30 [14] 40 [18] 50 [23] 75 [34] 100 [45] 125 [57] 150 [68] 200 [91])	TOTAL JAW TRAVEL in	mm	TOOLING LENGTH MAXIMUM in	mm	**TOTAL CLOSE GRIP FORCE AT 87 psi [6 bar] lb	N	OPTIONS: Sensors/Switches	Manifold	Rodlok	Jaw Travel Limitation	NPT Ports	Corrosion Resistant	Fluoro-Elastomer Seals
GRW03-x-32	29 [13.1]	2.56	65	14	350	170	756	●	●			●	●	
GRW03-x-40	35 [16.0]	3.58	91	15	381	207	921	●	●			●	●	
GRW03-x-50	73 [33.1]	4.61	117	18.5	470	429	1908	●	●			●	●	
GRR22-x-63x150	120 [54.3]	5.91	150	20	500	704	3130	●		●	●	●	●	●
GRR22-x-63x200	120 [54.3]	7.87	200	20	500	704	3130	●		●	●	●	●	●
GRR22-x-63x250	120 [54.3]	9.84	250	20	500	704	3130	●		●	●	●	●	●
GRR22-x-63x350	120 [54.3]	13.80	350	20	500	704	3130	●		●	●	●	●	●

PARALLEL GRIPPER SELECTION/COMPARISON GUIDE

P4: Parallel/2 Jaws/Synchronous Jaws/Springs Not Required/Light Duty (up to 5 lb part weight)

GRIPPER MODEL #	*TYPICAL PART WEIGHT RANGE lb [kg] (0.25 [.1] 0.5 [.2] 1 [.4] 1.5 [.7] 2 [.9] 3 [1.4] 4 [1.8] 5 [2.3] 6 [2.7] 7 [3.2])	TOTAL JAW TRAVEL in	TOTAL JAW TRAVEL mm	TOOLING LENGTH MAXIMUM in	TOOLING LENGTH MAXIMUM mm	**TOTAL CLOSE GRIP FORCE AT 87 psi [6 bar] lb	**TOTAL CLOSE GRIP FORCE AT 87 psi [6 bar] N	OPTIONS: Hall Sensor	Proximity Switch Ready	Spring Assist: Close	Spring Assist: Open	Seals: Buna-N (Standard)	Seals: Fluoro-Elastomer
19x6x (Short Travel)	0.9 [0.4]	.157	4	2.5	63	5.3	24	●	●	●		●	●
19x7x (Short Travel)	1.8 [0.8]	.276	7	3.8	96	10.6	47	●	●	●	●	●	●
19x8x (Short Travel)	3.7 [1.7]	.394	10	4	102	21.8	97	●	●	●	●	●	●
19x6x (Long Travel)	0.5 [0.2]	.315	8	2.5	63	3.2	14	●	●	●		●	●
19x7x (Long Travel)	1.4 [0.6]	.433	11	3.8	96	8.1	36	●	●	●	●	●	●
19x8x (Long Travel)	2.2 [1.0]	.630	16	4	102	13.1	58	●	●	●	●	●	●
19x9x (Long Travel)	4 [1.8]	.866	22	4	102	23.5	105	●	●	●	●	●	●
GRL12-x-14x7	4.8 [2.2]	.280	7	3	76.2	28	124		●			●	

P5: Parallel/2 Jaws/Synchronous Jaws/Springs Not Required/Medium Duty (5-20 lb part weight)

GRIPPER MODEL #	*TYPICAL PART WEIGHT RANGE lb [kg] (2.5 [1.1] 5 [2.3] 7.5 [3.4] 10 [4.5] 12.5 [5.7] 15 [7] 17.5 [8] 20 [9] 25 [11] 30 [14])	TOTAL JAW TRAVEL in	TOTAL JAW TRAVEL mm	TOOLING LENGTH MAXIMUM in	TOOLING LENGTH MAXIMUM mm	**TOTAL CLOSE GRIP FORCE AT 87 psi [6 bar] lb	**TOTAL CLOSE GRIP FORCE AT 87 psi [6 bar] N	OPTIONS: Proximity Switch Ready	Spring Assist: Close	Spring Assist: Open	Shurgrip Part Retention	Corrosion Resistant	Manifold Ports	Fluoro-Elastomer Seals
GRS33-x-27x4.5	11.6 [5.2]	.177	4.5	2.2	35.9	68	302	●	●	●			●	
GRS33-x-27x7	8.2 [3.7]	.276	7	2.2	55.9	48	213	●	●	●			●	
GRS33-x-28x6	13.1 [5.9]	.250	6.35	3.2	81.3	77	341	●	●	●			●	
GRS33-x-28x10	8.2 [3.7]	.394	10	3.2	81.3	48	213	●	●	●			●	
GRS33-x-32x8	18.5 [8.4]	.315	8	3.2	81.3	109	485	●	●	●			●	
GRS33-x-32x13	11.9 [5.4]	.512	13	3.2	81.3	70	310	●	●	●			●	
GRDx31	5.6 [2.5]	.147	3.75	3	76.2	33	147	●	●	●				●
GRDx41	6.8 [3.1]	.294	7.5	3	76.2	40	178	●	●	●				●
GRDx51	14.8 [6.7]	.275	7.0	4	102	87	387	●	●	●				●
GRDx52	9.2 [4.2]	.462	11.7	4	102	54	240	●	●	●				●
GRDx62	15.5 [7.0]	.659	16.75	5	127	91	406	●	●	●				●
GRW13-x-16x20	6.1 [2.8]	.790	20	5	127	36	168	●				●	●	
GRW13-x-25x53	15.3 [6.7]	2.09	53	8	203.2	90	400	●				●	●	
GRL12-x-14x13	5.1 [2.7]	.51	13	3	76.2	30	130	●					●	
GRL12-x-16x20	7 [3.2]	.79	20	4	102	41	182	●					●	
GRL12-x-16x26	7 [3.2]	1.02	26	5	127	41	182	●					●	
GRF31-x-19x4.5	5.1 [2.3]	.177	4.5	1.4	35.6	30	135	●						
GRF34-x-25x6.5	6 [2.7]	.256	6.5	2	50.8	35	156	●						
GRF33-x-28x6	13.1 [5.9]	.25	6	2.8	71.1	77	341	●						
GRF33-x-28x10	8.2 [3.7]	.394	10	2.8	71.1	48	13	●						
GRF33-x-32x8	19.7 [8.9]	.315	8	4	100	116	516	●						
GRF33-x-32x13	14.5 [6.6]	.512	13	2.8	71.1	85	378	●						
GRCx31 & GRCx33	14.1 [6.4]	.940	24	5	127	83	369	●	●	●	●			●
GRCx32 & GRCx34	16.3 [7.4]	.940	24	5	127	96	427	●	●	●	●	●		●
19x9x (Short Travel)	7.2 [3.3]	.512	13	4	102	42.6	190	●	●	●				●

P6: Parallel/2 Jaws/Synchronous Jaws/Springs Not Required/Heavy Duty (20-50 lb part weight)

GRIPPER MODEL #	*TYPICAL PART WEIGHT RANGE lb [kg] (10 [4.5] 15 [6.8] 20 [9] 25 [11.3] 30 [13.6] 35 [16] 40 [18] 50 [23] 60 [27] 70 [32])	TOTAL JAW TRAVEL in	TOTAL JAW TRAVEL mm	TOOLING LENGTH MAXIMUM in	TOOLING LENGTH MAXIMUM mm	**TOTAL CLOSE GRIP FORCE AT 87 psi [6 bar] lb	**TOTAL CLOSE GRIP FORCE AT 87 psi [6 bar] N	OPTIONS: Proximity Switch Ready	Spring Assist: Close	Spring Assist: Open	Corrosion Resistant	Manifold Ports	Shurgrip Part Retention	Fluoro-Elastomer Seals
GRS33-x-50x19	40 [18.1]	.750	19	4.2	106	235	1045	●	●	●		●		
GRS33-x-50x28	26.7 [12.1]	1.102	28	4.2	106	157	697	●	●	●		●		
GRDx61	23.1 [10.5]	.383	9.75	5	127	136	604	●	●	●				●
GRW13-x-32x65	28.9 [13.1]	2.56	65	14	350	170	756	●			●	●		
GRW13-x-40x91	35.2 [16]	3.58	91	15	381	207	921	●			●	●		
GRCx41 & GRCx43	35.5 [16.1]	1.475	37.5	5	127	209	930	●	●	●	●		●	●
GRCx42 & GRCx44	30.3 [13.7]	1.475	37.5	5	127	178	792	●	●	●	●		●	●
1536x	21.8 [9.9]	.62	15.8	6	152	128	570	●	●	●				●
1537x	44.4 [20.1]	1.00	254	8	203	261	1164	●	●	●				●

PARALLEL GRIPPER SELECTION/COMPARISON GUIDE

P7: Parallel/2 Jaws/Synchronous Jaws/Springs Not Required/Heavy Duty (over 50 lb part weight)

	GRIPPER MODEL #	*TYPICAL PART WEIGHT RANGE lb [kg] (45 [20] 50 [23] 60 [27] 70 [32] 80 [36] 100 [45] 125 [57] 150 [68] 200 [91] 250 [113])	TOTAL JAW TRAVEL in	TOTAL JAW TRAVEL mm	TOOLING LENGTH MAXIMUM in	TOOLING LENGTH MAXIMUM mm	**TOTAL CLOSE GRIP FORCE AT 87 psi [6 bar] lb	**TOTAL CLOSE GRIP FORCE AT 87 psi [6 bar] N	OPTIONS: Proximity Switches	Spring Assist: Close	Spring Assist: Open	Corrosion Resistant	Fluoro-Elastomer Seals	Rodlok	Shurgrip Part Retention	Manifold Ports	NPT Ports
	GRS33-x-63x32	67.7 [30.7]	1.260	32	6.5	152	398	1770	●	●	●					●	●
	GRS33-x-63x44	49.1 [22.3]	1.732	44	6.5	152	289	1287	●	●	●					●	●
	GRW13-x-50x117	72.9 [33.1]	4.61	117	18	450	429	1908	●			●				●	●
	GRCx5x	65.1 [29.5]	1.945	49.5	6	152	383	1704	●	●	●		●				●
	GRCx5x (Shurgrip)	54.1 [24.5]	1.945	49.5	6	152	318	1414	●	●	●	●	●		●		●
	GRCx6x	147.9 [67.1]	3.010	76.5	10	254	870	3870	●	●	●		●				●
	GRCx6x (Shurgrip)	103.5 [47.0]	3.010	76.5	10	254	609	2709	●	●	●	●	●		●		●
	1538x	82.9 [37.6]	1.31	33.3	10	254	488	2172	●	●	●		●				●
	1539x	166.6 [75.6]	1.80	45.8	10	254	980	4356	●	●	●		●				●
	GRR12-x-63x150	120 [54.3]	5.91	150	20	500	704	3131	●			●	●	●			●
	GRR12-x-63x200	120 [54.3]	7.87	200	20	500	704	3131	●			●	●	●			●
	GRR12-x-63x250	120 [54.3]	9.84	250	20	500	704	3131	●			●	●	●			●
	GRR12-x-63x300	120 [54.3]	13.8	350	20	500	704	3131	●			●	●	●			●

P8: Parallel/2 Jaws/Synchronous Jaws/Spring Assist (Close)/Light Duty (up to 5 lb part weight)

	GRIPPER MODEL #	*TYPICAL PART WEIGHT RANGE lb [kg] (0.5 [2.3] 1 [.4] 1.5 [.7] 2 [.9] 3 [1.4] 4 [1.8] 5 [2.3] 6 [2.7] 7 [3.2] 8 [3.6])	TOTAL JAW TRAVEL in	TOTAL JAW TRAVEL mm	TOOLING LENGTH MAXIMUM in	TOOLING LENGTH MAXIMUM mm	**TOTAL CLOSE GRIP FORCE AT 87 psi [6 bar] lb	**TOTAL CLOSE GRIP FORCE AT 87 psi [6 bar] N	OPTIONS: Hall Sensor	Proximity Switch Ready	Spring Assist: Close	Spring Assist: Open	Seals: Buna-N (Standard)	Seals: Fluoro-Elastomer
	19x7x (Short Travel)	2.2 [1.0]	.276	7	3.8	96	12.8	57	●	●	●	●	●	●
	19x8x (Short Travel)	4.4 [2.0]	.394	10	4	102	26	116	●	●	●	●	●	●
	19x7x (Long Travel)	1.7 [0.8]	.433	11	3.8	96	9.8	44	●	●	●	●	●	●
	19x8x (Long Travel)	2.7 [1.2]	.630	16	4	102	15.7	70	●	●	●	●	●	●
	19x9x (Long Travel)	4.8 [2.2]	.866	22	4	102	28	124	●	●	●	●	●	●

P9: Parallel/2 Jaws/Synchronous Jaws/Spring Assist (Close)/Medium Duty (5-20 lb part weight)

	GRIPPER MODEL #	*TYPICAL PART WEIGHT RANGE lb [kg] (2.5 [1.1] 5 [2.3] 7.5 [3.4] 10 [4.5] 12.5 [5.7] 15 [7] 17.5 [8] 20 [9] 25 [11] 30 [14])	TOTAL JAW TRAVEL in	TOTAL JAW TRAVEL mm	TOOLING LENGTH MAXIMUM in	TOOLING LENGTH MAXIMUM mm	**TOTAL CLOSE GRIP FORCE AT 87 psi [6 bar] lb	**TOTAL CLOSE GRIP FORCE AT 87 psi [6 bar] N	OPTIONS: Proximity Switches	Spring Assist: Close	Spring Assist: Open	Manifold Ports	Fluoro-Elastomer Seals
	GRS33-x-27x4.5	15.3 [6.9]	.177	4.5	2.2	35.9	90	400	●	●	●	●	
	GRS33-x-27x7	10.7 [4.9]	.276	7	2.2	35.9	63	280	●	●	●	●	
	GRS33-x-28x6	17 [7.7]	.250	6.35	2.2	35.9	100	445	●	●	●	●	
	GRS33-x-28x10	10.5 [4.8]	.394	10	3.2	81.3	62	276	●	●	●	●	
	GRS33-x-32x13	15.1 [6.9]	.512	132	3.2	81.3	89	396	●	●	●	●	
	GRDx31	8.2 [3.7]	.147	3.75	3	76.2	48	213	●	●	●		●
	GRDx41	10.2 [4.6]	.294	7.5	3	76.2	60	267	●	●	●		●
	GRDx52	13.6 [6.2]	.462	11.7	4	102	80	356	●	●	●		●
	19x9x (Short Travel)	8.7 [4.0]	.512	13	4	102	51	227	●	●	●		●

NOTES:

* Part weight is estimated at 2:1 safety factor per jaw and derated by 15%. Typical part weight range does not consider acceleration, moments,or friction grip.

** Total Grip Force is listed at minimum tooling lengths. See the engineering information to calculate exact force per tooling length required.

PARALLEL GRIPPER SELECTION/COMPARISON GUIDE

P10: Parallel/2 Jaws/Synchronous Jaws/Spring Assist (Close)/Heavy Duty (20-50 lb part weight)

	GRIPPER MODEL #	*TYPICAL PART WEIGHT RANGE lb [kg]	TOTAL JAW TRAVEL in	TOTAL JAW TRAVEL mm	TOOLING LENGTH MAXIMUM in	TOOLING LENGTH MAXIMUM mm	**TOTAL CLOSE GRIP FORCE AT 87 psi [6 bar] lb	**TOTAL CLOSE GRIP FORCE AT 87 psi [6 bar] N	OPTIONS: Proximity Switches	Spring Assist: Close	Spring Assist: Open	Manifold Ports	Corrosion Resistant	Shurgrip Part Retention	Fluoro-Elastomer Seals
	GRS33-x-32x8	23.5 [10.6]	.315	8	3.2	81	138	614	●	●	●	●			
	GRS33-x-50x28	35 [15.9]	1.102	28	4.2	106	206	916	●	●	●	●			
	GRDx51	21.9 [9.9]	.275	7	4	102	129	574	●	●	●				●
	GRDx61	34.3 [15.6]	.383	9.75	5	127	202	898	●	●	●				●
	GRDx62	23 [10.4]	.659	16.75	5	127	135	600	●	●	●				●
	GRCx3x	25 [11.3]	.940	24	5	127	147	654	●	●	●				●
	GRCx3x (Shurgrip)	21.6 [9.8]	.940	24	5	127	127	565	●	●	●		●	●	●
	GRCx4x (Shurgrip)	46 [20.9]	1.475	37.5	5	127	271	1205	●	●	●		●	●	●
	1536x	28.3 [12.8]	.620	15.8	6	152	166	741	●	●	●				●

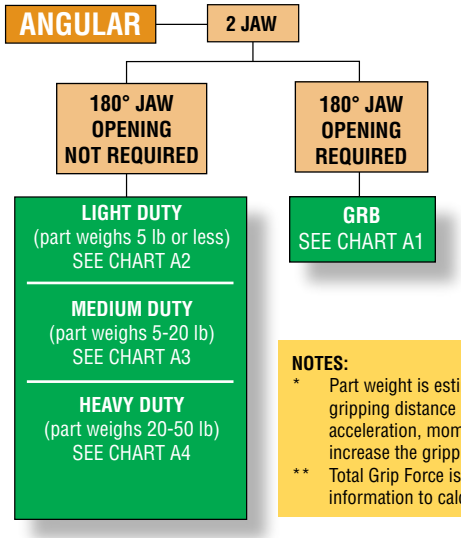
P11: Parallel/2 Jaws/Synchronous Jaws/Spring Assist (Close)/Heavy Duty (over 50 lb part weight)

	GRIPPER MODEL #	*TYPICAL PART WEIGHT RANGE lb [kg]	TOTAL JAW TRAVEL in	TOTAL JAW TRAVEL mm	TOOLING LENGTH MAXIMUM in	TOOLING LENGTH MAXIMUM mm	**TOTAL CLOSE GRIP FORCE AT 87 psi [6 bar] lb	**TOTAL CLOSE GRIP FORCE AT 87 psi [6 bar] N	OPTIONS: Proximity Switches	Spring Assist: Close	Spring Assist: Open	Manifold Ports	Corrosion Resistant	Shurgrip Part Retention	Fluoro-Elastomer Seals
	GRS33-x-50x19	52.5 [23.8]	.750	19	4.2	106	309	1374	●	●	●	●			
	GRS33-x-63x32	81 [36.8]	1.260	32	6.5	152	477	2122	●	●	●	●			
	GRS33-x-63x44	59 [26.8]	1.732	44	6.5	152	347	1543	●	●	●	●			
	GRCx4x	54 [24.6]	1.475	37.5	5	127	319	1419	●	●	●				●
	GRCx5x	100 [45.3]	1.945	49.5	6	152	587	2611	●	●	●				●
	GRCx6x	227 [102.9]	3.010	76.5	10	254	1335	5938	●	●	●				●
	GRCx5x (Shurgrip)	83 [37.6]	1.945	49.5	6	152	488	2171	●	●	●		●	●	●
	GRCx6x (Shurgrip)	158 [71.6]	3.010	76.5	10	254	929	432	●	●	●		●	●	●
	1537x	59 [27]	1.00	25.4	8	203	346	1539	●	●	●				●
	1538x	108 [79]	1.31	33.3	10	254	633	2816	●	●	●				●
	1539x	225 [102]	1.80	45.8	10	254	1323	5885	●	●	●				●

ANGULAR GRIPPER SELECTION/COMPARISON GUIDE

The intent of this guide is to provide a quick visual comparison of grippers that are categorized by application criteria.

It is recommended that you use PHD's online sizing software or the sizing catalog for exact gripper sizing. Consult PHD Application Engineering for assistance.



NOTES:

* Part weight is estimated at 2:1 safety factor per jaw at the typical gripping distance listed. Typical part weight range does not consider acceleration, moments, or friction grip. Optional spring assist can increase the gripping force or provide single acting service.

** Total Grip Force is listed minimum tooling length, see the engineering information to calculate exact force per tooling length required.

ANGULAR GRIPPER SELECTION/COMPARISON GUIDE

A1: Angular/2 Jaws/180° Jaw Opening Required

GRIPPER MODEL #	*TYPICAL PART WEIGHT RANGE lb [kg] (2 [0.9] 5 [2.3] 10 [4.5] 15 [7] 20 [9] 30 [14] 45 [20] 60 [27] 75 [34] 90 [41])	**TOTAL CLOSE GRIP FORCE AT 87 psi [6 bar] lb	N	TYPICAL GRIPPING DISTANCE in	mm	DISPLACEMENT in³	cm³	OPTIONS: Magnet for Switches	Proximity Switch Ready	Port Location
GRB11-x-12	1.4 [.64]	13	57	.83	21.0	0.09	1.4	●	●	●
GRB11-x-16	2.9 [1.32]	28	124	1.08	27.5	0.21	3.5	●	●	●
GRB11-x-20	9.6 [4.4]	79	353	1.10	38.0	0.38	6.2	●	●	●
GRB11-x-32	21.5 [9.76]	179	797	1.53	39.0	1.33	22	●	●	●
GRB11-x-40	33.6 [15.2]	265	1180	1.91	48.5	2.84	47	●	●	●
GRB11-x-50	70.7 [32.1]	549	2443	2.95	75.0	7.00	115	●	●	●

A2: Angular/2 Jaws/Light Duty (up to 5 lb part weight)

GRIPPER MODEL #	*TYPICAL PART WEIGHT RANGE lb [kg] (.5 [0.2] 1 [0.4] 1.5 [7] 2 [0.9] 2.5 [1.1] 3 [1.4] 3.5 [1.6] 4 [1.8] 4.5 [2] 5 [2.3])	**TOTAL CLOSE GRIP FORCE AT 87 psi [6 bar] lb	N	TYPICAL GRIPPING DISTANCE in	mm	DISPLACEMENT in³	OPTIONS: Hall Sensor	Sensor Ready	Proximity Switch Ready	Fluoro-Elastomer Seals
8400	1.4 [.64]	11.7	52	.33	8.4	.007	●	●		●
8410	2.6 [1.19]	19.7	88	.45	11.4	.018	●	●	●	●

A3: Angular/2 Jaws/Medium Duty (5-20 lb part weight)

GRIPPER MODEL #	*TYPICAL PART WEIGHT RANGE lb [kg] (2 [0.9] 3 [1.7] 4 [1.8] 5 [2.3] 6 [2.7] 7 [3.2] 8 [3.6] 10 [4.5] 12.5 [5.7] 15 [6.8])	**TOTAL CLOSE GRIP FORCE AT 87 psi [6 bar] lb	N	TYPICAL GRIPPING DISTANCE in	mm	DISPLACEMENT in³	OPTIONS: Hall Sensor	Sensor Ready	Proximity Switch Ready	Fluoro-Elastomer Seals
8420	6.7 [3.0]	55	244	.66	16.8	.055	●	●	●	●
8430	11.5 [5.2]	81	359	.87	22.1	.150	●	●	●	●

A4: Angular/2 Jaws/Heavy Duty (over 20 lb part weight)

GRIPPER MODEL #	*TYPICAL PART WEIGHT RANGE lb [kg] (20 [9] 40 [18] 80 [36] 100 [45] 150 [68] 200 [91] 500 [227] 1000 [454] 2000 [907])	**TOTAL CLOSE GRIP FORCE AT 87 psi [6 bar] lb	N	TYPICAL GRIPPING DISTANCE in	mm	DISPLACEMENT in³	cm³	OPTIONS: Hall Sensor	Sensor Ready	Proximity Switch Ready	Spring Assist: Close	Spring Assist: Open	Fluoro-Elastomer Seals
1532x	23.8 [10.8]	201	894	1.37	34.8	.59	9.6	●	●	●	●	●	●
1533x	50.7 [23]	499	2220	1.91	48.5	1.78	29.3	●	●	●	●	●	●
1534x	95.7 [43.4]	1025	4559	2.57	65.3	4.29	70.3	●	●	●	●	●	●
1535x	222.7 [101]	2167	9639	3.27	83.1	12.66	207.3	●	●	●	●	●	●

NOTES:

* Part weight is estimated at 2:1 safety factor per jaw at the typical gripping distance listed. Typical part weight range does not consider acceleration, moments,or friction grip. Optional spring assist can increase the gripping force or provide single acting service.

** Total Grip Force is listed minimum tooling length, see the engineering information to calculate exact force per tooling length required.

GRIPPER SIZING GUIDELINES

Proper gripper sizing and selection is dependent on a number of parameters. The table below lists the primary parameters along with the reason they are important. This guide provides the basic steps to selecting the right gripper for your application.

PARAMETER	IMPORTANCE
• Planned operating pressure at the gripper • Weight and geometry or shape of part • Weight and geometry of tooling • Tooling length Parallel gripper: Distance from the center of the gripping point to the face of the gripper Angular gripper: Distance from the center of the gripping point to the jaw pivot point • Type of grip on part (external or internal, encapsulated or friction) • Total gripper jaw travel or jaw rotation required • Desired gripper cycle time • Accelerations and decelerations due to part manipulation • Is spring assist desired/required	Affects whether the part can be gripped and manipulated
• Metric or imperial customer interface • Sensing requirements • Environment	Affects unit type and option selection

Once the above parameters are known, the next step is to determine the appropriate style and size of the gripper. Following are two methods that can be used to select the style and size of the gripper.

Method 1: Using PHD's Sizing Software

1. Refer to the Gripper Selection Guide on pages 4-1 through 4-9 to determine which grippers meet the style and jaw travel requirements for your application.
2. Input the application parameters (pressure, part weight and tooling length, etc.) into the software.
3. With your application's jaw travel requirements in mind, select a gripper from the list of valid devices shown in the software.
4. Using the information in the Engineering Data section of the catalog, confirm the selected gripper can withstand the applied jaw moments and axial force for your application. When calculating applied moments, include the grip force, part weight, acceleration, and external forces.
5. With the jaw travel, grip force and moment capacity confirmed, double check that the gripper's operating pressure range is acceptable, the gripper meets the cycle time requirements and if needed, the desired switch package and accessories are specified.

Method 2: Using Hand Calculations

1. Refer to the Gripper Selection Guide on pages 4-1 through 4-9 to determine which grippers meet the style and jaw travel requirements for your application.
2. Use Equation 1 below to **approximate** the required grip force factor (G_F).
3. Keeping in mind the style and jaw travel requirements of your application, select a gripper using the table on the following page with a grip force factor (G_F) equal to or greater than the minimum G_F value calculated.
4. Refer to the Engineering Data section of the catalog for the selected gripper and calculate the Total Grip Force (including tooling length effects). Remember to include spring assist grip force if desired. Verify that the Total Grip Force is adequate to maintain your desired Safety Factor of grip force to part weight.
5. Using the information in the Engineering Data section of the catalog, confirm the selected gripper can withstand the applied jaw moments and axial force for your application. When calculating applied moments, include the grip force, part weight, acceleration, and external forces.
6. With the jaw travel, grip force and moment capacity confirmed, double check that the gripper meets the cycle time requirements and that, if needed, the desired switch package and accessories are specified.

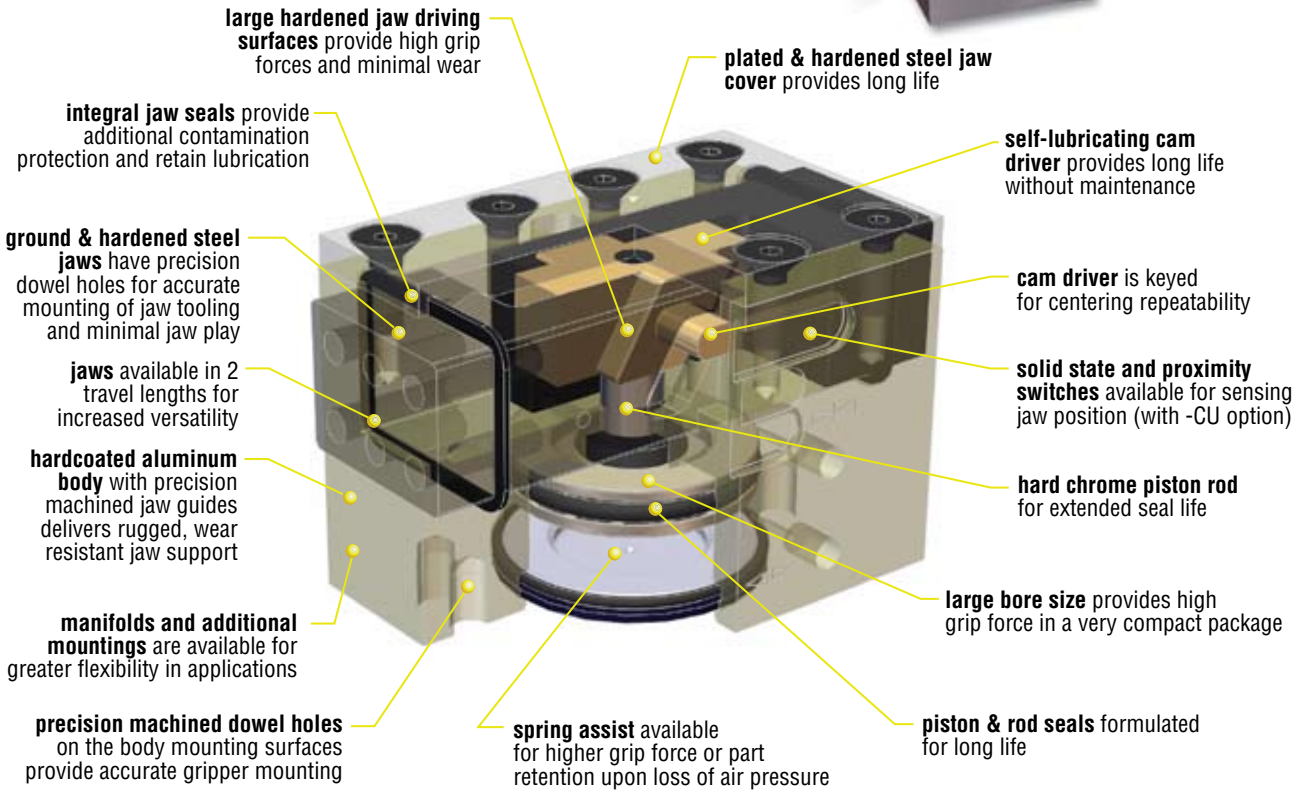
EQUATION 1:

	Parallel Grippers	Angular Grippers
Imperial	$G_F = (M \times F_S)/P$	$G_F = (M \times K \times F_S)/P$
Metric	$G_F = (9.81 \times M \times F_S)/P$	$G_F = (9.81 \times M \times K \times F_S)/P$

P = Working pressure, psi [bar]
M = Part mass, lb [kg]
K = Distance from jaw pivot to gripping point, in [mm]
(Note: Since the actual value of K is gripper dependent, enter a best estimate)
F_S = Safety Factor
PHD recommends that jaw tooling encapsulate the part. With part encapsulation, a minimum 2:1 safety factor of Total Grip Force to part weight should be used. For unencapsulated part applications, a minimum 4:1 safety factor is typical.

GRS

LOW PROFILE WITH MINIMAL JAW PLAY



Major Benefits

- Large hardened jaw driving surfaces
- Low profile
- Two jaw travels per size
- Manifold porting options
- Four bore sizes with five gripper sizes available in both imperial and metric versions
- Optional mounting and port positions available
- Spring assist on open or close available
- 1-2 day shipping
- Six million cycles minimum rated life (includes spring assist units)

Industry Uses

- Assembly machine builders
- Robotics
- Cosmetics
- Plumbing fixtures
- Vehicle lighting equipment

ORDERING DATA: SERIES GRS GRIPPERS

TO ORDER SPECIFY:
Product Line, Series, Type, Grip, Jaw, Design No., Size, Total Jaw Travel, and Options required.

OPTIONS
(OMIT IF NOT REQUIRED)

PORTING OPTIONS
L11-UB99 - Manifold option in location 99
L11-UB37 - Manifold option in location 37 (includes GR3 option)
UB48 - Port option in location 48

SWITCH OPTION
CU - Switch Ready

MOUNTING OPTION
GR3 - Mounting option in location 37

SPRING ASSIST
FSR2 - Spring assist close
FSE2 - Spring assist open

SERIES
Regular Duty

GRIP
High Force

DESIGN NO.
(See Note)
1 - Imperial
5 - Metric

G	R	S	3	3	-	1	-	27	x	4.5	-	L11-UB99

PRODUCT LINE
G - Gripper

TYPE
Short Parallel

JAW
Style 3

NOTE: Design number indicates imperial or metric mounting holes, dowel pin holes, and ports.

SIZE	BORE SIZE Diameter mm	(in)	MINIMUM TOTAL JAW TRAVEL Total Travel Per Bore Size mm	(in)
27	27	(1.063)	**4.5**	(.177)
27	27	(1.063)	**7**	(.276)
28	27	(1.063)	**6**	(.250)
28	27	(1.063)	**10**	(.394)
32	32	(1.260)	**8**	(.315)
32	32	(1.260)	**13**	(.512)
50	50	(1.969)	**19**	(.750)
50	50	(1.969)	**28**	(1.102)
63	63	(2.480)	**32**	(1.260)
63	63	(2.480)	**44**	(1.732)

4 mm ROUND INDUCTIVE PROXIMITY SWITCHES (SIZE 27, 28, & 32)

PART NUMBER	DESCRIPTION
18430-001-02	NPN (Sink) 10-30 VDC, 2 meter cable
18430-002-02	PNP (Source) 10-30 VDC, 2 meter cable

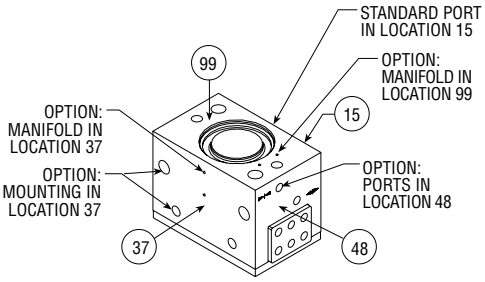
8 mm THREADED INDUCTIVE PROXIMITY SWITCHES (SIZE 50 & 63)

PART NUMBER	DESCRIPTION
51422-005-02	NPN (Sink) 5-30 VDC, 2 meter cable
51422-006-02	PNP (Source) 5-30 VDC, 2 meter cable

PROXIMITY SWITCH MOUNTING KITS

SIZE	KIT NUMBER
27 & 28	70663-27
32	70663-32
50	70663-50
63	70663-63

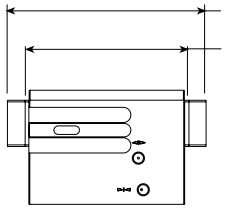
Each kit includes 1 target, 2 switch mounting brackets, and fasteners for mounting. Switches sold separately.



SERIES 6790 SOLID STATE & REED SWITCHES (ALL UNITS)

PART NUMBER	DESCRIPTION
67923-1	NPN (Sink) Solid State 4.5-30 VDC, Quick Connect
67903-1-02	NPN (Sink) Solid State 4.5-30 VDC, 2 meter cable
67903-1-05	NPN (Sink) Solid State 4.5-30 VDC, 5 meter cable
67924-1	PNP (Source) Solid State 4.5-30 VDC, Quick Connect
67904-1-02	PNP (Source) Solid State 4.5-30 VDC, 2 meter cable
67904-1-05	PNP (Source) Solid State 4.5-30 VDC, 5 meter cable
67922-1	PNP (Source) or NPN (Sink) DC Reed 4.5-30 VDC, Quick Connect
63549-02	2 meter Cordset with Quick Connect
63549-05	5 meter Cordset with Quick Connect
67929-2	AC Reed, Current Limited, Quick Connect

TOTAL JAW TRAVEL = OPEN POSITION - CLOSED POSITION



UNIQUE GRIPPERS ARE AVAILABLE. SEE PAGES 4-139 TO 4-164.

SPECIFICATIONS	SERIES GRS
OPERATING PRESSURE	
STANDARD UNIT	30 psi min to 100 psi max [2 bar min to 7 bar max] air
SPRING ASSIST UNIT	50 psi min to 100 psi max [3.5 bar min to 7 bar max] air
OPERATING TEMPERATURE	-20°F to +180°F [-28°C to +82°C]
RATED LIFE	6 million cycles minimum (including spring assist units)
GRIP REPEATABILITY	Within ±0.001 in [±0.025 mm] of original position
CYCLE TIME	See table below
LUBRICATION	Factory lubricated for rated life
MAINTENANCE	Field repairable

SIZE	MINIMUM TOTAL JAW TRAVEL		TOTAL CLOSE GRIP FORCE AT 87 psi [6 bar]		GRIPPER WEIGHT		CLOSE OR OPEN TIME 87 psi [6 bar]	DISPLACEMENT		GRIP FORCE FACTOR G_F			
										EXTERNAL GRIP		INTERNAL GRIP	
	in	mm	lb	N	lb	kg	sec	in^3	cm^3	IMPERIAL	METRIC	IMPERIAL	METRIC
27	0.177	4.5	68	302	0.29	0.13	0.11	0.133	2.2	0.78	50	0.83	54
	0.276	7	48	213	0.29	0.13	0.11	0.133	2.2	0.55	36	0.59	38
28	0.250	6.35	77	341	0.54	0.24	0.13	0.182	3.0	0.88	57	0.93	60
	0.394	10	48	213	0.54	0.24	0.13	0.182	3.0	0.55	36	0.59	38
32	0.315	8	109	485	1.0	0.45	0.16	0.335	5.5	1.25	81	1.33	86
	0.512	13	70	310	1.0	0.45	0.16	0.335	5.5	0.80	52	0.86	56
50	0.750	19	235	1045	2.4	1.1	0.18	1.570	26	2.7	174	2.8	181
	1.102	28	157	697	2.4	1.1	0.18	1.570	26	1.8	116	1.9	123
63	1.260	32	398	1770	7.8	3.5	0.22	4.397	72	4.6	297	4.7	303
	1.732	44	289	1287	7.8	3.5	0.22	4.397	72	3.3	213	3.5	226

SIZE	SPRING ASSIST GRIP FORCE								SPRING ASSIST GRIPPER WEIGHT		SPRING ASSIST CLOSE OR OPEN TIME 87 psi [6 bar] IN sec		
	S_F (SPRING ONLY)* SPRING CLOSE GRIP FORCE				S_F (SPRING ONLY)* SPRING OPEN GRIP FORCE								
	MINIMUM		MAXIMUM		MINIMUM		MAXIMUM				WITH SPRING	AGAINST SPRING	SPRING ONLY
	lb	N	lb	N	lb	N	lb	N	lb	kg			
27 x 4.5	22	96	31	137	17	73	33	146	0.39	0.18	0.12	0.24	0.16
27 x 7	15	68	22	96	12	51	23	103	0.39	0.18	0.12	0.24	0.16
28 x 6	23	102	35	154	16	71	37	164	0.69	0.31	0.13	0.26	0.20
28 x 10	14	63	22	96	10	44	23	103	0.69	0.31	0.13	0.26	0.20
32 x 8	29	130	50	224	22	98	53	234	1.34	0.61	0.16	0.46	0.27
32 x 13	19	83	32	143	14	63	34	150	1.34	0.61	0.16	0.46	0.27
50 x 19	74	327	113	503	35	155	113	504	3.11	1.41	0.17	0.32	0.29
50 x 28	49	218	75	336	23	104	76	336	3.11	1.41	0.17	0.32	0.29
63 x 32	79	353	159	708	36	160	160	710	9.5	4.31	0.22	0.42	0.51
63 x 44	58	257	116	515	26	117	116	516	9.5	4.31	0.22	0.42	0.51

*Spring grip force (S_F) varies with spring compression. The minimum spring grip force values occur with the spring at least compression (jaws fully closed on spring close units and fully open on spring open units). The maximum spring grip force values occur with the spring at most compression (jaws fully open on spring close units and fully closed on spring open units).

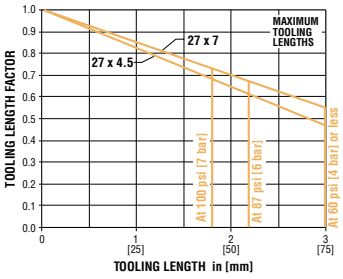
SIZING AND APPLICATION ASSISTANCE

See PHD Product Sizing Catalog for specific and complete sizing information.
Online sizing assistance is available at: ***www.phdinc.com/apps/sizing***

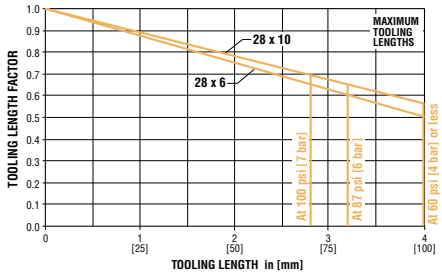
TOOLING LENGTH FACTOR

Jaw tooling should be designed so that the grip point is as close to the cover surface as possible. As the grip point is moved away from the cover surface, the applied moment causes jaw friction to increase, resulting in reduced effective grip force. The Grip Force Factor (G_F) values given in the table on page 4-13 are for zero tooling length (cover surface).

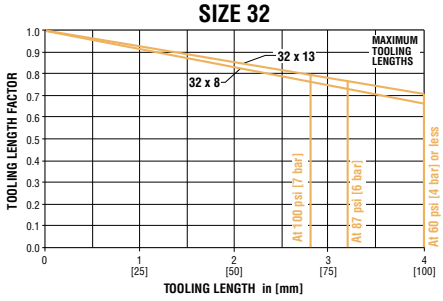
SIZE 27



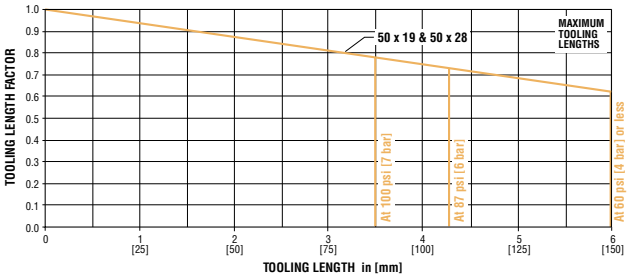
SIZE 28



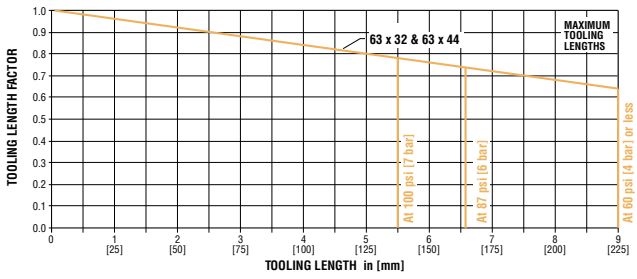
SIZE 32



SIZE 50



SIZE 63



GRIP FORCE CALCULATION EQUATIONS:

IMPERIAL:

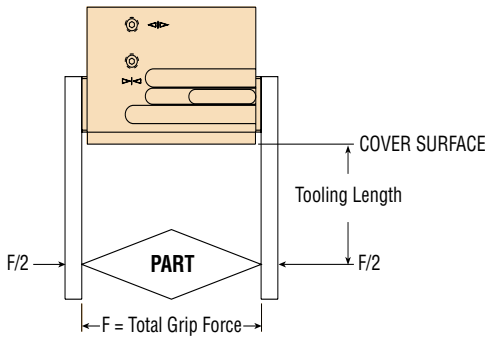
TOTAL GRIP FORCE [lb] = (Pressure [psi] x G_F) x Tooling Length Factor

TOTAL GRIP FORCE WITH SPRINGS [lb] = ((Pressure [psi] x G_F) ± S_F [lb]) x Tooling Length Factor

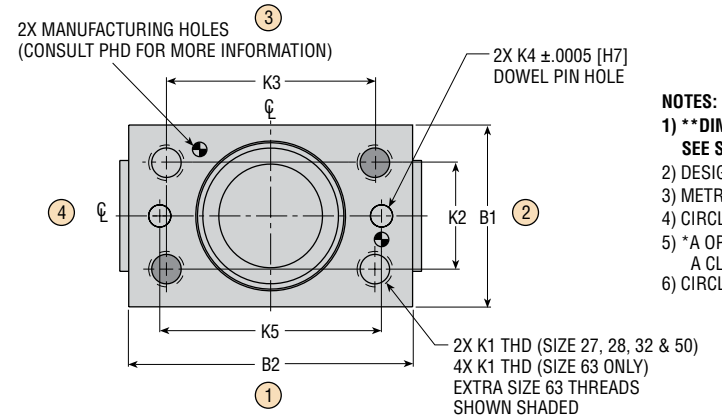
METRIC:

TOTAL GRIP FORCE [N] = (Pressure [bar] x G_F) x Tooling Length Factor

TOTAL GRIP FORCE WITH SPRINGS [N] = ((Pressure [bar] x G_F) ± S_F [N]) x Tooling Length Factor



DIMENSIONS: SERIES GRS GRIPPERS



NOTES:

1) **DIMENSIONS FOR THESE FEATURES CHANGE FOR SPRING ASSIST UNITS, SEE SPRING ASSIST DIMENSIONS ON OPTION PAGES FOR INFORMATION.

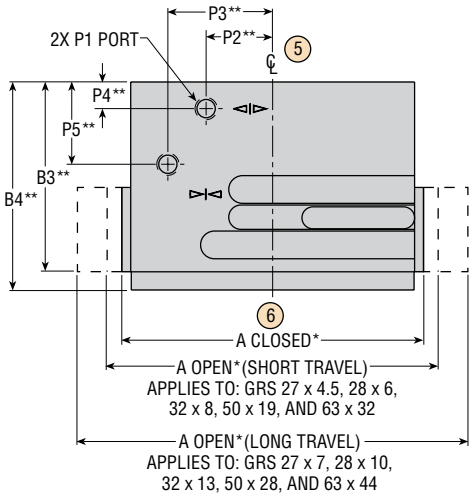
2) DESIGNATED ℄ IS CENTERLINE OF UNIT

3) METRIC INFORMATION SHOWN IN [ ] OR SHOWN IN COLUMNS DESIGNATED mm

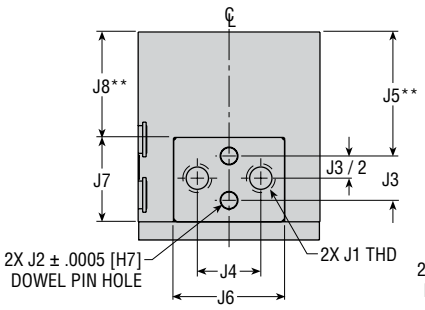
4) CIRCLED NUMBERS INDICATE POSITIONS

5) *A OPEN REFLECTS THE SMALLEST POSSIBLE OPEN DIMENSION
A CLOSED REFLECTS THE LARGEST POSSIBLE CLOSED DIMENSION

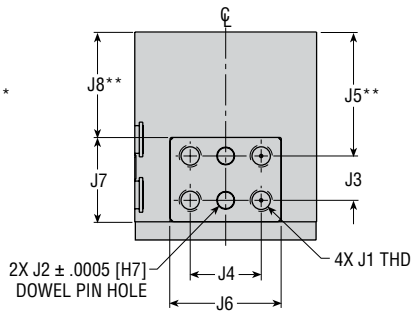
6) CIRCLED NUMBERS INDICATE POSITIONS



SIZE 27 & 28



SIZE 32, 50 & 63



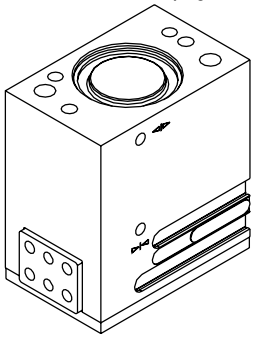
LETTER DIM	SIZE 27 in	27 mm	28 in	28 mm	32 in	32 mm	50 in	50 mm	63 in	63 mm
SHORT TRAVEL (MIN TRAVEL PER JAW)	.084	2.125	.125	3.0	.157	4.0	.375	9.5	.630	16.0
LONG TRAVEL (MIN TRAVEL PER JAW)	.138	3.5	.197	5.0	.256	6.5	.551	14.0	.875	22.0
A CLOSED*	1.614	41.0	2.125	54.0	2.677	68.0	3.500	88.9	5.748	146.0
A OPEN SHORT*	1.790	45.5	2.370	60.2	3.000	76.2	4.250	108.0	7.000	177.8
A OPEN LONG*	1.890	48.0	2.500	63.5	3.190	81.0	4.606	117.0	7.500	190.5
B1	1.378	35.0	1.496	38.0	1.614	41.0	2.283	58.0	2.953	75.0
B2	1.496	38.0	1.969	50.0	2.520	64.0	3.386	86.0	5.236	133.0
B3**	1.036	26.3	1.279	32.5	1.686	42.8	2.253	57.2	3.408	86.6
B4**	1.130	28.7	1.395	35.4	1.847	46.9	2.438	61.9	3.648	92.7
J1	8-32 x .236 DP	M4 x 0.7 x 6.0 DP	10-32 x .315 DP	M5 x 0.8 x 8 DP	10-32 x .394 DP	M5 x 0.8 x 10.0 DP	1/4-28 x .512 DP	M6 x 1.0 x 13.0 DP	3/8-24 x .768 DP	M10 x 1.5 x 19.5 DP
J2	.0658 x .197 DP	2.0 x 5.0 DP	.1283 x .197 DP	3.0 x 5.0 DP	.1595 x .236 DP	4.0 x 6.0 DP	.1908 x .394 DP	5.0 x 10.0 DP	.3158 x .512 DP	8.0 x 13.0 DP
J3	.2559	6.5	.315	8.0	.3937	10.0	.5510	14.0	.8661	22.0
J4	.354	9.0	.413	10.5	.630	16.0	.787	20.0	1.063	27.0
J5**	.6889	17.5	.8464	21.5	1.1023	28.0	1.4563	37.0	2.1653	55.0
J6	.6301	16.0	.7482	19.0	.9845	25.0	1.2600	32.0	1.7719	45.0
J7	.4333	11.0	.5514	14.0	.7482	19.0	1.0238	26.0	1.6144	41.0
J8**	.602	15.3	.727	18.5	.938	23.8	1.228	31.2	1.793	45.5
K1	8-32 x .375 DP	M5 x 0.8 x 9.5 DP	1/4-20 x .512 DP	M6 x 1.0 x 13.0 DP	5/16-18 x .591 DP	M8 x 1.25 x 15.0 DP	3/8-16 x .768 DP	M10 x 1.5 x 19.5 DP	1/2-13 x 1.024 DP	M12 x 1.75 x 26.0 DP
K2	1.024	26.0	.984	25.0	.945	24.0	1.457	37.0	1.969	50.0
K3	1.142	29.0	1.457	37.0	1.850	47.0	2.559	65.0	4.134	105.0
K4	.1283 x .250 DP	3.0 x 6.0 DP	.1908 x .256 DP	5.0 x 6.5 DP	.1908 x .256 DP	5.0 x 6.5 DP	.3158 x .512 DP	8.0 x 13.0 DP	.3783 x .512 DP	10.0 x 13 DP
K5	1.3386	34.0	1.5748	40.0	1.9685	50.0	2.6378	67.0	4.1340	105.0
P1	10-32	M5 x 0.8	10-32	M5 x 0.8	10-32	M5 x 0.8	1/8 NPT	1/8 BSPP	1/8 NPT	1/8 BSPP
P2**	.482	12.2	.433	11.0	.591	15.0	1.016	25.8	1.181	30.0
P3**	.601	15.3	.512	13.0	.591	15.0	.965	24.5	1.181	30.0
P4**	.201	5.1	.201	5.1	.236	6.0	.389	9.9	.413	10.5
P5**	.572	14.5	.591	15.0	.728	18.5	1.151	29.2	1.437	36.5

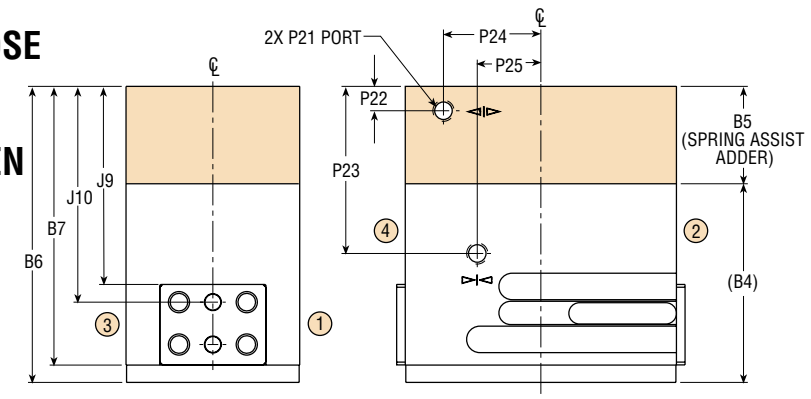
All dimensions are reference only unless specifically toleranced.

FSR2 MEDIUM FORCE SPRING ASSIST CLOSE

FSE2 MEDIUM FORCE SPRING ASSIST OPEN

Springs can maintain spring grip force if air pressure is lost or increase grip force in one specific direction when used with air pressure. Spring assist units are engineered and tested for a minimum of 6 million cycles under normal operating conditions. Working air pressure for spring assist units is 50 psi min - 100 psi max [3.5 bar min - 7 bar max]. For spring grip forces, see table on page 4-13.



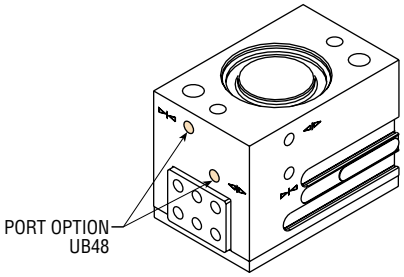


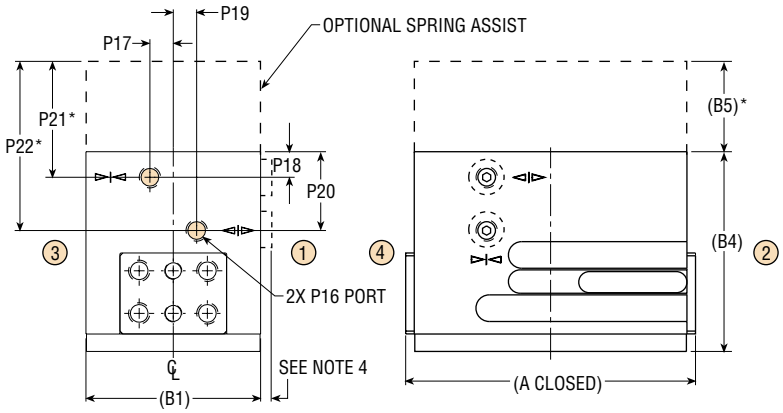
LETTER	SIZE									
	27		28		32		50		63	
DIM	in	mm	in	mm	in	mm	in	mm	in	mm
(B4)	1.130	28.7	1.395	35.4	1.847	46.9	2.438	61.9	3.648	92.7
B5	.6100	15.5	.6100	15.5	.9054	23.0	1.1614	29.5	1.2993	33.0
B6	1.740	44.2	2.005	50.9	2.753	69.9	3.599	91.4	4.948	125.7
B7	1.646	41.8	1.889	48.0	2.592	65.8	3.414	86.7	4.708	119.6
J9	1.212	30.8	1.337	34.0	1.843	46.8	2.389	60.7	3.092	78.5
J10	1.299	33.0	1.456	37.0	2.008	51.0	2.618	66.5	3.465	88.0
P21	10-32	M5 x 0.8	10-32	M5 x 0.8	10-32	M5 x 0.8	1/8 NPT	1/8 BSPP	1/8 NPT	1/8 BSPP
P22	.201	5.1	.201	5.1	.236	6.0	.389	9.9	.413	10.5
P23	1.164	29.6	1.138	28.9	1.553	39.4	2.087	53.0	2.736	69.5
P24	.482	12.2	.433	11.0	.591	15.0	1.016	25.8	1.181	30.0
P25	.601	15.3	.512	13.0	.591	15.0	.965	24.5	1.181	30.0

NOTES:
1) DESIGNATED ℄ IS CENTERLINE OF UNIT

UB48 PORT OPTION IN LOCATION 48

This option provides ports in location 48. The standard ports are plugged.





LETTER	SIZE									
	27		28		32		50		63	
DIM	in	mm	in	mm	in	mm	in	mm	in	mm
P16	10-32	M5	10-32	M5	10-32	M5	10-32	M5	1/8 NPT	1/8 BSPP
P17	.276	7.0	.236	6.0	.216	5.5	.295	7.5	.472	12.0
P18	.201	5.1	.201	5.1	.236	6.0	.290	7.4	.394	10.0
P19	.433	11.0	.236	6.0	.216	5.5	.787	20.0	.472	12.0
P20	.446	11.3	.511	13.0	.728	18.5	1.060	26.9	1.407	35.7
P21*	.201	5.1	.201	5.1	.236	6.0	.290	7.4	.394	10.0
P22*	1.056	26.8	1.121	28.5	1.553	39.4	2.086	53.0	2.697	68.5
(B1)	1.378	35.0	1.496	38.0	1.614	41.0	2.283	58.0	2.953	75.0
(B4)	1.130	28.7	1.395	35.4	1.847	46.9	2.438	61.9	3.648	92.7
(B5)*	.610	15.5	.610	15.5	.905	23.0	1.161	29.5	1.299	33.0
(A CLOSED)	1.614	41.0	2.125	54.0	2.677	68.0	3.500	88.9	5.748	146.0

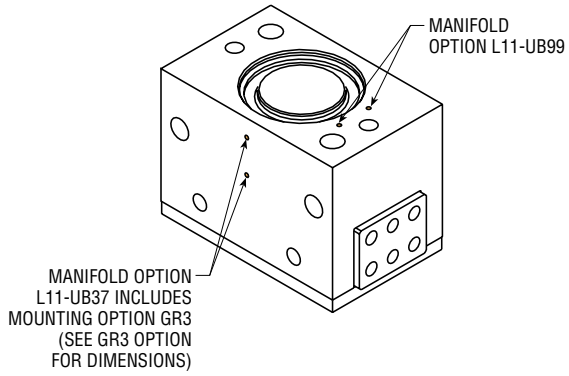
NOTES:
1) DESIGNATED ℄ IS CENTERLINE OF UNIT
2) CIRCLED NUMBERS INDICATE POSITIONS
3) * APPLIES TO SPRING ASSIST UNITS ONLY
4) .098 [2.5 mm] PORT PLUG HEAD FOR SIZE 50 & 63 METRIC UNITS ONLY. FOR ALL OTHER SIZES, PORT PLUG HEAD MAY PROTRUDE TO .040 [1 mm]

All dimensions are reference only unless specifically toleranced.

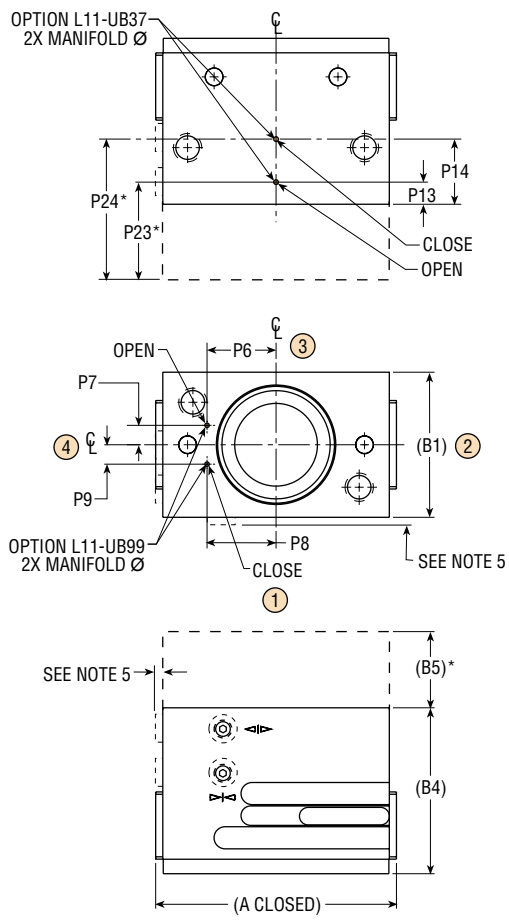
L11-UB99 L11-UB37 MANIFOLD PORTS

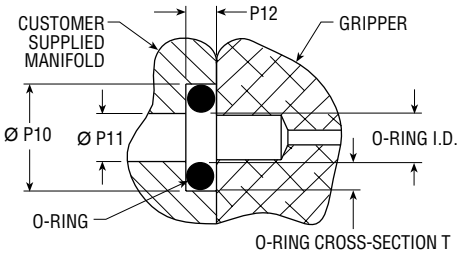
With these options the gripper is configured for manifold mounting on either the standard or optional mounting face, according to the selected option code. The standard ports are plugged. O-ring seals are provided for mounting between the gripper and the manifold.

When the L11-UB37 option is specified, the GR3 option is automatically included to provide mountings on the manifold surface. See page 4-18 for GR3 mounting information.



JAWS SHOWN IN CLOSED POSITION





MANIFOLD PORTING DIMENSIONS

FOR CUSTOMER USE
(DIMENSIONS REQUIRED
FOR CUSTOMER MOUNTING SURFACE)

LETTER DIM	SIZE 27 in	27 mm	28 in	28 mm	32 in	32 mm	50 in	50 mm	63 in	63 mm
P6	.608	15.4	.650	16.5	.768	19.5	1.181	30.0	1.811	46.0
P7	.236	6.0	.177	4.5	.138	3.5	.276	7.0	.472	12.0
P8	.591	15.0	.650	16.5	.768	19.5	1.437	36.5	1.811	46.0
P9	.295	7.5	.236	6.0	.216	5.5	.276	7.0	.472	12.0
P10	.197	5.0	.197	5.0	.197	5.0	.236	6.0	.236	6.0
P10 O-RING (I.D. x T)	2 mm x 1.5 mm		2 mm x 1.5 mm		2 mm x 1.5 mm		3 mm x 1.5 mm		3 mm x 1.5 m	
P11	.078	2.0	.078	2.0	.078	2.0	.098	2.5	.098	2.5
P12	.048	1.2	.048	1.2	.048	1.2	.048	1.2	.048	1.2
P13	.191	4.9	.190	4.8	.246	6.2	.290	7.4	.343	8.7
P14	.489	12.4	.545	13.8	.725	18.4	1.060	26.9	1.504	38.2
P23*	.191	4.9	.190	4.8	.246	6.2	.290	7.4	.343	8.7
P24*	1.006	25.6	1.121	28.5	1.553	39.4	2.071	52.6	2.743	69.7
(B1)	1.378	35.0	1.496	38.0	1.614	41.0	2.283	58.0	2.953	75.0
(B4)	1.130	28.7	1.395	35.4	1.847	46.9	2.438	61.9	3.648	92.7
(B5)*	.6100	15.5	.6100	15.5	.9054	23.0	1.1614	29.5	1.2993	33.0

NOTES:
1) DESIGNATED ℄ IS CENTERLINE OF UNIT
2) DIMENSIONS TO MANIFOLD HOLES ARE FOR LOCATION OF O-RING COUNTERBORES. MANIFOLD HOLES MAY DIFFER SLIGHTLY
3) * APPLIES TO SPRING ASSIST UNITS ONLY
4) CIRCLED NUMBERS INDICATE POSITIONS
5) .098 [2.5 mm] PORT PLUG HEAD FOR 50 & 63 METRIC UNITS ONLY. FOR ALL OTHER SIZES, PORT PLUG HEAD MAY PROTRUDE UP TO .040 [1 mm]

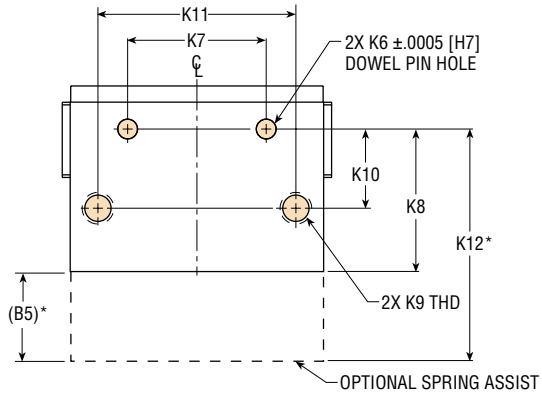
REPLACEMENT MANIFOLD SEAL KITS

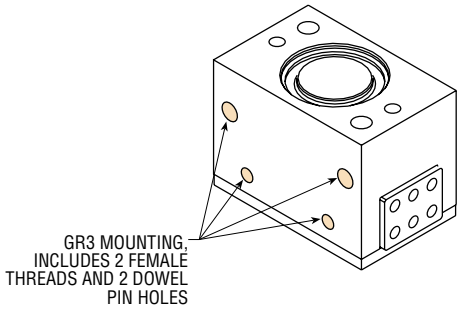
SIZE	KIT NUMBER
27 & 28	70247-27-1
32	70247-32-1
50	70247-50-1
63	70247-63-1

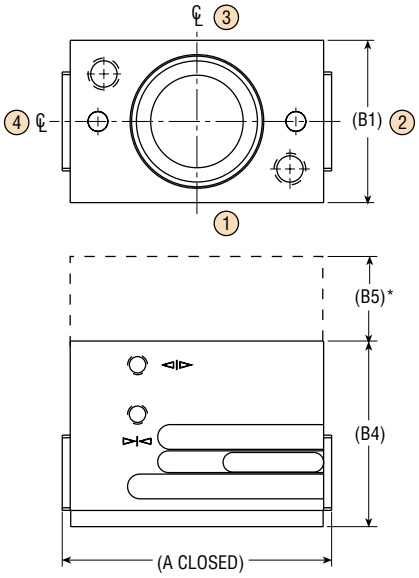
Manifold kit includes O-rings.

GR3 MOUNTING OPTION IN LOCATION 37

This option provides mounting threads and dowel holes on the side opposite the standard ports.





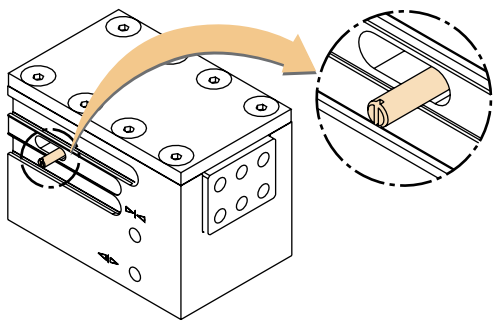


LETTER DIM	SIZE 27 in	27 mm	28 in	28 mm	32 in	32 mm	50 in	50 mm	63 in	63 mm
K6	.1283 x .236 DP	3.0 x 6.0 DP	.1908 x .236 DP	5.0 x 6.0 DP	.1908 x .197 DP	5.0 x 5.0 DP	.3158 x .315 DP	8.0 x 8.0 DP	.3783 x.394 DP	10.0 x 10.0 DP
K7	.7480	19.0	.9449	24.0	1.3780	35.0	1.9685	50.0	3.1496	80.0
K8	.866	22.0	1.063	27.0	1.417	36.0	1.890	48.0	2.717	69.0
K9	8-32 x .315 DP	M5 x 0.8 x 8.0 DP	1/4-20 x .512 DP	M6 x 1.0 x 13.0 DP	5/16-18 x .591 DP	M8 x 1.25 x 15.0 DP	3/8-16 x .630 DP	M10 x 1.5 x 16.0 DP	1/2-13 x 1.024 DP	M12 x 1.75 x 26.0 DP
K10	.433	11.0	.551	14.0	.787	20.0	1.024	26.0	1.378	35.0
K11	1.220	31.0	1.496	38.0	1.969	50.0	2.559	65.0	4.134	105.0
K12*	1.476	37.5	1.673	42.5	2.323	59.0	3.051	77.5	4.016	102.0
(B1)	1.378	35.0	1.496	38.0	1.614	41.0	2.283	58.0	2.953	75.0
(B4)	1.130	28.7	1.395	35.4	1.847	46.9	2.438	61.9	3.648	92.7
(B5)*	.6100	15.5	.6100	15.5	.9054	23.0	1.1614	29.5	1.2993	33.0
(A CLOSED)	1.614	41.0	2.125	54.0	2.677	68.0	3.500	88.9	5.748	146.0

NOTES:
1) DESIGNATED ℄ IS CENTERLINE OF UNIT
2) METRIC INFORMATION SHOWN IN [ ] OR IN COLUMNS DESIGNATED mm
3) CIRCLED NUMBERS INDICATE POSITIONS
4) *APPLIES TO SPRING ASSIST UNITS ONLY

CU SWITCH READY

With this option the gripper includes a target pin attached to the jaw for use with inductive proximity switches as well as the Series 6790 Solid State and Reed switches. Switches and switch mounting kits are required in addition to the CU option and are sold separately. See Accessories pages for switches and mounting kits.



All dimensions are reference only unless specifically toleranced.

PROXIMITY SWITCHES (-CU OPTION REQUIRED)

4 mm ROUND INDUCTIVE PROXIMITY SWITCHES (SIZE 27, 28, & 32)

PART NUMBER	DESCRIPTION
18430-001-02	NPN (Sink) 10-30 VDC, 2 meter cable
18430-002-02	PNP (Source) 10-30 VDC, 2 meter cable

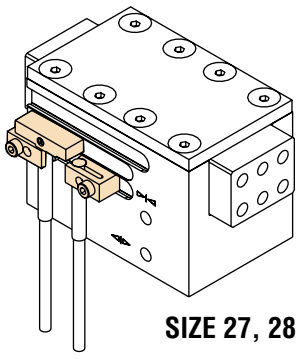
8 mm THREADED INDUCTIVE PROXIMITY SWITCHES (SIZE 50 & 63)

PART NUMBER	DESCRIPTION
51422-005-02	NPN (Sink) 5-30 VDC, 2 meter cable
51422-006-02	PNP (Source) 5-30 VDC, 2 meter cable

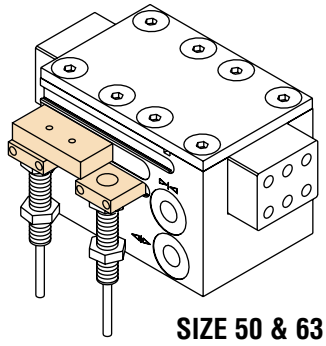
PROXIMITY SWITCH MOUNTING KITS

SIZE	KIT NUMBER
27 & 28	70663-27
32	70663-32
50	70663-50
63	70663-63

Each kit includes 1 target, 2 switch mounting brackets, and fasteners for mounting. Switches sold separately.

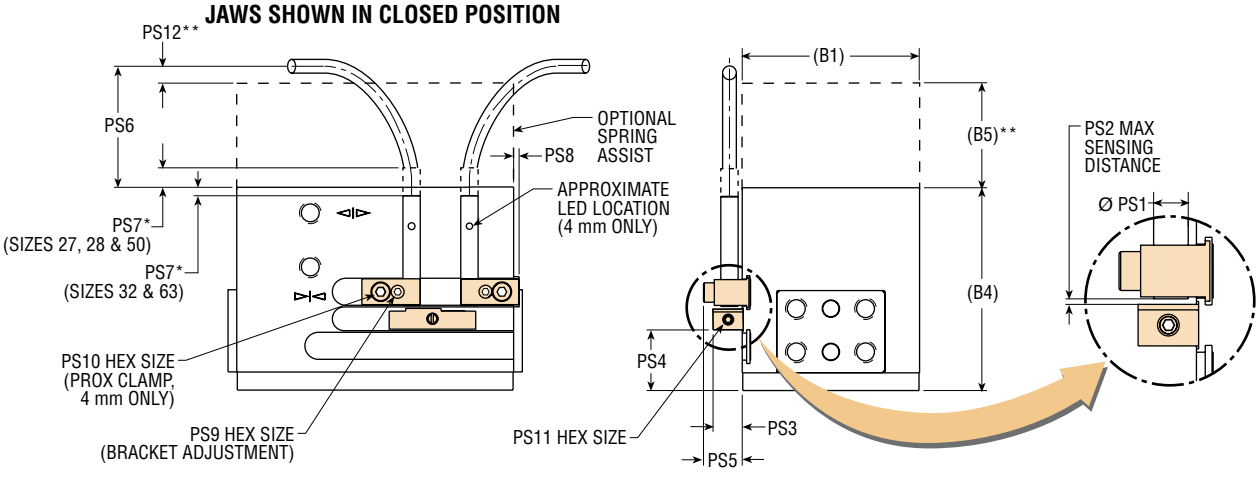


SIZE 27, 28, & 32



SIZE 50 & 63

JAWS SHOWN IN CLOSED POSITION



LETTER DIM	SIZE 27 in	27 mm	28 in	28 mm	32 in	32 mm	50 in	50 mm	63 in	63 mm
PS1	4 mm ROUND		4 mm ROUND		4 mm ROUND		8 mm THREADED		8 mm THREADED	
PS2	.020	.5	.020	.5	.020	.5	.030	.8	.030	.8
PS3	.236	6.0	.236	6.0	.276	7.0	.680	17.3	.680	17.3
PS4	.354	9.0	.454	11.5	.551	14.0	.630	16.0	1.337	34.0
PS5	.393	10.0	.393	10.0	.393	10.0	.690	17.5	.690	17.5
PS6	1.377	35.0	1.218	30.9	.860	21.8	1.252	31.8	.753	19.1
PS7*	.435	11.0	.276	7.0	.082	2.1	.310	7.9	.189	4.8
PS8	.256	6.5	.165	4.2	.050	1.3	—	—	—	—
PS9	.051	1.3	.051	1.3	.051	1.3	.051	1.3	.051	1.3
PS10	.079	2.0	.079	2.0	.079	2.0	—	—	—	—
PS11	.051	1.3	.051	1.3	.051	1.3	.061	1.5	.061	1.5
PS12**	.767	19.5	.608	15.4	—	—	.091	2.3	—	—
(B1)	1.378	35.0	1.496	38.0	1.614	41.0	2.283	58.0	2.953	75.0
(B4)**	1.130	28.7	1.395	35.4	1.847	46.9	2.438	61.9	3.648	92.7
(B5)**	.6100	15.5	.6100	15.5	.9054	23.0	1.1614	29.5	1.2993	33.0

NOTES:
1) * INDICATES BOTTOM OF PROXIMITY SWITCH BARREL, DOES NOT INCLUDE CABLE. DIMENSIONS DO NOT APPLY TO SPRING ASSIST UNIT BECAUSE PROXIMITY SWITCH BARREL DOES NOT PROTRUDE ON SPRING ASSIST UNITS
2) ** APPLIES TO SPRING ASSIST UNITS ONLY

SERIES 6790 SWITCHES (-CU OPTION REQUIRED)

SERIES 6790 SOLID STATE & REED SWITCHES (ALL UNITS)

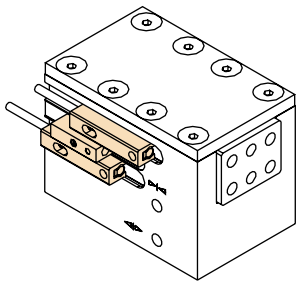
PART NUMBER	DESCRIPTION
67923-1	NPN (Sink) Solid State 4.5-30 VDC, Quick Connect
67903-1-02	NPN (Sink) Solid State 4.5-30 VDC, 2 meter cable
67903-1-05	NPN (Sink) Solid State 4.5-30 VDC, 5 meter cable
67924-1	PNP (Source) Solid State 4.5-30 VDC, Quick Connect
67904-1-02	PNP (Source) Solid State 4.5-30 VDC, 2 meter cable
67904-1-05	PNP (Source) Solid State 4.5-30 VDC, 5 meter cable
67922-1	PNP (Source) or NPN (Sink) DC Reed 4.5-30 VDC, Quick Connect
67902-1-02	PNP (Source) or NPN (Sink) DC Reed 4.5-30 VDC, 2 meter cable
67902-1-05	PNP (Source) or NPN (Sink) DC Reed 4.5-30 VDC, 5 meter cable
63549-02	2 meter Cordset with Quick Connect
63549-05	5 meter Cordset with Quick Connect
67929-2	AC Reed, Current Limited, Quick Connect

NOTES:
1) Switch set screw torque to 16 in-oz [.11 Nm] max.
2) See switches and sensors section for additional switch information and complete specification.

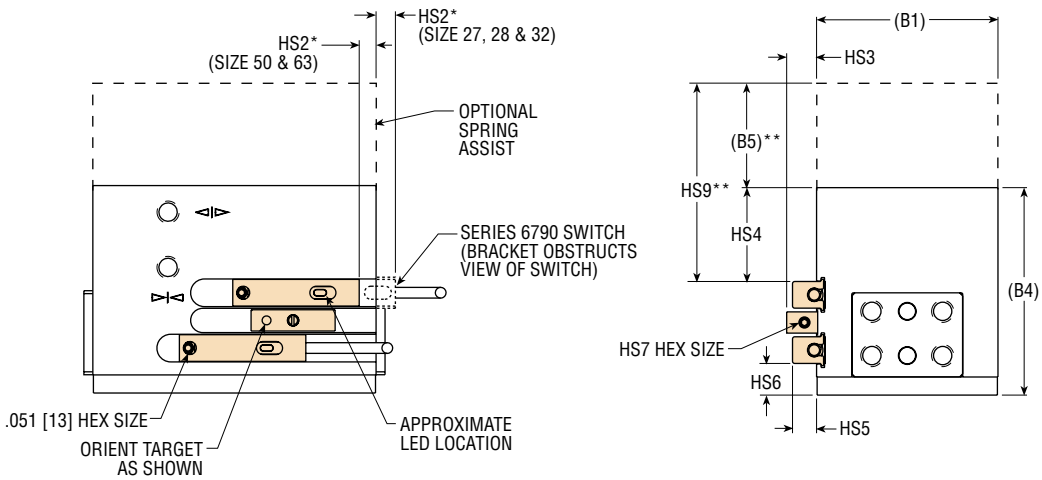
SERIES 6790 SWITCH MOUNTING KITS

SIZE	REED	SOLID STATE
27 & 28	76108-27	76107-27
32	76108-32	76107-32
50	76108-50	76107-50
63	76108-63	76107-63

Each kit includes 1 target, 2 switch mounting brackets, and fasteners for mounting. Switches sold separately.



JAWS SHOWN IN CLOSED POSITION



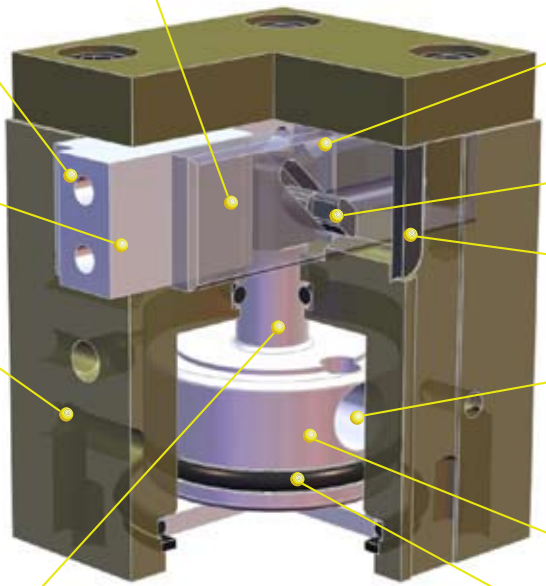
LETTER	SIZE									
	27		28		32		50		63	
DIM	in	mm	in	mm	in	mm	in	mm	in	mm
HS2*	.197	5.0	.040	1.0	.040	1.0	.560	14.2	1.298	33.0
HS3	.236	6.0	.236	6.0	.266	6.8	.236	6.0	.236	6.0
HS4	.315	8.0	.483	12.3	.835	21.2	1.194	30.3	1.707	43.4
HS5	.246	6.2	.246	6.2	.214	5.4	.296	7.5	.236	6.0
HS6	.084	2.1	.185	4.7	.282	7.2	.325	8.3	1.032	26.2
HS7 HEX	.051	1.3	.051	1.3	.051	1.3	.061	1.5	.061	1.5
HS9**	.925	23.5	1.093	27.8	1.740	44.2	2.355	59.8	3.006	76.4
(B1)	1.378	35.0	1.496	38.0	1.614	41.0	2.283	58.0	2.953	75.0
(B4)	1.130	28.7	1.395	35.4	1.847	46.9	2.438	61.9	3.648	92.7
(B5)**	.6100	15.5	.6100	15.5	.9054	23.0	1.1614	29.5	1.2993	33.0

NOTES:
1) * INDICATES END OF SERIES 6790 SWITCH BRACKET, DOES NOT INCLUDE CABLE
2) ** APPLIES TO SPRING ASSIST UNITS ONLY

All dimensions are reference only unless specifically toleranced.

GRD

LOW PROFILE WITH MINIMAL JAW PLAY



close tolerance jaw mechanism minimizes jaw play

hardened steel jaws provide male keys for precise location and are available in short or long travel

maximum grip force direction (open or close) is customer selected

hardcoated aluminum body with precision dowel holes provide a wear resistant jaw guide

spring assist available for higher grip force or part retention upon loss of air pressure

hardened steel cam driver for high grip force and durability

cam driver is keyed to body for centering repeatability

switch pin slot is covered on units without switches for contamination protection

hall, reed or proximity switches available for sensing position

large bore size provides high grip force in a compact package

fluoro-elastomer seals also available for fluid compatibility

Major Benefits

- High grip force to weight ratio
- Compact size
- Two body styles with a total of four sizes available in both imperial and metric versions
- Spring assist on open or close available in two different forces
- One day shipping
- 10 million cycles minimum rated life with standard seals (includes spring assist units)

Industry Uses

- Assembly machine builders
- Cosmetics
- Batteries
- Light bulb manufacturing
- Plumbing fixtures
- Semiconductor

ORDERING DATA: SERIES GRD PARALLEL GRIPPERS

TO ORDER SPECIFY:
Product Type, Series, Type, Style, Size, Jaw Style, Design No., and Options.

UNIQUE GRIPPERS ARE AVAILABLE. SEE PAGES 4-139 TO 4-164.

PRODUCT TYPE
G - Gripper

SERIES

TYPE
D - Parallel
High Grip Force

BORE SIZE
3 - 20 mm Bore
4 - 25 mm Bore
5 - 32 mm Bore
6 - 40 mm Bore

DESIGN NO.

MAXIMUM FORCE REVERSED JAW MOVEMENT
0 - Maximum Force on Open
5 - Maximum Force on Close
(See Note 2.)

SEALS
1 - Buna-N (Standard)
2 - Fluoro-Elastomer

G	R	D	1	4	1	-	1	-	0	5	5	1

STYLE

IMPERIAL	METRIC
1 - Full Mounting	5 - Full Mounting
2 - Full Mounting Corrosion Resistant	6 - Full Mounting Corrosion Resistant
3 - Bottom Mount	7 - Bottom Mount
4 - Bottom Mount Corrosion Resistant	8 - Bottom Mount Corrosion Resistant

JAW STYLE
1 - Short Travel
2 - Long Travel
(See Note 1.)

SENSOR OPTION
0 - None
1 - Reed Switch Ready
(For Series 5580 Switches)
2 - Hall Effect Switch Ready
(For Series 5580 Switches)
6 - 4 mm External Proximity Switch Ready
7 - 8 mm External Proximity Switch Ready
8 - 12 mm External Proximity Switch Ready (See Note 1.)

SPRING OPTION
0 - None
MEDIUM FORCE
3 - Spring Assist Close
4 - Spring Assist Open
HEAVY FORCE
5 - Spring Assist Close
6 - Spring Assist Open
(See Notes 2 & 3.)

NOTES:
1) Long jaw travel and 12 mm external proximity switch ready options are not available on size 3 or size 4 units.
2) Spring assist available in same direction as maximum force movement only. (-x04x, -x06x, -x53x, -x55x) See option pages.
3) Spring assist options (-xx3x, -xx4x, -xx5x & -xx6x) are available with full mounting style units only and see page 4-24 for dimensional changes (GRD1xx, GRD2xx, GRD5xx & GRD6xx).
4) All switches and kits must be ordered separately. See option pages.

Options may affect unit length. See unit dimension and options pages for adders.

SERIES 5580 REED SWITCHES

PART NO.	DESCRIPTION
55802-1-02	NPN (Sink) or PNP (Source) 4.5-24 VDC, 2 meter cable
55822-1	NPN (Sink) or PNP (Source) 4.5-24 VDC, Quick Connect

4 mm ROUND PROXIMITY SWITCHES

PART NO.	DESCRIPTION
18430-001-02	NPN (Sink) 10-30 VDC, 2 meter cable
18430-002-02	PNP (Source) 10-30 VDC, 2 meter cable

SERIES 5580 HALL EFFECT SWITCHES

PART NO.	DESCRIPTION
55803-1-02	NPN (Sink) 4.5-24 VDC, 2 meter cable
55804-1-02	PNP (Source) 4.5-24 VDC, 2 meter cable
55823-1	NPN (Sink) 4.5-24 VDC, Quick Connect
55824-1	PNP (Source) 4.5-24 VDC, Quick Connect

8 mm THREADED PROXIMITY SWITCHES

PART NO.	DESCRIPTION
51422-005-02	NPN (Sink) 5-30 VDC, 2 meter cable
51422-006-02	PNP (Source) 5-30 VDC, 2 meter cable

SWITCH MOUNTING KIT FOR SERIES 5580 SWITCHES

PART NO.	DESCRIPTION
61494	Switch Mounting Kit

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

12 mm THREADED PROXIMITY SWITCHES

PART NO.	DESCRIPTION
15561-001	NPN (Sink) 24 VDC, 3 meter cable
15561-002	PNP (Source) 24 VDC, 3 meter cable
15561-003	AC 117 VAC, 3 meter cable

SPECIFICATIONS	SERIES GRD
OPERATING PRESSURE	
STANDARD UNIT	30 psi min to 100 psi max [2 bar min to 7 bar max] air
MEDIUM SPRING ASSIST UNIT	60 psi min to 100 psi max [4 bar min to 7 bar max] air
HEAVY SPRING ASSIST UNIT	72 psi min to 100 psi max [5 bar min to 7 bar max] air
OPERATING TEMPERATURE	-20°F to +180°F [-28°C to +82°C]
RATED LIFE	10 million cycles minimum with standard seals (including spring assist units)
GRIP REPEATABILITY	Within ±0.002 in [±0.05 mm] of original position
CYCLE TIME	See tables below
LUBRICATION	Factory lubricated for rated life
MAINTENANCE	Field repairable

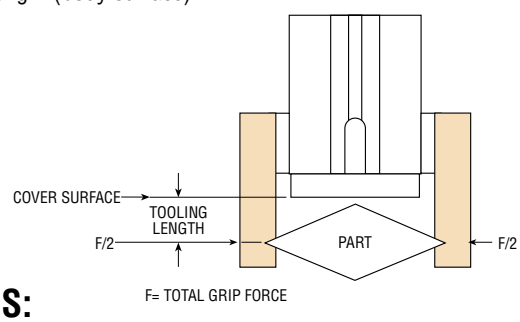
MODEL NO.	MIN. TOTAL JAW TRAVEL		TOTAL GRIP FORCE AT 87 psi [6 bar]		GRIPPER WEIGHT		CLOSE OR OPEN TIME 87 psi [6 bar]	MINIMUM OPERATING PRESSURE		DISPLACE-MENT		GRIP FORCE FACTOR G_F MAXIMUM DIRECTION		GRIP FORCE FACTOR G_F MINIMUM DIRECTION	
	in	mm	lb	N	lb	kg	sec	psi	bar	in^3	cm^3	IMPERIAL	METRIC	IMPERIAL	METRIC
GRDx31	.147	3.75	33	147	0.25	0.11	.02	30	2	.07	1	.38	24.5	.33	21.3
GRDx41	.294	7.5	40	178	0.38	0.17	.02	30	2	.12	2	.46	29.7	.42	27.1
GRDx51	.275	7.0	87	387	0.66	0.30	.04	30	2	.25	4	1.00	64.5	.90	58.1
GRDx52	.462	11.75	54	240	0.72	0.33	.04	30	2	.25	4	.62	40.0	.55	35.5
GRDx61	.383	9.75	136	604	1.41	0.64	.06	30	2	.54	9	1.56	100.6	1.42	91.6
GRDx62	.659	16.75	91	406	1.56	0.71	.06	30	2	.54	9	1.05	67.7	.95	61.3

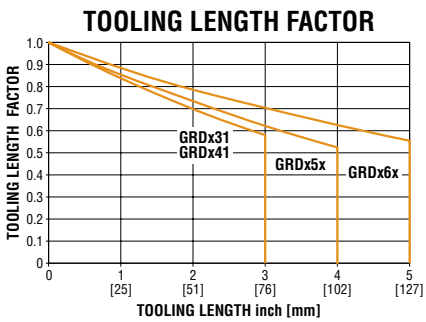
MODEL NO.	HEAVY SPRING S_F SPRING GRIP FORCE		GRIPPER WEIGHT		CLOSE OR OPEN TIME 87 psi [6 bar] in sec AGAINST SPRING	WITH SPRING	SPRING ONLY	MEDIUM SPRING S_F SPRING GRIP FORCE		GRIPPER WEIGHT		CLOSE OR OPEN TIME 87 psi [6 bar] in sec AGAINST SPRING	WITH SPRING	SPRING ONLY
	lb	N	lb	kg				lb	N	lb	kg			
GRDx31	15	67	0.34	0.16	.03	.02	.03	12	55	0.33	0.15	.03	.02	.04
GRDx41	20	87	0.54	0.25	.03	.02	.03	16	71	0.53	0.24	.03	.02	.04
GRDx51	42	187	0.97	0.44	.06	.03	.05	35	155	0.94	0.43	.05	.04	.07
GRDx52	26	117	1.03	0.47	.06	.03	.05	22	96	1.00	0.45	.05	.04	.07
GRDx61	66	294	2.03	0.92	.10	.05	.08	55	242	1.98	0.90	.08	.06	.10
GRDx62	44	196	2.19	0.99	.10	.05	.08	37	163	2.14	0.97	.08	.06	.10

TOOLING LENGTH FACTOR

Tooling should be designed so that the grip point is as close to the cover surface as possible. As the grip point is moved away from the body surface, the applied moment causes jaw friction to increase, resulting in reduced effective grip force. The Grip Force Factor (G_F) values given above are for zero tooling length (body surface).

SIZING AND APPLICATION ASSISTANCE
See PHD Product Sizing Catalog for specific and complete sizing information.
Online sizing assistance is available at: ***www.phdinc.com/apps/sizing***





GRIP FORCE CALCULATION EQUATIONS:

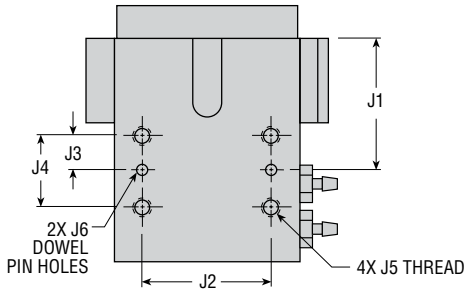
IMPERIAL:

TOTAL GRIP FORCE [lb] = (Pressure [psi] x G_F) x Tooling Length Factor
TOTAL GRIP FORCE WITH SPRINGS [lb] = ((Pressure [psi] x G_F) ± S_F [lb]) x Tooling Length Factor

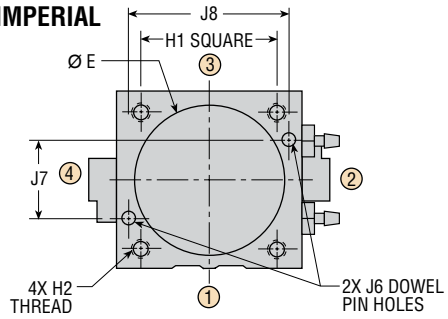
METRIC:

TOTAL GRIP FORCE [N] = (Pressure [bar] x G_F) x Tooling Length Factor
TOTAL GRIP FORCE WITH SPRINGS [N] = ((Pressure [bar] x G_F) ± S_F [N]) x Tooling Length Factor

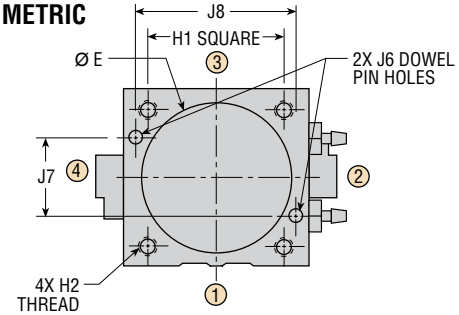
DIMENSIONS: SERIES GRD GRIPPERS, FULL MOUNTING

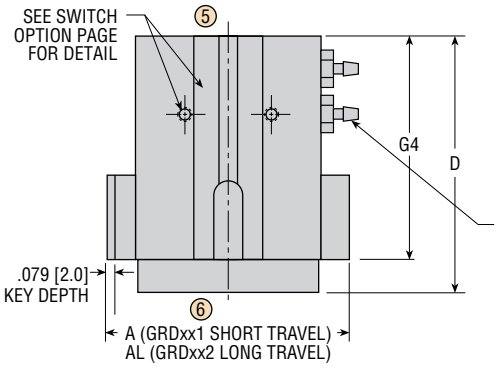


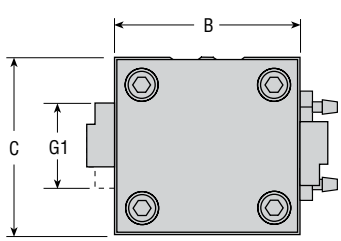
IMPERIAL

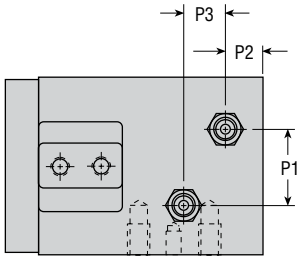


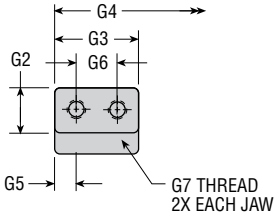
METRIC











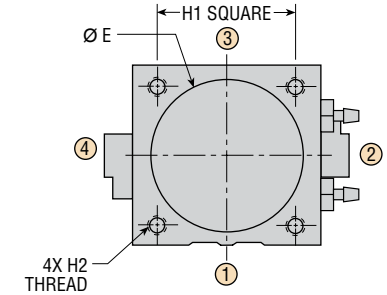
LETTER DIM.	MODEL NO. GRDx31 in	GRDx31 mm	GRDx41 in	GRDx41 mm	GRDx5x in	GRDx5x mm	GRDx6x in	GRDx6x mm
NOMINAL JAW TRAVEL								
SHORT	.187	4.75	.335	8.5	.315	8	.423	10.75
LONG	—	—	—	—	.502	12.75	.699	17.75
A CLOSED **	1.368	34.75	1.851	47.0	1.870	47.5	2.392	60.75
A OPEN **	1.515	38.5	2.145	54.5	2.145	54.5	2.775	70.5
AL CLOSED **	—	—	—	—	2.412	61.25	2.933	74.5
AL OPEN **	—	—	—	—	2.874	73.0	3.592	91.25
B	1.141	29.0	1.457	37.0	1.654	42.0	2.126	54.0
C	1.063	27.0	1.378	35.0	1.575	40.0	1.969	50.0
D	1.922	48.75	1.909	48.5	2.303	58.5	2.972	75.5
E*	.866 x .079 DP	22.0 x 2.0 DP	1.104 x .079 DP	28.0 x 2.0 DP	1.341 x .082 DP	34.0 x 2.0 DP	1.656 x .087 DP	42.0 x 2.25 DP
G1	.551	14.0	.551	14.0	.787	20.0	1.024	26.0
G2*	.2756	7.0	.2756	7.0	.3940	10.0	.5118	13.0
G3*	.4921	12.5	.4921	12.5	.748	19.0	.9842	25.0
G4	1.664	42.25	1.651	42.0	2.006	51.0	2.616	66.5
G5	.121	3.0	.121	3.0	.186	4.5	.180	6.5
G6	.250	6.5	.250	6.5	.375	10.0	.625	12.0
G7	6-32 x .280 DP	M3 x 0.5 x 6.0 DP	6-32 x .280 DP	M3 x 0.5 x 6.0 DP	8-32 x .320 DP	M4 x 0.7 x 8.0 DP	10-24 x .380 DP	M5 x 0.8 x 10.0 DP
H1	.846	21.5	1.102	28.0	1.220	31.0	1.535	39.0
H2	4-40 x .220 DP	M3 x 0.5 x 6.0 DP	8-32 x .330 DP	M4 x 0.7 x 8.0 DP	10-24 x .375 DP	M5 x 0.8 x 10.0 DP	1/4-20 x .500 DP	M6 x 1.0 x 12.0 DP
J1	.886	22.5	.906	23.0	1.201	30.5	1.614	41.0
J2*	.8465	21.50	1.1024	28.00	1.2205	31.00	1.5354	39.0
J3	.276	7.0	.296	7.5	.315	8.0	.394	10.0
J4	.551	14.0	.591	15.0	.630	16.0	.787	20.0
J5	4-40 x .220 DP	M3 x 0.5 x 6.0 DP	8-32 x .330 DP	M4 x 0.7 x 8.0 DP	10-24 x .281 DP	M5 x 0.8 x 7.5 DP	1/4-20 x .375 DP	M6 x 1.0 x 9.0 DP
J6*	.0634	2.0	.1259	3.0	.1259	3.0	.1884	4.0
J7*	.5118	13.00	.7480	19.00	.8661	22.00	1.0630	27.00
J8*	.9843	25.00	1.2205	31.00	1.4173	36.00	1.8504	47.0
P1	.492	12.5	.492	12.5	.669	17.0	.669	17.0
P2	.326	8.25	.332	8.5	.333	8.5	.392	10.0
P3	.492	12.5	.472	12.0	.531	13.5	.669	17.0
P4	10-32	M5 x 0.8	10-32	M5 x 0.8	10-32	M5 x 0.8	10-32	M5 x 0.8
P5	1/16	3.0	1/16	3.0	1/16	3.0	1/16	3.0

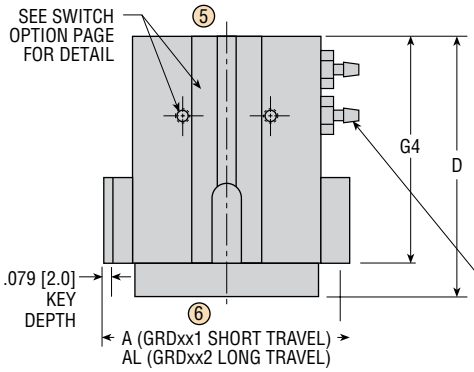
NOTES:

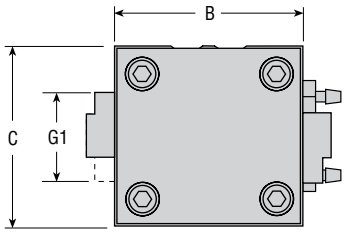
1) NUMBERS IN [ ] ARE mm
2) *TOLERANCE FOR DIMENSIONS: E = ± .005 [± 0.13]
   G2 = ± .0006 [± 0.015] SIZE 3x, 4x G2 = ± .0007 [± 0.018] SIZE 5x G2 = ± .0008 [± 0.020] SIZE 6x
   G3 = ± .0003 [± 0.007]
   J2 (BETWEEN DOWEL PIN HOLES) = ± .0008 [± 0.02] J6 = ± .0005 [H7] J7 AND J8 = ± .0008 [± 0.02]
3) CIRCLED NUMBERS INDICATE SURFACE POSITIONS
4) ** A OR AL CLOSED REFLECTS THE LARGEST POSSIBLE CLOSED DIMENSION.
   A OR AL OPEN REFLECTS THE SMALLEST POSSIBLE OPEN DIMENSION.
5) SEE PAGE 4-29 FOR DIMENSIONAL CHANGES FOR SPRING OPTIONS -xx3x, -xx4x, -xx5x, -xx6x.

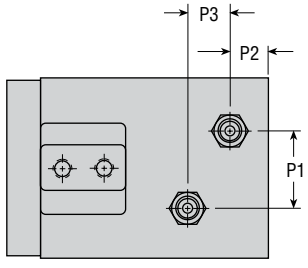
All dimensions are reference only unless specifically toleranced.

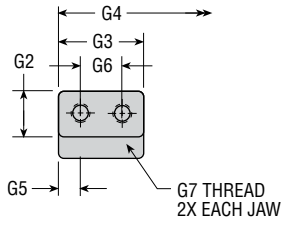
DIMENSIONS: SERIES GRD GRIPPERS, BOTTOM MOUNTING











LETTER DIM.	MODEL NO. GRDx31 in	GRDx31 mm	GRDx41 in	GRDx41 mm	GRDx5x in	GRDx5x mm	GRDx6x in	GRDx6x mm
NOMINAL JAW TRAVEL								
SHORT	.187	4.75	.335	8.5	.315	8	.423	10.75
LONG	—	—	—	—	.502	12.75	.699	17.75
A CLOSED**	1.368	34.75	1.851	47.0	1.870	47.5	2.392	60.75
A OPEN**	1.515	38.5	2.145	54.5	2.145	54.5	2.775	70.5
AL CLOSED**	—	—	—	—	2.412	61.25	2.933	74.5
AL OPEN**	—	—	—	—	2.874	73.0	3.592	91.25
B	1.141	29.0	1.457	37.0	1.654	42.0	2.126	54.0
C	1.063	27.0	1.378	35.0	1.575	40.0	1.969	50.0
D	1.922	48.75	1.909	48.5	2.303	58.5	2.972	75.5
E*	.866 x .079 DP	22.0 x 2.0 DP	1.104 x .079 DP	28.0 x 2.0 DP	1.341 x .082 DP	34.0 x 2.0 DP	1.656 x .087 DP	42.0 x 2.25 DP
G1	.551	14.0	.551	14.0	.787	20.0	1.024	26.0
G2*	.2756	7.0	.2756	7.0	.3940	10.0	.5118	13.0
G3*	.4921	12.5	.4921	12.5	.7480	19.0	.9842	25.0
G4	1.664	42.25	1.651	42.0	2.006	51.0	2.616	66.5
G5	.121	3.0	.121	3.0	.186	4.5	.180	6.5
G6	.250	6.5	.250	6.5	.375	10.0	.625	12.0
G7	6-32 x .280 DP	M3 x 0.5 x 6.0 DP	6-32 x .280 DP	M3 x 0.5 x 6.0 DP	8-32 x .320 DP	M4 x 0.7 x 8.0 DP	10-24 x .380 DP	M5 x 0.8 x 10.0 DP
H1	.846	21.5	1.102	28.0	1.220	31.0	1.535	39.0
H2	4-40 x .220 DP	M3 x 0.5 x 6.0 DP	8-32 x .330 DP	M4 x 0.7 x 8.0 DP	10-24 x .375 DP	M5 x 0.8 x 10.0 DP	1/4-20 x .500 DP	M6 x 1.0 x 12.0 DP
P1	.492	12.5	.492	12.5	.669	17.0	.669	17.0
P2	.326	8.25	.332	8.5	.333	8.5	.392	10.0
P3	.492	12.5	.472	12.0	.531	13.5	.669	17.0
P4	10-32	M5 x 0.8	10-32	M5 x 0.8	10-32	M5 x 0.8	10-32	M5 x 0.8
P5	1/16	3.0	1/16	3.0	1/16	3.0	1/16	3.0

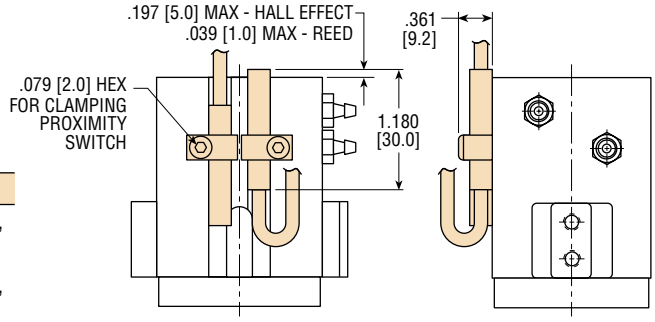
NOTES:

1) NUMBERS IN [ ] ARE mm
2) *TOLERANCE FOR DIMENSIONS: E = ± .005 [± 0.13]
   G2 = ± .0006 [± 0.015] SIZE 3x, 4x G2 = ± .0007 [± 0.018] SIZE 5x G2 = ± .0008 [± 0.020] SIZE 6x
   G3 = ± .0003 [± 0.007]
3) CIRCLED NUMBERS INDICATE SURFACE POSITIONS
4) ** A OR AL CLOSED REFLECTS THE LARGEST POSSIBLE CLOSED DIMENSION.
   A OR AL OPEN REFLECTS THE SMALLEST POSSIBLE OPEN DIMENSION.
5) SEE PAGE 4-29 FOR DIMENSIONAL CHANGES FOR SPRING OPTIONS -xx3x, -xx4x, -xx5x, -xx6x.

1 REED SWITCH READY

2 HALL EFFECT SWITCH READY

Options -1 and -2 equip the gripper with magnets for use with PHD Series 5580 Reed and Hall Effect Switches. See Switches and Sensors section for complete switch specifications. Switches and mounting kits must be ordered separately.



REED SWITCHES

PART NO.	COLOR	DESCRIPTION
55802-1-02	White	NPN (Sink) or PNP (Source) 4.5-24 VDC, 2 meter cable
55822-1	White	NPN (Sink) or PNP (Source) 4.5-24 VDC, Quick Connect

HALL EFFECT SWITCHES

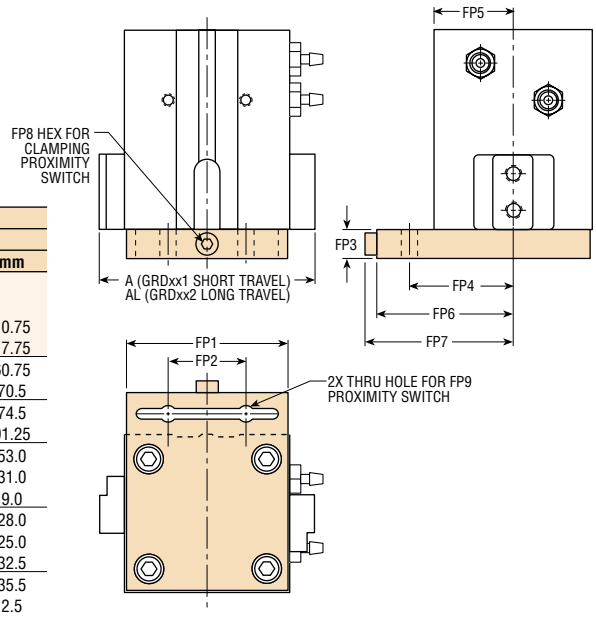
PART NO.	COLOR	DESCRIPTION
55803-1-02	Yellow	NPN (Sink) 4.5-24 VDC, 2 meter cable
55804-1-02	Red	PNP (Source) 4.5-24 VDC, 2 meter cable
55823-1	Yellow	NPN (Sink) 4.5-24 VDC, Quick Connect
55824-1	Red	PNP (Source) 4.5-24 VDC, Quick Connect

PART NO.	DESCRIPTION
61494	Switch Mounting Kit
63549-02	2 meter Cordset with Quick Connect
63549-05	5 meter Cordset with Quick Connect

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

6 4 mm EXTERNAL PROXIMITY SWITCH READY (-6xxx)

This option equips the gripper with a cover and hardware to provide for the mounting of 4 mm round metal sensing proximity switches. The user is required to design and mount targets for the switch to sense. See Switches and Sensors section for complete switch specifications.



LETTER DIM.	MODEL NO. GRDx31 in	GRDx31 mm	GRDx41 in	GRDx41 mm	GRDx5x in	GRDx5x mm	GRDx6x in	GRDx6x mm
NOMINAL JAW TRAVEL								
SHORT	.187	4.75	.335	8.5	.315	8.0	.423	10.75
LONG	—	—	—	—	.502	12.75	.699	17.75
A CLOSED*	1.368	34.75	1.851	47.0	1.870	47.5	2.392	60.75
A OPEN*	1.515	38.5	2.145	54.5	2.145	54.5	2.775	70.5
AL CLOSED*	—	—	—	—	2.412	61.25	2.933	74.5
AL OPEN*	—	—	—	—	2.874	73.0	3.592	91.25
FP1	1.122	28.5	1.417	36.0	1.614	41.0	2.087	53.0
FP2	.551	14.0	.630	16.0	.748	19.0	1.220	31.0
FP3	.256	6.5	.256	6.5	.295	7.5	.354	9.0
FP4	.650	16.5	.807	20.5	.906	23.0	1.102	28.0
FP5	.532	13.5	.689	17.5	.788	20.0	.984	25.0
FP6	.846	21.5	.984	25.0	1.083	27.5	1.280	32.5
FP7	.964	24.5	1.102	28.0	1.201	30.5	1.398	35.5
FP8	.098	2.5	.098	2.5	.098	2.5	.098	2.5
FP9	4 mm	4 mm	4 mm	4 mm	4 mm	4 mm	4 mm	4 mm

NOTES:

1) PROXIMITY SWITCHES MUST BE ORDERED SEPARATELY
2) HAND TIGHTEN CLAMP SHCS UNTIL PROXIMITY SWITCHES NO LONGER MOVE
3) * A CLOSED REFLECTS THE LARGEST POSSIBLE CLOSED DIMENSION. A OPEN REFLECTS THE SMALLEST POSSIBLE OPEN DIMENSION.

4 mm ROUND PROXIMITY SWITCHES

PART NO.	DESCRIPTION
18430-001-02	NPN (Sink) 10-30 VDC, 2 meter cable
18430-002-02	PNP (Source) 10-30 VDC, 2 meter cable

7 8 mm EXTERNAL PROXIMITY SWITCH READY (-7xxx)

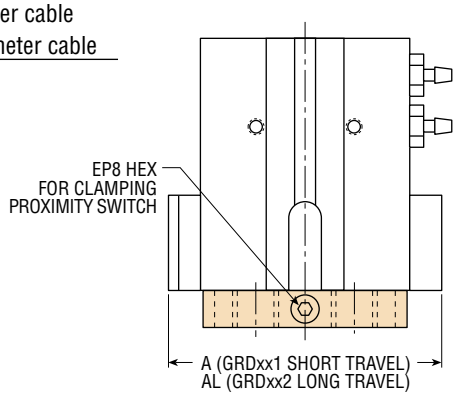
This option equips the gripper with a cover and hardware to provide for the mounting of 8 mm threaded metal sensing proximity switches. The user is required to design and mount targets for the switch to sense. See Switches and Sensors section for complete switch specifications.

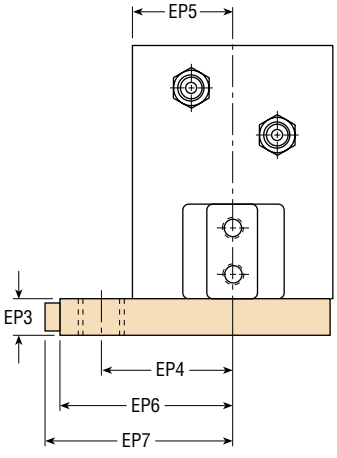
LETTER DIM.	MODEL NO. GRDx31 in	GRDx31 mm	GRDx41 in	GRDx41 mm	GRDx5x in	GRDx5x mm	GRDx6x in	GRDx6x mm
NOMINAL JAW TRAVEL								
SHORT	.187	4.75	.335	8.5	.315	8.0	.423	10.75
LONG	—	—	—	—	.502	12.75	.699	17.75
A CLOSED*	1.368	34.75	1.851	47.0	1.870	47.5	2.392	60.75
A OPEN*	1.515	38.5	2.145	54.5	2.145	54.5	2.775	70.5
AL CLOSED*	—	—	—	—	2.412	61.25	2.933	74.5
AL OPEN*	—	—	—	—	2.874	73.0	3.592	91.25
EP1	1.122	28.5	1.417	36.0	1.614	41.0	2.087	53.0
EP2	.551	14.0	.630	16.0	.748	19.0	1.220	31.0
EP3	.256	6.5	.256	6.5	.295	7.5	.354	9.0
EP4	.718	18.25	.866	22.0	.984	25.0	1.180	30.0
EP5	.532	13.5	.689	17.5	.788	20.0	.984	25.0
EP6	.935	23.75	1.063	27.0	1.279	32.5	1.418	36.0
EP7	1.053	26.75	1.181	30.0	1.397	35.5	1.535	39.0
EP8	.098	2.5	.098	2.5	.098	2.5	.098	2.5
EP9	M8 x 1.0	M8 x 1.0	M8 x 1.0	M8 x 1.0	M8 x 1.0	M8 x 1.0	M8 x 1.0	M8 x 1.0

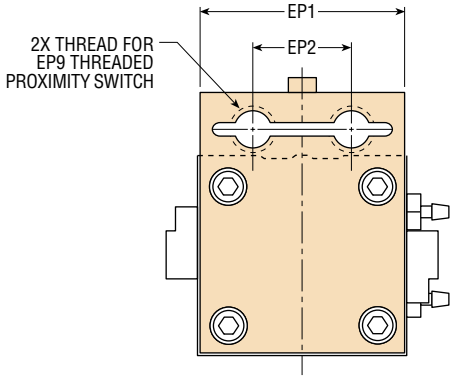
NOTES:
1) PROXIMITY SWITCHES MUST BE ORDERED SEPARATELY
2) HAND TIGHTEN CLAMP SHCS UNTIL PROXIMITY SWITCHES NO LONGER MOVE
3)* A CLOSED REFLECTS THE LARGEST POSSIBLE CLOSED DIMENSION. A OPEN REFLECTS THE SMALLEST POSSIBLE OPEN DIMENSION.

8 mm THREADED PROXIMITY SWITCHES

PART NO.	DESCRIPTION
51422-005-02	NPN (Sink) 5-30 VDC, 2 meter cable
51422-006-02	PNP (Source) 5-30 VDC, 2 meter cable







All dimensions are reference only unless specifically toleranced.

8 12 mm EXTERNAL PROXIMITY SWITCH READY (-8xxx)

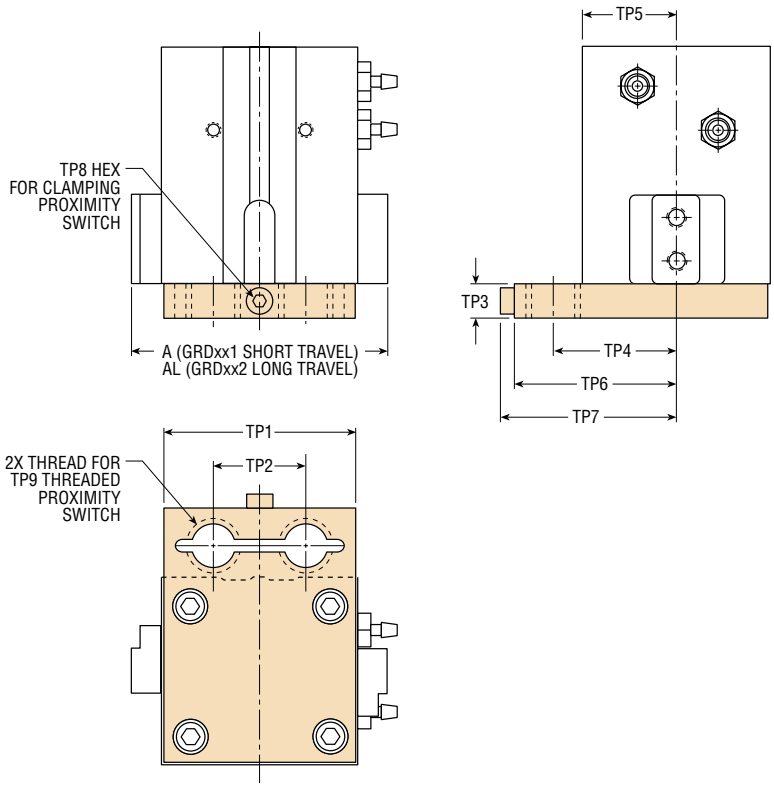
This option equips the gripper with a cover and hardware to provide for the mounting of 12 mm threaded metal sensing proximity switches. The user is required to design and mount targets for the switch to sense. See the example below.

LETTER DIM.	MODEL NO. GRDx5x in	GRDx5x mm	GRDx6x in	GRDx6x mm
NOMINAL JAW TRAVEL				
SHORT	.315	8.0	.423	10.75
LONG	.502	12.75	.699	17.75
A CLOSED*	1.870	47.5	2.392	60.75
A OPEN*	2.145	54.5	2.775	70.5
AL CLOSED*	2.412	61.25	2.933	74.5
AL OPEN*	2.874	73.0	3.592	91.25
TP1	1.614	41.0	2.087	53.0
TP2	.748	19.0	1.220	31.0
TP3	.295	7.5	.354	9.0
TP4	1.063	27.0	1.260	32.0
TP5	.788	20.0	.984	25.0
TP6	1.378	35.0	1.574	40.0
TP7	1.496	38.0	1.692	43.0
TP8	.098	2.5	.098	2.5
TP9	M12 x 1.0	M12 x 1.0	M12 x 1.0	M12 x 1.0

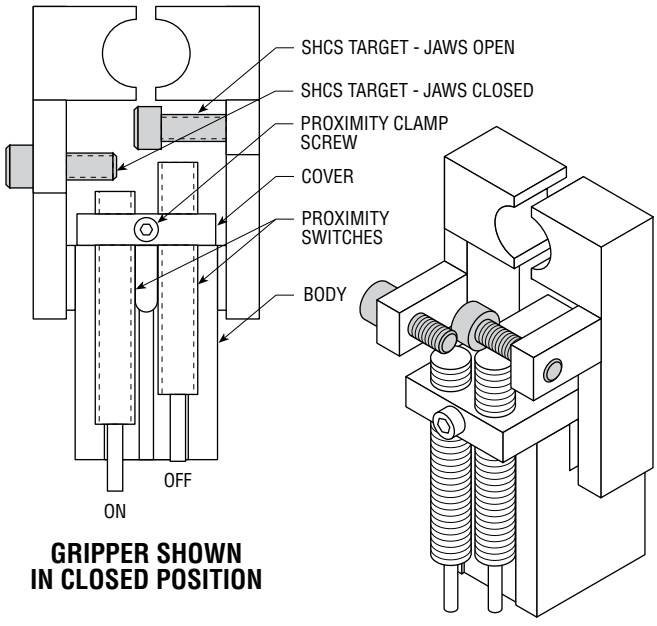
NOTES:
1) PROXIMITY SWITCHES MUST BE ORDERED SEPARATELY
2) HAND TIGHTEN CLAMP SHCS UNTIL PROXIMITY SWITCHES NO LONGER MOVE
3) * A CLOSED REFLECTS THE LARGEST POSSIBLE CLOSED DIMENSION. A OPEN REFLECTS THE SMALLEST POSSIBLE OPEN DIMENSION.

12 mm THREADED PROXIMITY SWITCHES

PART NO.	DESCRIPTION
15561-001	NPN (Sink) 24 VDC, 3 meter cable
15561-002	PNP (Source) 24 VDC, 3 meter cable
15561-003	AC 117 VAC, 3 meter cable



EXAMPLE OF TARGET CREATED BY CUSTOMER FOR EXTERNAL PROXIMITY SWITCHES



GRIPPER SHOWN IN CLOSED POSITION

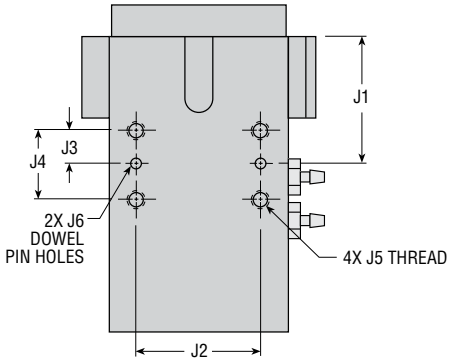
All dimensions are reference only unless specifically toleranced.

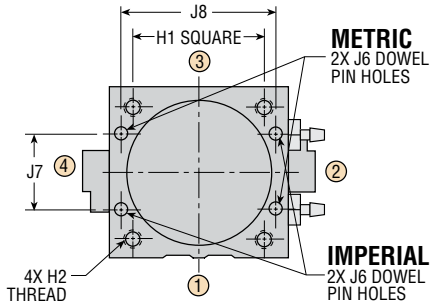
3 & 4 **MEDIUM FORCE SPRING ASSIST (-xx3x) or (-xx4x)**

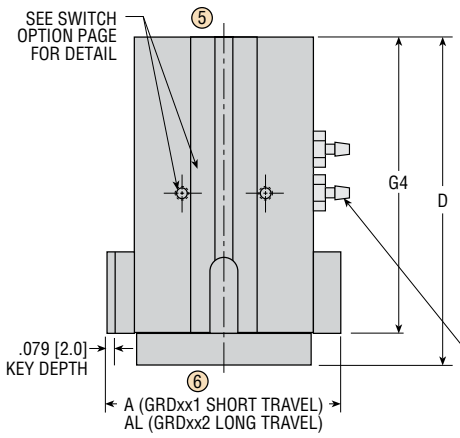
5 & 6 **HEAVY FORCE SPRING ASSIST (-xx5x) or (-xx6x)**

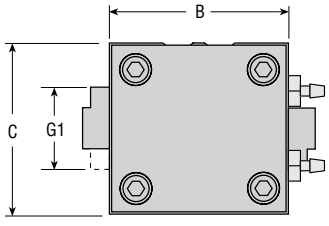
(Full mounting style only) Springs can maintain spring grip force if air pressure is lost or increase grip force in one specific direction when used with air pressure. They can open or close the gripper without air pressure. Spring life in excess of 10 million cycles can be expected. For minimum operating pressures and spring forces, see table on page 4-23.

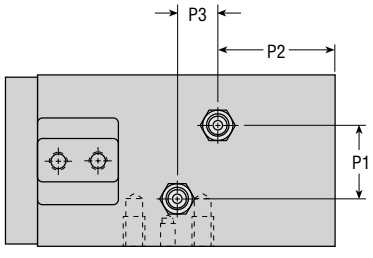
NOTE: Spring assist option may affect dimensions.

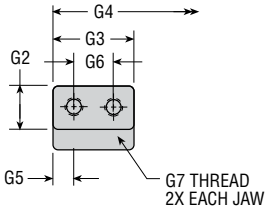










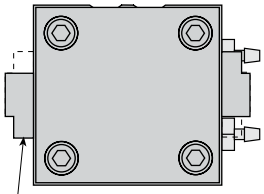


LETTER DIM.	MODEL NO. GRDx3x in	GRDx3x mm	GRDx4x in	GRDx4x mm	GRDx5x in	GRDx5x mm	GRDx6x in	GRDx6x mm
NOMINAL JAW TRAVEL								
SHORT	.187	4.75	.335	8.5	.315	8	.423	10.75
LONG	—	—	—	—	.502	12.75	.699	17.75
A CLOSED **	1.368	34.75	1.851	47.0	1.870	47.5	2.392	60.75
A OPEN **	1.515	38.5	2.145	54.5	2.145	54.5	2.775	70.5
AL CLOSED **	—	—	—	—	2.412	61.25	2.933	74.5
AL OPEN **	—	—	—	—	2.874	73.0	3.592	91.25
B	1.141	29.0	1.457	37.0	1.654	42.0	2.126	54.0
C	1.063	27.0	1.378	35.0	1.575	40.0	1.969	50.0
D	2.500	63.5	2.599	66.0	3.149	80.0	4.094	104.0
G1	.551	14.0	.551	14.0	.787	20.0	1.024	26.0
G2*	.2756	7.0	.2756	7.0	.3940	10.0	.5118	13.0
G3*	.4921	12.5	.4921	12.5	.748	19.0	.9842	25.0
G4	2.242	57.0	2.341	59.5	2.852	72.5	3.738	95.0
G5	.121	3.0	.121	3.0	.186	4.5	.180	6.5
G6	.250	6.5	.250	6.5	.375	10.0	.625	12.0
G7	6-32 x .280 DP	M3 x 0.5 x 6.0 DP	6-32 x .280 DP	M3 x 0.5 x 6.0 DP	8-32 x .328 DP	M4 x 0.7 x 8.0 DP	10-24 x .380 DP	M5 x 0.8 x 10.0 DP
H1	.846	21.5	1.102	28.0	1.220	31.0	1.535	39.0
H2	4-40 x .220 DP	M3 x 0.5 x 6.0 DP	8-32 x .330 DP	M4 x 0.7 x 8.0 DP	10-24 x .375 DP	M5 x 0.8 x 10.0 DP	1/4-20 x .500 DP	M6 x 1.0 x 12.0 DP
J1	.886	22.5	.906	23.0	1.201	30.50	1.614	41.0
J2*	.8465	21.50	1.1024	28.00	1.2205	31.00	1.5354	39.0
J3	.276	7.0	.296	7.5	.315	8.0	.394	10.0
J4	.551	14.0	.591	15.0	.630	16.0	.787	20.0
J5	4-40 x .220 DP	M3 x 0.5 x 6.0 DP	8-32 x .330 DP	M4 x 0.7 x 8.0 DP	10-24 x .281 DP	M5 x 0.8 x 7.5 DP	1/4-20 x .375 DP	M6 x 1.0 x 9.0 DP
J6*	.0634	2.0	.1259	3.0	.1259	3.0	.1884	4.0
J7*	.5118	13.00	.7480	19.00	.8661	22.00	1.0630	27.00
J8*	.9843	25.00	1.2205	31.00	1.4173	36.00	1.8504	47.0
P1	.492	12.5	.492	12.5	.669	17.0	.669	17.0
P2	.904	23.0	1.022	26.0	1.179	26.0	1.514	38.5
P3	.492	12.5	.472	12.0	.531	13.5	.669	17.0
P4	10-32	M5 x 0.8	10-32	M5 x 0.8	10-32	M5 x 0.8	10-32	M5 x 0.8
P5	1/16	3.0	1/16	3.0	1/16	3.0	1/16	3.0

NOTES:
1) NUMBERS IN [ ] ARE mm
2) *TOLERANCE FOR DIMENSIONS:
   G2 = ± .0006 [± 0.015] SIZE 3x, 4x G2 = ± .0007 [± 0.018] SIZE 5x G2 = ± .0008 [± 0.020] SIZE 6x
   G3 = ± .0003 [± 0.007] J2 (BETWEEN DOWEL PIN HOLES) = ± .0008 [± 0.02]
   J6 = ± .0005 [H7] J7 AND J8 = ± .0008 [± 0.02]
3) CIRCLED NUMBERS INDICATE SURFACE POSITIONS
4) **A CLOSED REFLECTS THE LARGEST POSSIBLE CLOSED DIMENSION.
   A OPEN REFLECTS THE SMALLEST POSSIBLE OPEN DIMENSION.

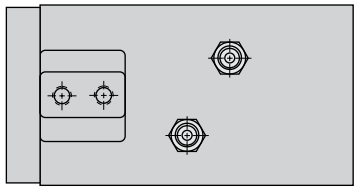
5 MAXIMUM FORCE IN CLOSE DIRECTION (-x5xx)

This option changes the maximum force of the jaws from the open direction to the closed direction. This switches or changes the jaw offset 180° from standard.



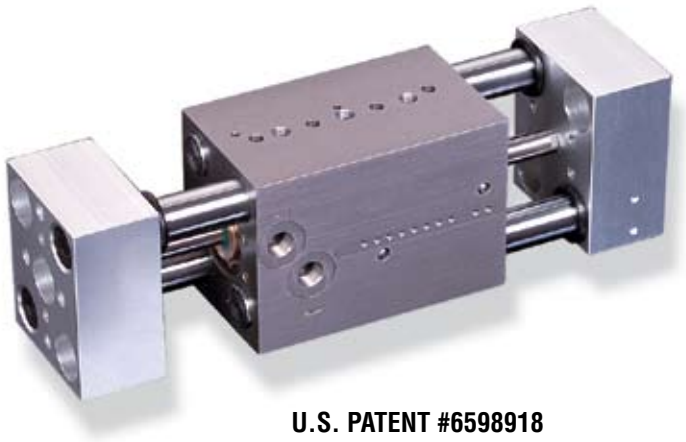
NOTE JAW OFFSET ON THIS SIDE.

DIMENSIONS REMAIN THE SAME. SEE DIMENSION PAGES.

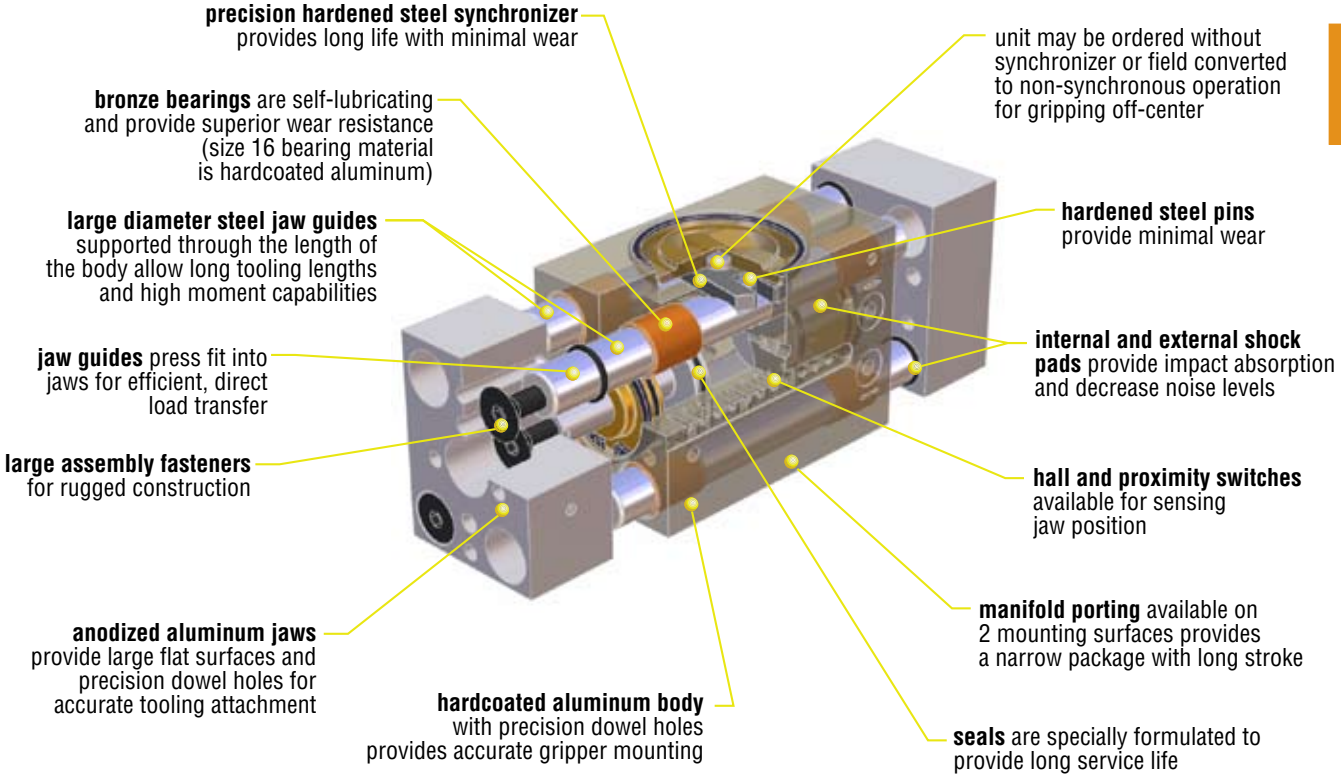


GRW

LOW PROFILE WITH MINIMAL JAW PLAY



U.S. PATENT #6598918
INTERNATIONAL PATENT PENDING



Major Benefits

- Units can be ordered without synchronous jaw motion or converted in the field
- Large diameter jaw guides provide superior jaw stability and high moment capacities
- Manifold porting options
- Two standard mounting surfaces
- Five sizes available in both imperial and metric versions
- 1-2 day shipping
- 6 million cycles minimum rated life

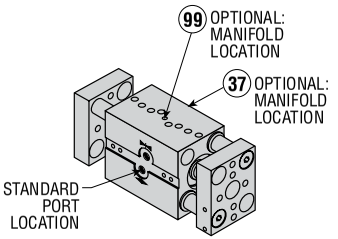
Industry Uses

- Assembly machine builders
- Powdered metal
- Bearing manufacturing
- Automotive
- Light bulb manufacturing
- Robotics
- Vehicle lighting equipment
- Material handling

ORDERING DATA: SERIES GRW GRIPPERS

TO ORDER SPECIFY:
Product Line, Series, Type, Synchronization, Jaw, Design No., Size, Total Jaw Travel, and Options required.

OPTIONS
(OMIT IF NOT REQUIRED)
MANIFOLD OPTIONS
L11-UB99 - Manifold option in location 99
L11-UB37 - Manifold option in location 37
UNIT OPTIONS
Z1 - Corrosion resistant coating on exposed ferrous parts except for jaw guides.



SERIES
Regular Duty

SYNCHRONIZATION
0 - Non-synchronized
1 - Synchronized

DESIGN NO.
(See Note 1)
1 - Imperial
5 - Metric

G R W 1 3 - 1 - 16 x 20 - L11-UB99

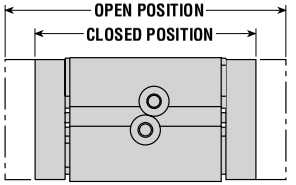
PRODUCT LINE
G - Gripper

TYPE
Wide Body Parallel

JAW
Style 3

BORE SIZE Diameter mm (in)	NOMINAL TOTAL JAW TRAVEL Total Travel Per Bore Size mm (in)
16 (.630)	20 (.79)
25 (.984)	53 (2.09)
32 (1.260)	65 (2.56)
40 (1.575)	91 (3.58)
50 (1.969)	117 (4.61)

TOTAL JAW TRAVEL =
(OPEN POSITION - CLOSED POSITION)



4 mm ROUND INDUCTIVE PROXIMITY SWITCHES
(16, 25 & 32 mm BORE UNITS)

PART NUMBER	DESCRIPTION
18430-001-02	NPN (Sink) 10-30 VDC, 2 meter cable
18430-002-02	PNP (Source) 10-30 VDC, 2 meter cable

8 mm THREADED INDUCTIVE PROXIMITY SWITCHES
(40 & 50 mm BORE UNITS)

PART NUMBER	DESCRIPTION
51422-005-02	NPN (Sink) 5-30 VDC, 2 meter cable
51422-006-02	PNP (Source) 5-30 VDC, 2 meter cable

6 mm SQUARE HALL EFFECT SWITCHES

PART NUMBER	COLOR	DESCRIPTION
55803-1-02	Yellow	NPN (Sink) 4.5-24 VDC, 2 meter cable
55804-1-02	Red	PNP (Source) 4.5-24 VDC, 2 meter cable
55823-1	Yellow	NPN (Sink) 4.5-24 VDC, Quick Connect
55824-1	Red	PNP (Source) 4.5-24 VDC, Quick Connect

NOTE:
1) Design number indicates imperial or metric mounting holes, dowel pin holes, and ports.

PROXIMITY SWITCH MOUNTING KITS

SIZE	KIT NUMBER STANDARD PLATING	KIT NUMBER -Z1 PLATING
16	65710-16-20	68465-16-20
25	65710-25-53	68465-25-53
32	65710-32-65	68465-32-65
40	68457-40-91	68466-40-91
50	68457-50-117	68466-50-117

HALL EFFECT SWITCH MOUNTING KITS

SIZE	KIT NUMBER STANDARD PLATING	KIT NUMBER -Z1 PLATING
16	68446-16-20	68467-16-20
25	68446-25-53	68467-25-53
32	68446-32-65	68467-32-65
40	68446-40-91	68467-40-91
50	68446-50-117	68467-50-117

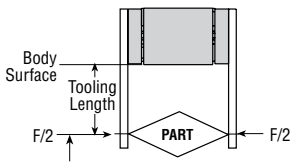
UNIQUE GRIPPERS ARE AVAILABLE.
SEE PAGES 4-139 TO 4-164.

SPECIFICATIONS	SERIES GRW
OPERATING PRESSURE STANDARD UNIT	30 psi min to 100 psi max [2 bar min to 7 bar max] air
OPERATING TEMPERATURE	-20° to +180°F [-28° to +82°C]
RATED LIFE	6 million cycles minimum
GRIP REPEATABILITY	Within ±0.002 in [±0.05 mm] of original centered position
CYCLE TIME	See table below
LUBRICATION	Factory lubricated for rated life
MAINTENANCE	Field repairable

SIZE	NOMINAL TOTAL JAW TRAVEL in	mm	TOTAL CLOSE GRIP FORCE AT 87 psi [6 bar] lb	N	GRIPPER WEIGHT lb	kg	CLOSE OR OPEN TIME 87 psi [6 bar] sec	DISPLACEMENT in³	cm³	GRIP FORCE FACTOR G_F EXTERNAL GRIP IMPERIAL	METRIC	INTERNAL GRIP IMPERIAL	METRIC
16	0.79	20	36	160	0.69	0.3	0.09	0.25	4.0	0.41	26	0.49	31
25	2.09	53	90	400	2.5	1.1	0.14	1.59	26	1.03	66	1.21	78
32	2.56	65	170	756	5.3	2.4	0.24	3.19	52	1.96	126	2.17	140
40	3.58	91	207	921	11.2	5.1	0.30	7.0	114	2.38	154	2.61	168
50	4.61	117	429	1908	22.1	10.0	0.60	14.0	229	4.93	318	5.49	354

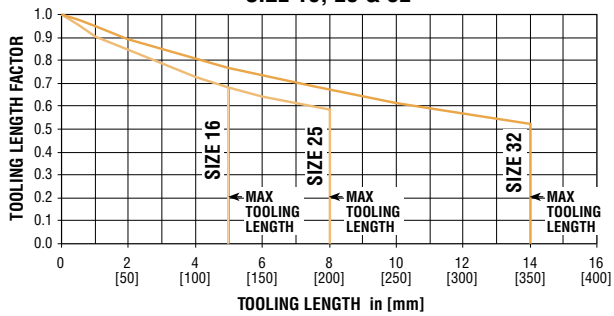
TOOLING LENGTH FACTOR

Jaw tooling should be designed so that the grip point is as close to the body surface as possible. As the grip point is moved away from the body surface, the applied moment causes jaw friction to increase, resulting in reduced effective grip force. The Grip Force Factor (G_F) values given in the table above are for zero tooling length (body surface). The graphs show how grip force decreases as the grip point is moved from the body surface.

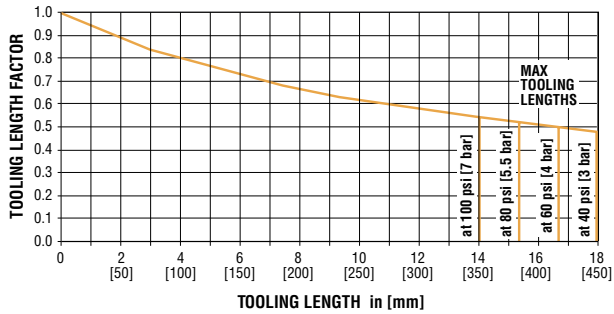


F= TOTAL GRIP FORCE

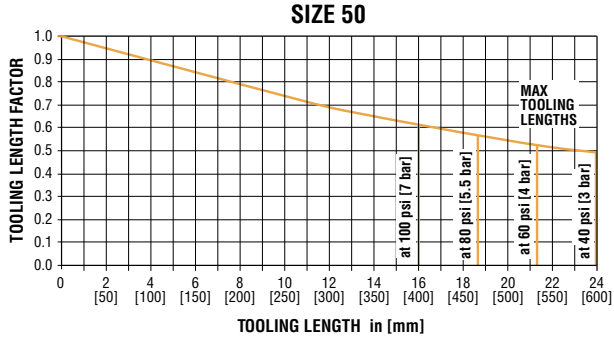
SIZE 16, 25 & 32



SIZE 40



SIZE 50



GRIP FORCE CALCULATION EQUATIONS:

IMPERIAL:

TOTAL GRIP FORCE [lb] = (Pressure [psi] x G_F) x Tooling Length Factor

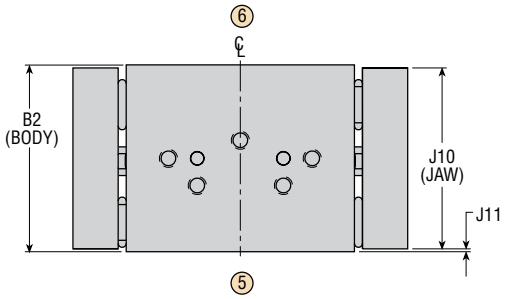
METRIC:

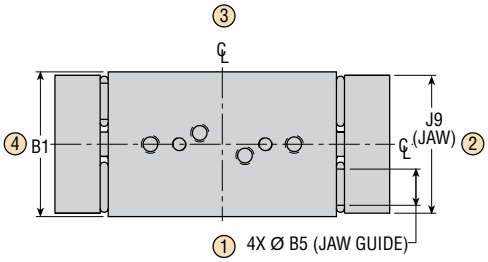
TOTAL GRIP FORCE [N] = (Pressure [bar] x G_F) x Tooling Length Factor

SIZING AND APPLICATION ASSISTANCE

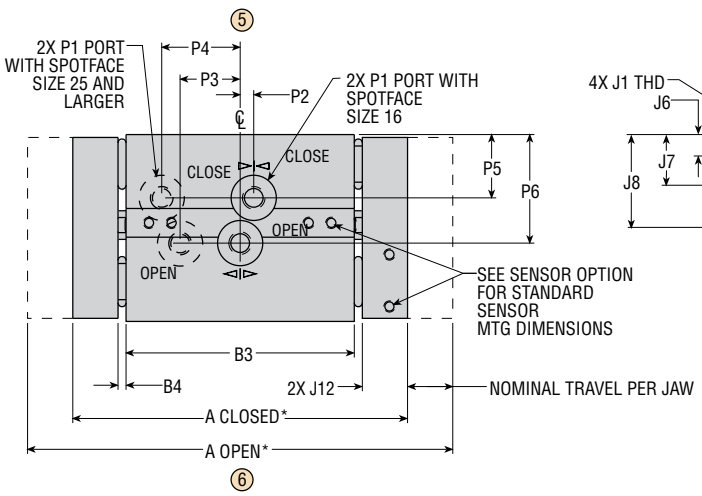
See PHD Product Sizing Catalog for specific and complete sizing information. Online sizing assistance is available at: ***www.phdinc.com/apps/sizing***

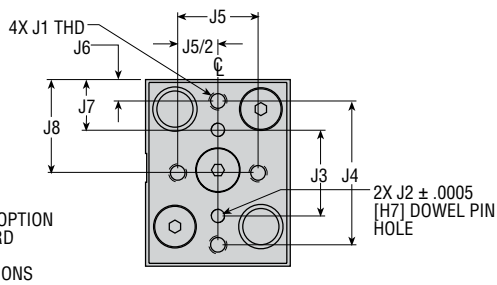
DIMENSIONS SHOWN APPLY TO ALL SIZES UNLESS NOTED OTHERWISE, SEE OTHER VIEWS FOR SIZE DEPENDENT FEATURES





LETTER DIM	SIZE 16 in	16 mm	25 in	25 mm	32 in	32 mm	40 in	40 mm	50 in	50 mm
NOM TRAVEL PER JAW	.394	10.0	1.043	26.5	1.280	32.5	1.791	45.5	2.303	58.5
A CLOSED*	2.900	73.7	5.380	136.7	6.730	170.9	9.125	231.8	11.645	295.8
A OPEN*	3.660	93.0	7.380	187.5	9.230	234.4	12.625	320.7	16.157	410.4
B1	1.260	32.0	1.790	45.5	2.362	60.0	2.913	74.0	3.543	90.0
B2	1.625	41.3	2.244	57.0	2.874	73.0	3.504	89.0	4.528	115.0
B3	1.987	50.5	3.201	81.3	3.929	99.8	5.390	136.9	6.932	176.1
B4	.063	1.6	.063	1.6	.125	3.2	.125	3.2	.238	6.0
B5	.315	8.0	.472	12.0	.630	16.0	.787	20.0	.984	25.0
J1	8-32 thru	M4 x 0.7 thru	10-32 x .500 DP	M5 x 0.8 x 13.0 DP	1/4-20 x .750 DP	M6 x 1.0 x 19.0 DP	5/16-18 x 1.000 DP	M8 x 1.25 x 25.0 DP	3/8-16 x 1.000 DP	M10 x 1.5 x 25.0 DP
J2	.1283 thru	3.0 thru	.1908 x .500 DP	5.0 x 13.0 DP	.1908 x .500 DP	5.0 x 13.0 DP	.1908 x .500 DP	5.0 x 12.5 DP	.3158 x .512 DP	8.0 x 13.0 DP
J3	.750	19.05	1.000	25.40	1.250	31.75	1.312	33.32	2.375	60.33
J4	1.250	31.8	1.625	41.3	2.125	54.0	2.250	57.2	3.375	85.7
J5	.700	17.8	.875	22.2	1.188	30.2	1.625	41.3	1.660	42.2
J6	.187	4.7	.188	4.8	.250	6.35	.500	12.7	.282	7.2
J7	.438	11.1	.500	12.7	.687	17.45	.968	24.6	.782	19.9
J8	.813	20.7	1.000	25.4	1.312	33.3	1.625	41.3	1.969	50.0
J9	1.200	30.5	1.654	42.0	2.240	56.9	2.835	72.0	3.425	87.0
J10	1.575	40.0	2.158	54.8	2.795	71.0	3.400	86.4	4.429	112.5
J11	.025	.6	.033	.8	.040	1.0	.040	1.0	.040	1.0
J12	.394	10.0	1.028	26.1	1.275	32.4	1.735	44.1	2.105	53.5
K1	8-32 x .200 DP	M4 x 0.7 x 5.0 DP	10-32 x .250 DP	M5 x 0.8 x 6.3 DP	1/4-20 x .354 DP	M6 x 1.0 x 9.0 DP	1/4-20 x .472 DP	M6 x 1.0 x 12.0 DP	5/16-18 x .551 DP	M8 x 1.25 x 14.0 DP
K2	.1283 x .188 DP	3.0 x 5.0 DP	.1283 x .250 DP	4.0 x 6.0 DP	.1908 x .440 DP	5.0 x 11.0 DP	.1908 x .440 DP	5.0 x 11.0 DP	.3158 x .500 DP	8.0 x 12.5 DP
K3	.750	19.1	.787	20.0	.750	19.05	N/A	N/A	3.000	76.2
K4	1.250	31.8	2.000	50.8	2.000	50.8	2.500	63.5	5.500	139.7
K5	.813	20.7	.738	18.75	1.042	26.5	1.150	29.2	1.594	40.5
K6	.157	4.0	.625	15.88	.750	19.05	1.125	28.6	1.340	34.0
K7	.236	6.0	N/A	N/A	N/A	N/A	.563	14.3	.670	17.0
K8	.394	10.0	1.250	31.75	N/A	N/A	N/A	N/A	2.500	63.5
K9	.750	19.1	.750	19.05	1.000	25.40	1.250	31.8	4.000	101.6
K10	1.252	31.8	2.250	57.15	2.000	50.8	2.500	63.5	5.118	130.0
K11	.098	2.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
K12	.630	16.0	.895	22.7	1.181	30.0	1.457	37.0	1.772	45.0
K13	8-32 x .280 DP	M4 x 0.7 x 7.0 DP	10-32 x .375 DP	M5 x 0.8 x 9.0 DP	1/4-20 x .492 DP	M6 x 1.0 x 12.5 DP	5/16-18 x .561 DP	M8 x 1.25 x 14.0 DP	3/8-16 x .709 DP	M10 x 1.5 x 18.0 DP
K14	.1283 x .188 DP	3.0 x 6.0 DP	.1283 x .250 DP	4.0 x 6.0 DP	.1908 x .440 DP	5.0 x 11.0 DP	.1908 x .440 DP	5.0 x 11.0 DP	.3158 x .500 DP	8.0 x 12.5 DP
K15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.024	26.0
P1	10-32	M5 x 0.8	10-32	M5 x 0.8	1/8 NPT	1/8 BSP	1/8 NPT	1/8 BSPP	1/8 NPT	1/8 BSPP
P2	.118	3.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P3	N/A	N/A	1.260	32.0	1.000	25.4	1.868	47.4	2.639	67.0
P4	N/A	N/A	1.260	32.0	1.592	40.4	2.245	57.0	2.931	74.4
P5	.551	14.0	.768	19.5	1.161	29.5	1.301	33.0	1.713	43.5
P6	.945	24.0	1.398	35.5	1.673	42.5	2.069	52.6	2.697	68.5

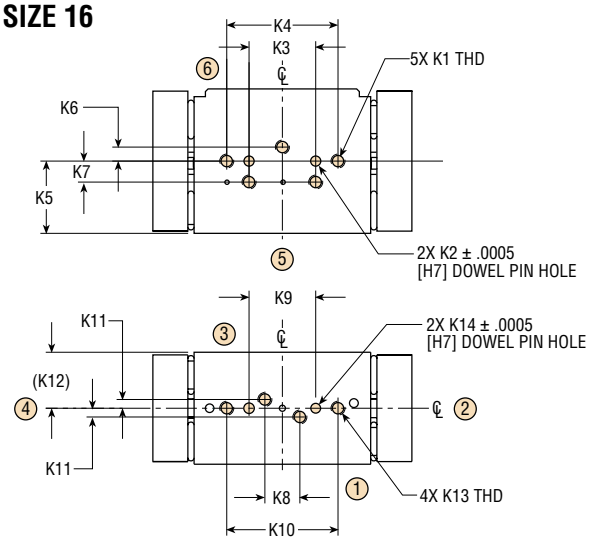




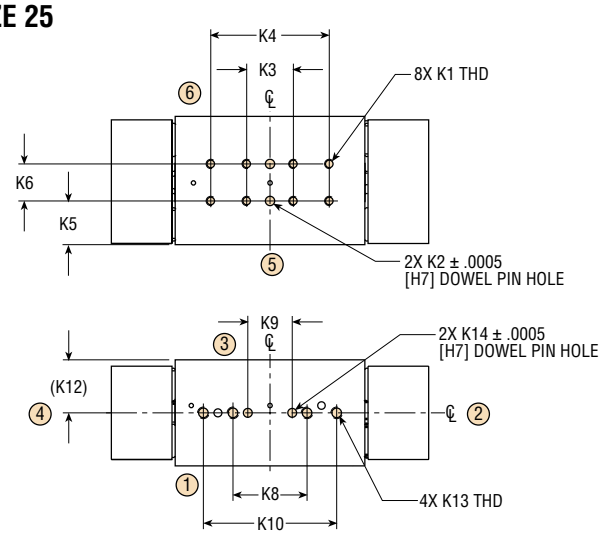
NOTES:
1) DESIGNATED ℄ IS CENTERLINE OF UNIT
2) METRIC INFORMATION SHOWN IN [ ]
3) UNMARKED HOLES ARE USED FOR PHD MANUFACTURING, CONTACT PHD IF DIMENSIONAL INFORMATION IS REQUIRED
4) CIRCLED NUMBERS INDICATE POSITIONS
5) *A CLOSED REFLECTS THE LARGEST POSSIBLE CLOSED DIMENSION
A OPEN REFLECTS THE SMALLEST POSSIBLE OPEN DIMENSION

MOUNTING DIMENSIONS: SERIES GRW GRIPPERS

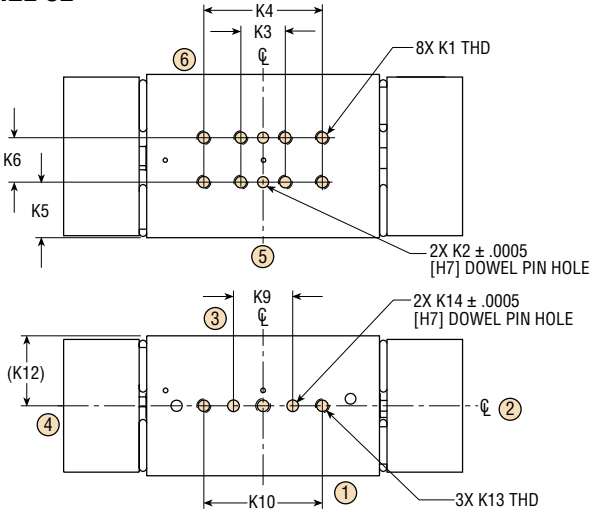
SIZE 16



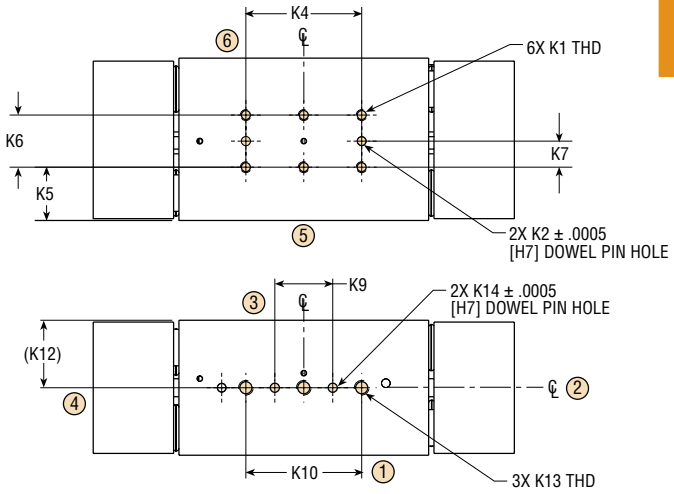
SIZE 25



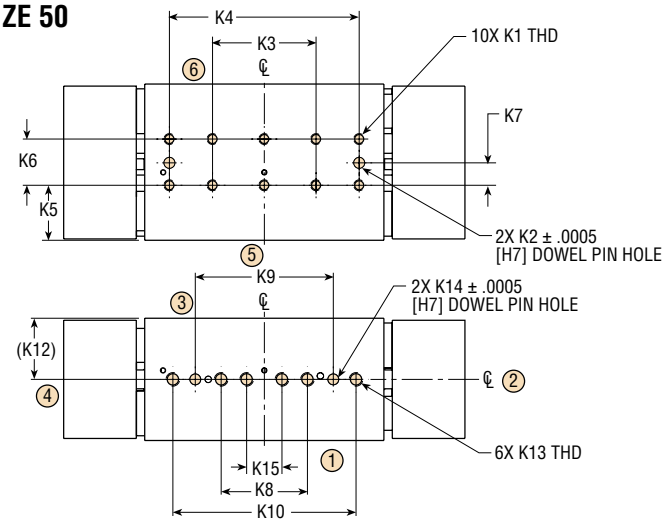
SIZE 32



SIZE 40



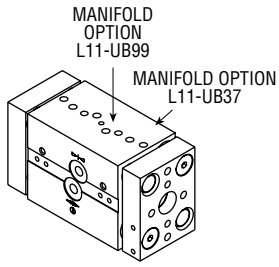
SIZE 50



All dimensions are reference only unless specifically toleranced.

L11-UB99 L11-UB37

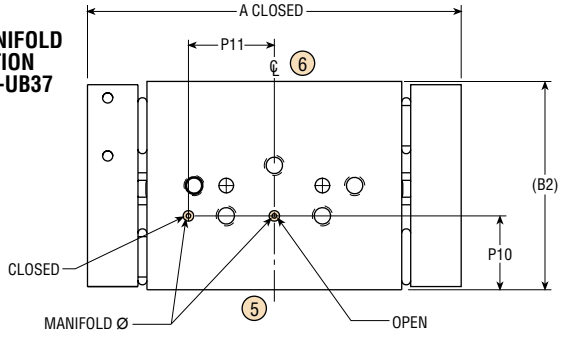
With this option the gripper is configured for manifold mounting on one of the two standard mounting surfaces, according to the selected option code. The standard ports are plugged. O-ring seals are provided for mounting between the gripper and the manifold.



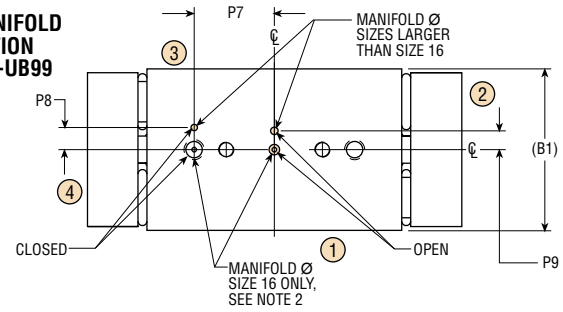
TYPE	MANIFOLD REPLACEMENT KIT NUMBER				
	SIZE 16	SIZE 25	SIZE 32	SIZE 40	SIZE 50
IMPERIAL	65709-16-1-1	65709-25-1-1	65709-32-1-1	65709-40-1-1	65709-50-1-1
METRIC	65709-16-5-1	65709-25-5-1	65709-32-5-1	65709-40-5-1	65709-50-5-1

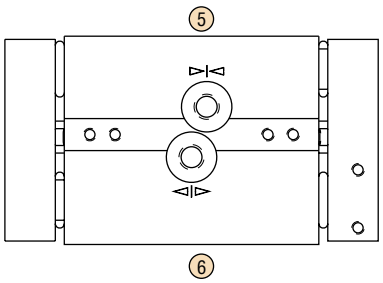
Manifold kit includes port plugs and o-rings.

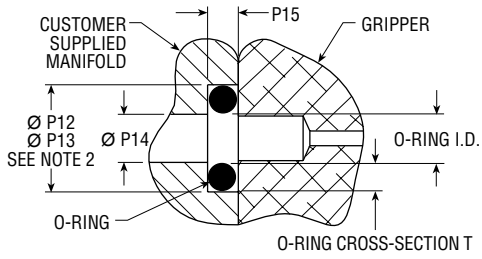
MANIFOLD OPTION L11-UB37



MANIFOLD OPTION L11-UB99







MANIFOLD PORTING DIMENSIONS

FOR CUSTOMER USE
(DIMENSIONS REQUIRED
ON CUSTOMER MOUNTING SURFACE)

LETTER DIM	SIZE									
	16		25		32		40		50	
	in	mm	in	mm	in	mm	in	mm	in	mm
P7	.625	15.9	1.266	32.2	1.590	40.4	2.245	57.0	2.931	74.4
P8	—	—	.138	3.5	.177	4.5	.197	5.0	.236	6.0
P9	—	—	.138	3.5	.236	6.0	.335	8.5	.236	6.0
P10	.577	14.7	1.050	26.7	1.417	36.0	1.713	43.5	1.969	50.0
P11	.670	17.0	1.266	32.2	1.590	40.4	2.245	57.0	2.931	74.4
P12	.236	6.0	.197	5.0	.197	5.0	.276	7.0	.276	7.0
P12 O-RING (I.D. x T)	3 mm x 1.5 mm		2 mm x 1.5 mm		2 mm x 1.5 mm		4 mm x 1.5 mm		4 mm x 1.5 mm	
P13	.276	7.0	See Note 2		See Note 2		See Note 2		See Note 2	
P13 O-RING (I.D. x T)	4 mm x 1.5 mm		See Note 2		See Note 2		See Note 2		See Note 2	
P14	.098	2.5	.080	2.0	.098	2.5	.125	3.2	.125	3.2
P15	.048	1.2	.048	1.2	.048	1.2	.048	1.2	.048	1.2
(B1)	1.260	32.0	1.790	45.5	2.362	60.0	2.913	74.0	3.543	90.0
(B2)	1.625	41.3	2.244	57.0	2.874	73.0	3.504	89.0	4.528	115.0
A CLOSED	2.900	73.7	5.380	136.7	6.729	170.9	9.125	231.8	11.645	295.8

NOTES:
1) DESIGNATED ℄ IS CENTERLINE OF UNIT
2) USE P12 FOR ALL UNITS EXCEPT SIZE 16 WITH MANIFOLD OPTION IN LOCATION 99. FOR THIS UNIT ONLY, ONE MANIFOLD ORIFICE IS LOCATED IN A MOUNTING THREAD (SEE OPTION ILLUSTRATION) AND REQUIRES THE P13 DIAMETER.
3) CIRCLED NUMBERS INDICATE POSITION.

Z1 CORROSION RESISTANT

This option provides appropriate corrosion resistant coating on all ferrous parts except jaw guides.

PROXIMITY SWITCH KIT

This kit equips the gripper with brackets to provide for the mounting of up to two 4 mm round proximity switches. Proximity switches must be ordered separately.

4 mm ROUND INDUCTIVE PROXIMITY SWITCHES

PART NUMBER	DESCRIPTION
18430-001-02	NPN (Sink) 10-30 VDC, 2 meter cable
18430-002-02	PNP (Source) 10-30 VDC, 2 meter cable

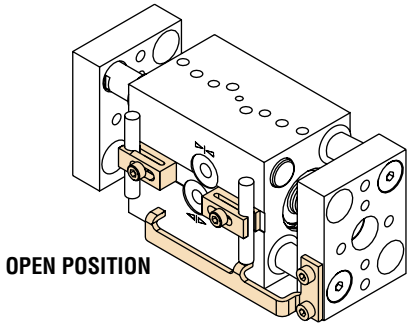
8 mm THREADED INDUCTIVE PROXIMITY SWITCHES (40 & 50 mm BORE UNITS)

PART NUMBER	DESCRIPTION
51422-005-02	NPN (Sink) 5-30 VDC, 2 meter cable
51422-006-02	PNP (Source) 5-30 VDC, 2 meter cable

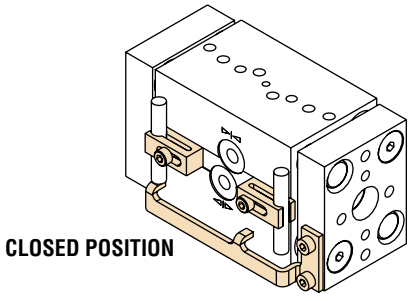
PROXIMITY SWITCH MOUNTING KITS

SIZE	KIT NUMBER	
	STANDARD PLATING	-Z1 PLATING
16	65710-16-20	68465-16-20
25	65710-25-53	68465-25-53
32	65710-32-65	68465-32-65
40	68457-40-91	68466-40-91
50	68457-50-117	68466-50-117

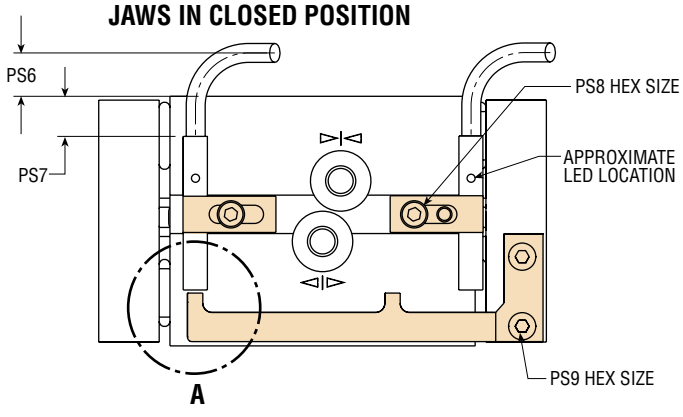
Each kit includes 1 target bracket, 2 switch mounting brackets, and socket head cap screws for mounting.

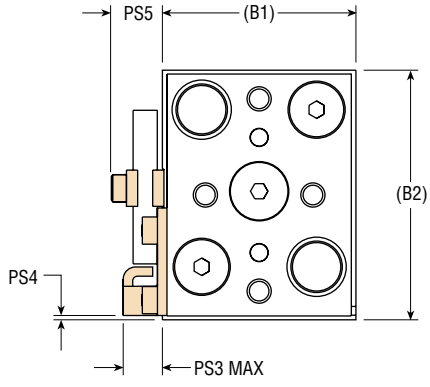


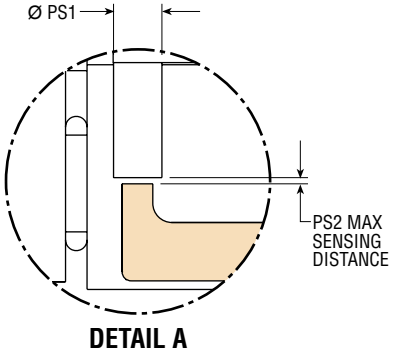
OPEN POSITION



CLOSED POSITION







LETTER DIM	SIZE 16 in	16 mm	25 in	25 mm	32 in	32 mm	40 in	40 mm	50 in	50 mm
PS1	4 mm ROUND		4 mm ROUND		4 mm ROUND		8 mm THREADED		8 mm THREADED	
PS2	.020	.5	.020	.5	.020	.5	.030	.8	.030	.8
PS3	.265	6.73	.150	3.81	.250	6.35	.571	14.50	.551	14.00
PS4	.028	.71	.100	2.54	.067	1.70	.140	3.56	.154	3.91
PS5	.347	8.81	.347	8.81	.347	8.81	.571	14.50	.571	14.50
PS6	.67	17.0	.29	7.4	N/A	N/A	N/A	N/A	N/A	N/A
PS7	.26	6.6	.64	16.3	1.08	27.4	1.797	45.7	2.746	69.8
PS8	.08	2.0	.08	2.0	.08	2.0	.079	2.0	.079	2.0
PS9	.08	2.0	.10	2.5	.10	2.5	.118	3.0	.157	4.0
(B1)	1.260	32.0	1.790	45.5	2.362	60.0	2.913	74.0	3.543	90.0
(B2)	1.625	41.3	2.244	57.0	2.874	73.0	3.504	89.0	4.528	115.0

All dimensions are reference only unless specifically toleranced.

HALL EFFECT SWITCH KIT

This kit equips the gripper with brackets to provide for the mounting of up to two 6 mm square Hall Effect switches. Hall Effect switches must be ordered separately.

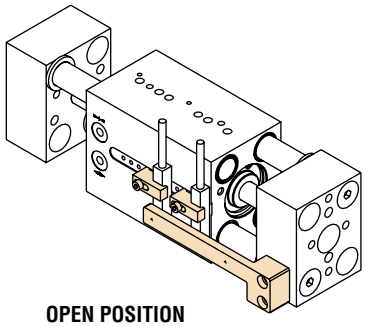
6 mm SQUARE HALL EFFECT SWITCHES

PART NUMBER	COLOR	DESCRIPTION
55803-1-02	Yellow	NPN (Sink) 4.5-24 VDC, 2 meter cable
55804-1-02	Red	PNP (Source) 4.5-24 VDC, 2 meter cable
55823-1	Yellow	NPN (Sink) 4.5-24 VDC, Quick Connect
55824-1	Red	PNP (Source) 4.5-24 VDC, Quick Connect

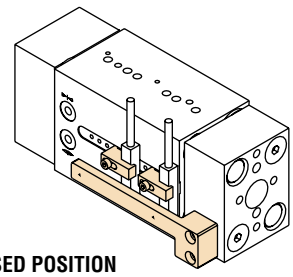
HALL EFFECT SWITCH MOUNTING KITS

SIZE	KIT NUMBER	
	STANDARD PLATING	-Z1 PLATING
16	68446-16-20	68467-16-20
25	68446-25-53	68467-25-53
32	68446-32-65	68467-32-65
40	68446-40-91	68467-40-91
50	68446-50-117	68467-50-117

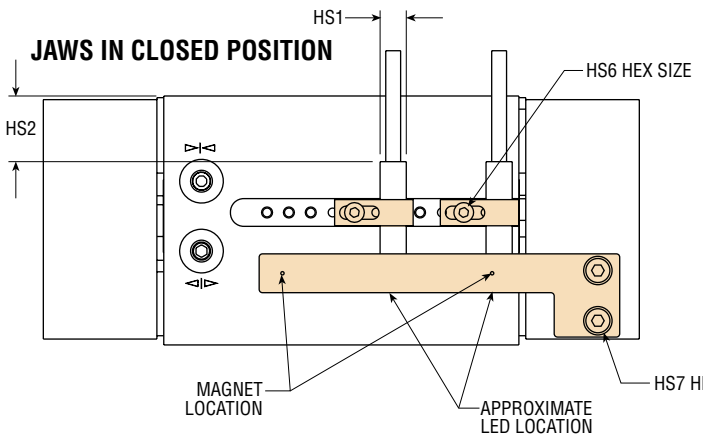
Each kit includes 1 target bracket, 2 switch mounting brackets, and socket head cap screws for mounting.

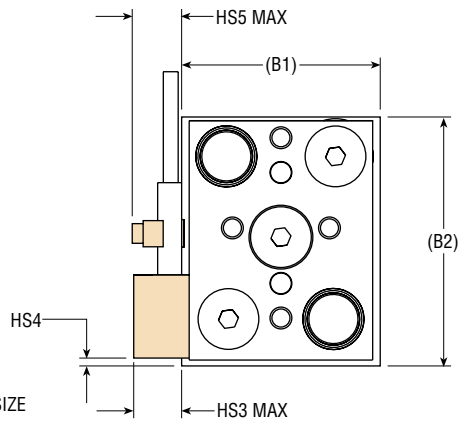


OPEN POSITION



CLOSED POSITION





LETTER DIM	SIZE									
	16		25		32		40		50	
	in	mm	in	mm	in	mm	in	mm	in	mm
HS1	6 mm SQUARE		6 mm SQUARE		6 mm SQUARE		6 mm SQUARE		6 mm SQUARE	
HS2	.365	9.3	.592	15.0	.950	24.1	2.020	51.3	2.640	67.06
HS3	.581	14.8	.543	13.8	.550	14.0	.571	14.50	.551	14.00
HS4	.030	.8	.070	1.8	.096	2.4	.184	4.7	.154	3.9
HS5	.465	11.8	.465	11.8	.465	11.8	.465	11.8	.465	11.8
HS6	.079	2.0	.079	2.0	.079	2.0	.079	2.0	.079	2.0
HS7	.079	2.0	.098	2.5	.098	2.5	.118	3.0	.157	4.0
(B1)	1.260	32.0	1.790	45.5	2.362	60.0	2.913	74.0	3.543	90.0
(B2)	1.625	41.3	2.244	57.0	2.874	73.0	3.504	89.0	4.528	115.0

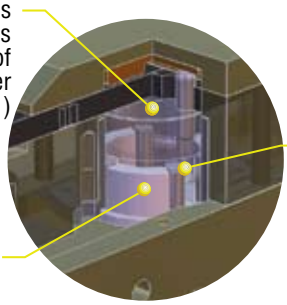
All dimensions are reference only unless specifically toleranced.

GRC

LOW PROFILE WITH MINIMAL JAW PLAY

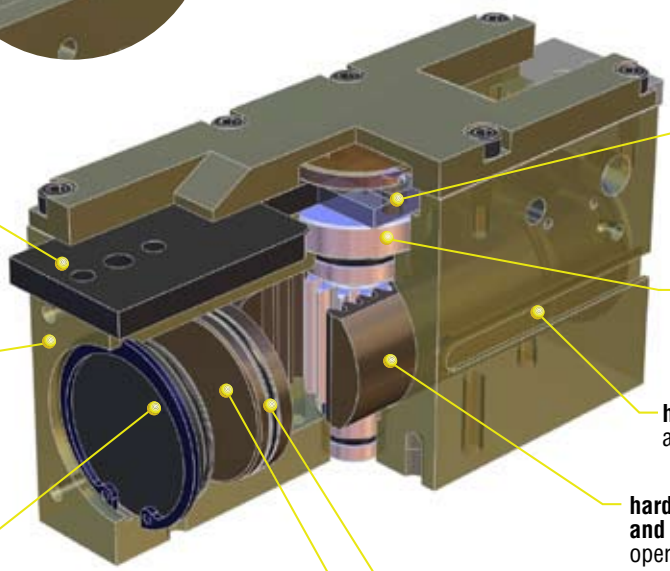
U.S. Patent No. 4768821

SHURGRIP version restrains jaw movement and provides part retention upon loss of air pressure (licensed under U.S. Patent No. 4768821)



SHURGRIP with manual operation allows easy set up and adjustment of tooling by manual operation without air pressure

SHURGRIP components are made of hardened steel for long life with minimal wear



close tolerance jaw mechanism minimizes jaw play

hardened steel jaws, available in 2 jaw styles, provide dowel holes for precise location of tooling

hardened steel cam driver for high grip force and long life

hardcoated aluminum body with precision dowel holes provides accurate gripper mounting

hall, reed and proximity switches available for sensing jaw position

spring assist available for higher grip forces or part retention upon loss of air pressure

available in heavy or medium duty spring forces

hardcoated aluminum rack and piston provide smooth operation and long life

large bore size provides high grip force to weight ratio

fluoro-elastomer seals are available for fluid compatibility

Major Benefits

- High grip force to weight ratio
- Two body and jaw styles with a total of four sizes available in both imperial and metric versions
- Spring assist on open or close (available in two different forces)
- SHURGRIP option available for restraining jaw movement and part retention
- 1-2 day shipping
- 10 million cycles minimum rated life with standard seals (includes spring assist units)

Industry Uses

- Assembly machine builders
- Automotive
- Batteries
- Light bulb manufacturing
- Plumbing fixtures
- Robotics

ORDERING DATA: SERIES GRC PARALLEL GRIPPERS

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

PRODUCT TYPE	SERIES	TYPE	BORE SIZE		DESIGN NO.	OPTIONS	SEALS	
G - Gripper	R - Regular Duty	C - Rotary Parallel	3 - 1.00 (25 mm) Bore 4 - 1.50 (40 mm) Bore 5 - 2.00 (50 mm) Bore 6 - 3.00 (75 mm) Bore				1 - Buna-N (Standard) 2 - Fluoro-Elastomer	

G	R	C	1	3	1	-	2	-	0	0	0	1

STYLE

IMPERIAL	METRIC
1 - Full Mounting	5 - Full Mounting
2 - Full Mounting Corrosion Resistant	6 - Full Mounting Corrosion Resistant
3 - Bottom Mount	7 - Bottom Mount
4 - Bottom Mount Corrosion Resistant	8 - Bottom Mount Corrosion Resistant

MODEL/JAW OPTION
1 - Standard, Raised Jaw
2 - SHURGRIP, Raised Jaw
3 - Standard, Flat Jaw
4 - SHURGRIP, Flat Jaw

SENSOR OPTION
0 - None
2 - Hall Effect Switch Ready (For Series 5360 Switches)
3 - Reed Switch Ready (For Series 6200 Switches)
5 - Internal Proximity Switch Ready SHURGRIP only (See Note 2.)
6 - 12 mm External Proximity Switch Ready (See Note 1 & 2.)

Switches must be ordered separately. See option pages for details.

SPRING OPTION
0 - None
MEDIUM DUTY
3 - Spring Assist Closed
4 - Spring Assist Open
HEAVY DUTY
5 - Spring Assist Closed
6 - Spring Assist Open
(See Notes 1 and 4.)

NOTES:
1) Available on full mounting style only.
2) See Switch Mounting Kits on option pages.
3) See Switches and Sensors section for switch information.
4) Spring Assist Open option not available with -2 or -3 sensor options.

INTERNAL PROXIMITY SWITCHES

GRIPPER MODEL NO.	PROXIMITY SWITCH MODEL NO.	DESCRIPTION
GRCx3x	18430-001-02	4 mm Round NPN (Sink)
	18430-002-02	4 mm Round PNP (Source)
GRCx4x, 5x, 6x	51422-005-02	8 mm Threaded NPN (Sink)
	51422-006-02	8 mm Threaded PNP (Source)

SERIES 5360 MINIATURE HALL EFFECT SWITCHES

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

CORDSETS (For Series 5360 Switches with Quick Connect)

PART NO.	DESCRIPTION
63549-02	2 meter Cordset with Quick Connect
63549-05	5 meter Cordset with Quick Connect

SERIES 6200 REED SWITCH

PART NO.	DESCRIPTION
62002-1-02	NPN (Sink) or PNP (Source) 4.5-24 VDC

12 mm PROXIMITY SWITCH AND NUT

PART NO.	DESCRIPTION
15561-001	NPN (Sink) 24 VDC
15561-002	PNP (Source) 24 VDC
15561-003	AC 117 VAC

UNIQUE GRIPPERS ARE AVAILABLE.
SEE PAGES 4-139 TO 4-164.

SPECIFICATIONS	SERIES GRC
OPERATING PRESSURE	
STANDARD UNIT	40 psi min to 100 psi max [2.8 bar min to 7 bar max] air
MEDIUM SPRING ASSIST UNIT	60 psi min to 100 psi max [4 bar min to 7 bar max] air
HEAVY SPRING ASSIST UNIT	72 psi min to 100 psi max [5 bar min to 7 bar max] air
MEDIUM SPRING ASSIST UNIT WITH SHURGRIP	65 psi min to 100 psi max [4.5 bar min to 7 bar max] air
HEAVY SPRING ASSIST UNIT WITH SHURGRIP	80 psi min to 100 psi max [5.5 bar min to 7 bar max] air
OPERATING TEMPERATURE	-20°F to +180°F [-28°C to +82°C]
RATED LIFE	10 million cycles minimum with standard seals (including spring assist units)
GRIP REPEATABILITY	Within ±0.002 in [±0.05 mm] of original centered position
CYCLE TIME	See table below
LUBRICATION	Factory lubricated for rated life
MAINTENANCE	Field repairable

GRIPPER NO.	MIN. TOTAL JAW TRAVEL		TOTAL GRIP FORCE AT 87 psi [6 bar]		GRIPPER WEIGHT (FLAT JAWS)		GRIPPER WEIGHT (RAISED JAWS)		CLOSE OR OPEN TIME 87 psi [6 bar]	MINIMUM OPERATING PRESSURE		DISPLACE-MENT		GRIP FORCE FACTOR G_F	
	in	mm	lb	N	lb	kg	lb	kg	sec	psi	bar	in^3	cm^3	IMPERIAL	METRIC
GRCx31 & 33	.940	24	96	427	1.68	0.76	1.81	0.82	.06	30	2	0.82	13.5	1.10	71.1
GRCx32 & 34	.940	24	83	369	2.32	1.05	2.45	1.11	.06	36	2.5	0.82	13.5	0.95	61.4
GRCx41 & 43	1.475	37.5	209	930	3.98	1.81	4.21	1.91	.08	30	2	2.77	45.5	2.4	155.2
GRCx42 & 44	1.475	37.5	178	792	5.34	2.42	5.57	2.53	.08	36	2.5	2.77	45.5	2.05	132.6
GRCx51 & 53	1.945	49.5	383	1704	7.35	3.33	7.89	3.58	.25	30	2	6.58	108.0	4.4	284.5
GRCx52 & 54	1.945	49.5	318	1414	10.52	4.77	11.1	5.02	.25	36	2.5	6.58	108.0	3.65	236.0
GRCx61 & 63	3.010	76.5	870	3870	20.47	9.28	21.7	9.85	.30	30	2	22.2	364.0	10	646.7
GRCx62 & 64	3.010	76.5	609	2709	28.2	12.79	29.4	13.4	.30	36	2.5	22.2	364.0	7	452.7

GRIPPER NO.	HEAVY SPRING							MEDIUM SPRING						
	SPRING GRIP FORCE S_F		WEIGHT ADDER		CLOSE OR OPEN TIME 87 psi [6 bar] in seconds			SPRING GRIP FORCE S_F		WEIGHT ADDER		CLOSE OR OPEN TIME 87 psi [6 bar] in seconds		
	lb	N	lb	kg	AGAINST SPRING	WITH SPRING	SPRING ONLY	lb	N	lb	kg	AGAINST SPRING	WITH SPRING	SPRING ONLY
GRCx31 & 33	51	227	0.67	0.3	.10	.05	.08	35	156	0.60	0.27	.08	.05	.10
GRCx32 & 34	44	196	0.67	0.3	.10	.05	.08	30	133	0.60	0.27	.08	.05	.10
GRCx41 & 43	110	489	1.69	0.8	.16	.06	.10	78	347	1.43	0.65	.12	.07	.14
GRCx42 & 44	93	414	1.69	0.8	.16	.06	.10	66	294	1.43	0.65	.12	.07	.14
GRCx51 & 53	204	907	3.48	1.6	.35	.15	.30	140	623	2.88	1.31	.30	.20	.35
GRCx52 & 54	170	756	3.48	1.6	.35	.15	.30	117	520	2.88	1.31	.30	.20	.35
GRCx61 & 63	465	2068	9.5	4.3	.50	.20	.35	312	1388	7.81	3.54	.40	.25	.50
GRCx62 & 64	320	1423	9.5	4.3	.50	.20	.35	215	956	7.81	3.54	.40	.25	.50

SIZING AND APPLICATION ASSISTANCE

See PHD Product Sizing Catalog for specific and complete sizing information.
Online sizing assistance is available at: ***www.phdinc.com/apps/sizing***

GRIP FORCE CALCULATION EQUATIONS:

IMPERIAL:

TOTAL GRIP FORCE [lb] = (Pressure [psi] x G_F) x Jaw Position Factor x Tooling Length Factor
TOTAL GRIP FORCE WITH SPRINGS [lb] = ((Pressure [psi] x G_F) ± S_F [lb]) x Jaw Position Factor x Tooling Length Factor

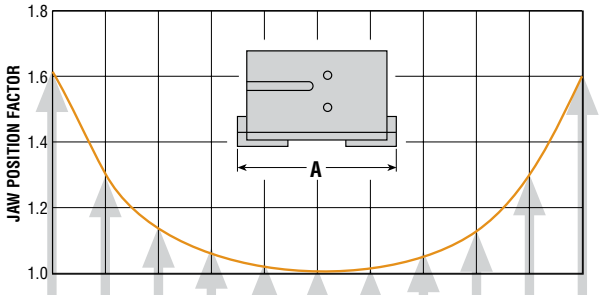
METRIC:

TOTAL GRIP FORCE [N] = (Pressure [bar] x G_F) x Jaw Position Factor x Tooling Length Factor
TOTAL GRIP FORCE WITH SPRINGS [N] = ((Pressure [bar] x G_F) ± S_F [N]) x Jaw Position Factor x Tooling Length Factor

JAW POSITION FACTOR GRAPH

The Series GRC Gripper mechanism increases grip force as the jaws move away from midposition toward open or closed position. Tooling can be designed to take advantage of the higher forces available when the jaws are close to the end positions.
The chart shows how force increases as the jaws move toward the end positions. The grip forces should be multiplied by the jaw position factor for an accurate grip force calculation.

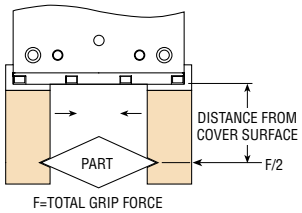
JAW POSITION FACTOR BASED ON DIMENSION "A" ACROSS GRIPPER JAWS



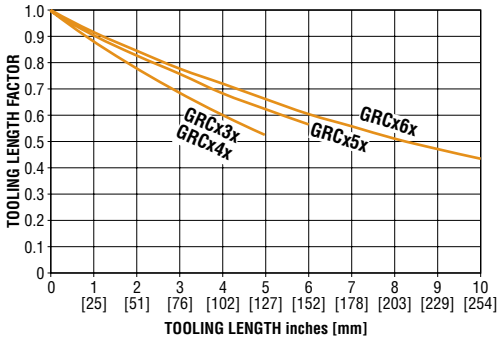
GRIPPER MODEL	DIMENSION "A" inches [mm]										
GRCx31 & 33	4.685	4.785	4.885	4.985	5.085	5.185	5.285	5.385	5.485	5.585	5.685
GRCx32 & 34	[119.0]	[121.5]	[124.1]	[126.6]	[129.2]	[131.7]	[134.3]	[136.8]	[139.4]	[141.9]	[144.5]
GRCx41 & 43	6.200	6.354	6.507	6.660	6.814	6.967	7.120	7.274	7.427	7.581	7.735
GRCx42 & 44	[157.5]	[161.4]	[165.3]	[169.2]	[173.1]	[177.0]	[180.9]	[184.8]	[188.7]	[192.6]	[196.4]
GRCx51 & 53	7.520	7.720	7.920	8.120	8.320	8.520	8.720	8.920	9.120	9.320	9.525
GRCx52 & 54	[191.0]	[196.1]	[201.2]	[206.3]	[211.4]	[216.5]	[221.6]	[226.7]	[231.8]	[236.9]	[242.0]
GRCx61 & 63	10.315	10.622	10.929	11.236	11.543	11.850	12.157	12.464	12.771	13.078	13.385
GRCx62 & 64	[262.0]	[269.8]	[277.6]	[285.4]	[293.2]	[301.0]	[308.8]	[316.6]	[324.4]	[332.2]	[340.0]

TOOLING LENGTH FACTOR

Design tooling so that the grip point is as close to the cover surface as possible. When the grip point moves away, jaw friction increases, which decreases grip force. The G_F information given on page 4-41 is for zero tooling length (cover surface). The graph shows how force decreases as the grip point moves away from the cover surface.



TOOLING LENGTH FACTOR

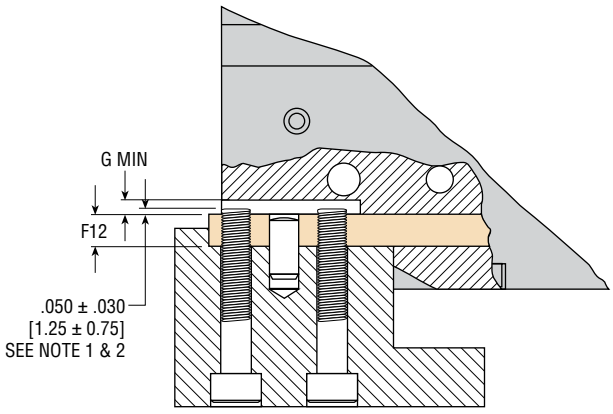


All dimensions are reference only unless specifically toleranced.

FLAT JAW TOOLING

Special attention should be paid to the distance the fasteners extend through the flat jaw. If they extend through more than G dimension and come in contact with the body, damage to the gripper cover or jaw may occur. Tooling counterbores, fastener length and tolerances should be specified so that the fastener fully engages the jaw and nominally extends through .05 inch [1.25 mm] with a tolerance of ± .03 inch [± .75 mm]. This assures a distance of G dimension is never reached.

The flat jaw provides two threads for mounting tooling and a precision hole closely located from the end of the jaw. Customers can key tooling using the end of the jaw and precision hole to provide squareness and location. See pages 4-45 and 4-47 for maximum recommended tooling dimensions (dimensions F8 and F10).



LETTER DIM.	MODEL NUMBER							
	GRCx3x		GRCx4x		GRCx5x		GRCx6x	
	in	mm	in	mm	in	mm	in	mm
F12	.184	4.7	.258	6.6	.317	8.1	.436	11.1
G MIN	.098	2.5	.120	3.0	.120	3.0	.245	6.2

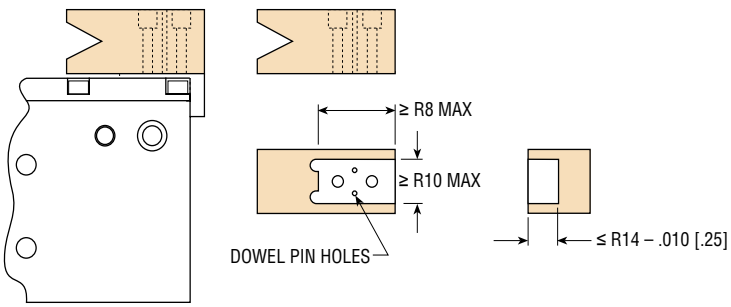
NOTES:
1) MOUNTING SCREWS MUST PROTRUDE PAST BOTTOM OF JAW TO ENSURE MAXIMUM THREAD ENGAGEMENT
2) MOUNTING SCREWS MUST NOT EXCEED RECOMMENDED DEPTH OF ENGAGEMENT OR COME IN CONTACT WITH BOTTOM OF BODY

GRC

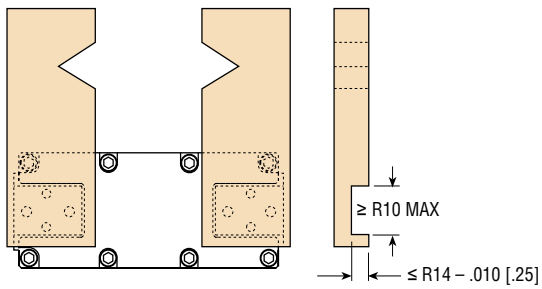
RAISED JAW TOOLING

The boss on raised jaws (dimensions R8 and R10) are held to a close tolerance. These surfaces can be used as a means of orienting and precisely keying the tooling to the gripper jaws. Dowel pin holes in the jaws can also be used for precise tooling location. See pages 4-45 and 4-47 for specific jaw dimensions.

ON-CENTER TOOLING

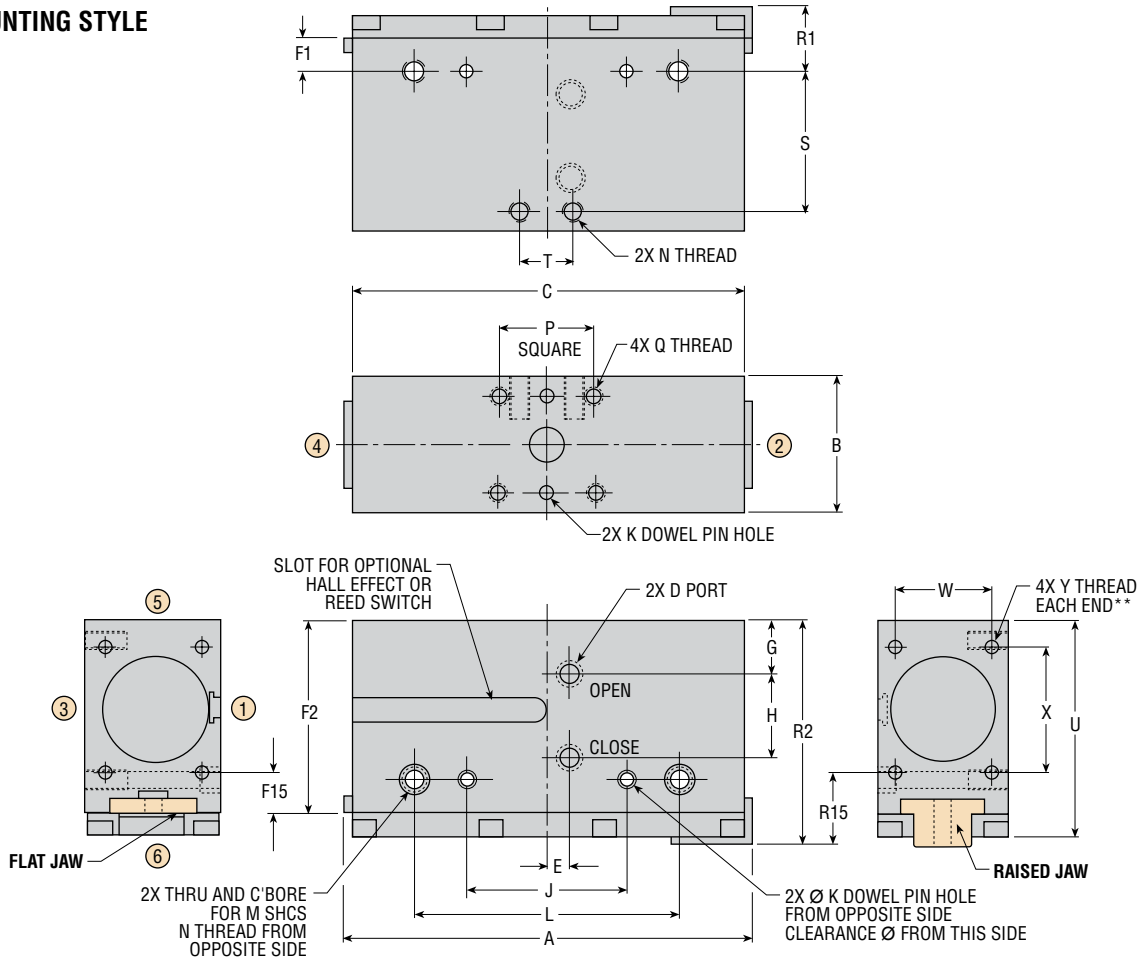


OFF-CENTER TOOLING



DIMENSIONS: STANDARD SERIES GRC PARALLEL GRIPPERS

FULL MOUNTING STYLE
GRC1xx
GRC2xx
GRC5xx
GRC6xx

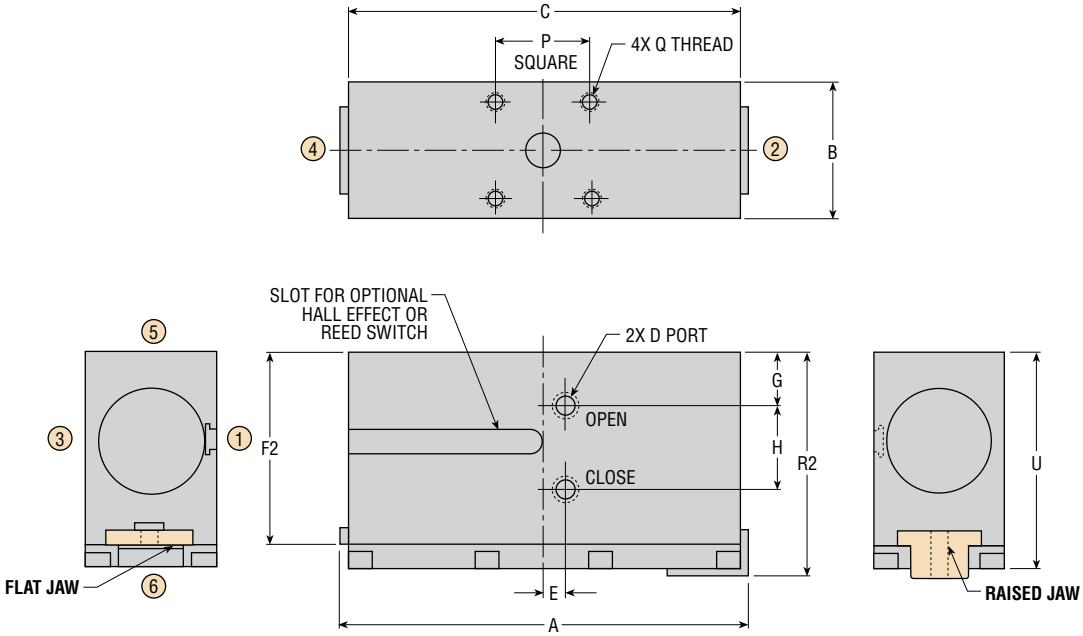


UNITS ARE SHOWN WITH 1 FLAT AND 1 RAISED JAW. UNITS ARE AVAILABLE ONLY WITH 2 FLAT OR RAISED JAWS.

**NOT RECOMMENDED FOR GRIPPER MOUNTING UNLESS BOTH ENDS ARE USED.

CIRCLED NUMBERS INDICATE SURFACE POSITIONS.

BOTTOM MOUNTING STYLE
GRC3xx
GRC4xx
GRC7xx
GRC8xx



All dimensions are reference only unless specifically toleranced.

DIMENSIONS: STANDARD SERIES GRC PARALLEL GRIPPERS

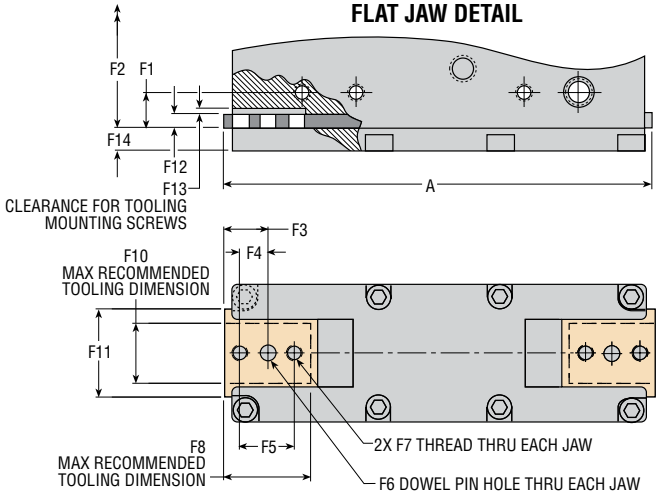
LETTER DIM.	MODEL NO. GRCx3x in	GRCx3x mm	GRCx4x in	GRCx4x mm	GRCx5x in	GRCx5x mm	GRCx6x in	GRCx6x mm
NOMINAL JAW TRAVEL	1.00	25.5	1.53	39	2.00	51	3.07	78
A CLOSED •	4.715	119.7	6.230	158.2	7.550	191.7	10.345	262.70
A OPEN •	5.655	143.6	7.705	195.8	9.495	241.2	13.355	339.2
B	1.575	40.0	2.046	52.0	2.638	67.0	3.936	100.0
C	4.570	116.0	6.004	152.5	7.320	186.0	10.080	256.0
D	10-32	M5 x 0.8	1/8 NPT	1/8 BSP	1/8 NPT	1/8 BSP	1/4 NPT	1/4 BSP
E	.354	9.0	.354	9.0	.551	14.0	—	—
G	.630	16.0	.820	21.0	1.004	25.5	1.030	26.0
H	.910	23.0	1.299	33.0	1.535	39.0	2.559	65.0
J*	1.654	42.00	2.441	62.00	3.150	80.00	4.724	120.00
K*	.1884 x .25 DP	5.02 x 6.0	.1884 x .310 DP	5.02 X 8.0	.2509 x .350 DP	6.02 x 9.0 DP	.3759 x .450 DP	10.02 x 12.0 DP
L	2.953	75.0	4.016	102.0	5.905	150.0	7.874	200.0
M	#10	M5	1/4	M6	5/16	M8	3/8	M10
N	1/4-20 x .47 DP	M6 x 1.0 x 12 DP	5/16-18 x .630	M8 X 1.25 x 16.0 DP	3/8-16 x .750 DP	M10 x 1.5 x 19.0	1/2-13 x 1.000 DP	M14 x 2.0 x 28.0 DP
P*	1.1810	30.00	1.4570	37.00	1.9680	50.00	2.9920	76.00
Q	10-24 x .38 DP	M5 x 0.8 x 9.5 DP	1/4-20 x .500	M6 x 1.0 x 12.0 DP	5/16-18 x .630 DP	M8 x 1.25 x 16.0 DP	3/8-16 x .750 DP	M10 x 1.5 x 19.0
S	1.614	41.0	2.165	55.0	2.678	68.0	3.740	95.0
T	.630	16.0	.826	21.0	1.063	27.0	1.890	48.0
U	2.556	65.0	3.370	85.5	4.148	105.5	5.767	146.5
W	1.162	29.5	1.496	38.0	2.008	51.0	3.071	78.0
X	1.378	35.0	1.929	49.0	2.244	57.0	3.071	78.0
Y	M4 x 0.7 x .32 DP	M4 x 0.7 x 8.0 DP	M5 x 0.8 x .350 DP	M5 x 0.8 x 9.0 DP	M6 x 1.0 x .411 DP	M6 x 1.0 x 10.5 DP	M8 x 1.25 x .630 DP	M8 x 1.25 x 16.0 DP
F1	.415	10.5	.555	14.0	.671	17.0	.984	25.0
F2	2.284	58.0	3.018	76.75	3.696	94.0	5.156	131.0
F3*	.551	14.0	.610	15.5	.768	19.5	1.023	26.0
F4	.354	9.0	.394	10.0	.492	12.5	.689	17.5
F5	.709	18.0	.788	20.0	.984	25.0	1.378	35.0
F6*	.1884	5.02	.2509	6.02	.3134	8.02	.5009	12.02
F7	10-24	M5 x 0.8	1/4-20	M6 x 1.0	5/16-18	M8 x 1.25	3/8-16	M10 x 1.5
F8	1.102	28.0	1.220	31.0	1.535	39.0	2.047	52.0
F10	.591	15.0	.886	22.5	1.122	28.5	1.968	50.0
F11	.934	23.75	1.284	32.5	1.748	44.5	2.830	72.0
F12	.184	4.75	.258	6.5	.317	8.0	.436	11.0
F13	.100	2.5	.125	3.0	.125	3.0	.250	6.25
F14	.272	7.0	.352	9.0	.451	11.5	.611	15.5
F15	.605	15.5	.683	17.5	.954	24.25	1.415	36.0
R1	.788	20.0	1.007	25.5	1.221	31.0	1.713	43.5
R2	2.657	67.5	3.470	88.0	4.246	108.0	5.885	149.5
R3	.551	14.0	.610	15.5	.768	19.5	1.023	26.0
R4	.354	9.0	.394	10.0	.492	12.5	.689	17.5
R5	.709	18.0	.788	20.0	.984	25.0	1.378	35.0
R6*	.1259 x .250 DP	4.02 x 6.0 DP	.1884 x .320 DP	5.02 x 8.0 DP	.2509 x .370 DP	6.02 x 9.0 DP	.3759 x .560 DP	10.02 X 14.0
R7	10-24 x .380 DP	M5 x 0.8 x 9.5 DP	1/4-20 x .500 DP	M6 x 1.0 x 12.5 DP	5/16-18 x .630 DP	M8 x 1.25 x 16.0 DP	3/8-16 x .787 DP	M10 x 1.5 x 20.0 DP
R8*	1.102	28.0	1.220	31.0	1.535	39.0	2.047	52.0
R9*	.2953	7.5	.5512	14.0	.7086	18.0	1.2992	33.0
R10*	.5906	15.00	.8858	22.50	1.1220	28.50	1.9685	50.00
R11	.934	23.75	1.284	32.5	1.748	44.50	2.830	72.0
R12	.557	14.25	.710	18.0	.866	22.0	1.165	29.5
R14	.101	2.5	.100	2.5	.098	2.5	.118	3.0
R15	.976	24.75	1.134	28.75	1.502	38.25	2.143	54.5

NOTES: 1) NUMBERS IN [ ] ARE IN MILLIMETERS

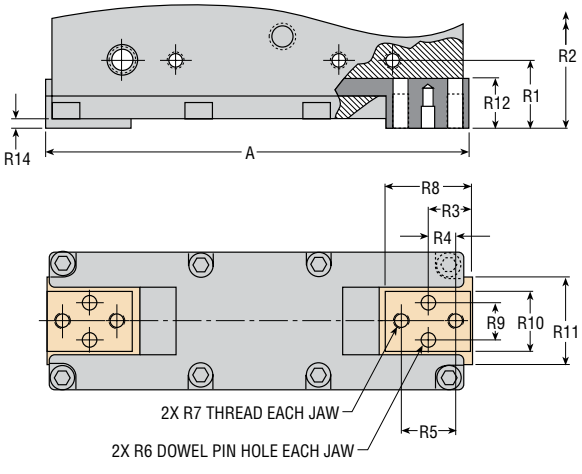
2) *TOLERANCE FOR DIMENSIONS: J = ± .0010 [±0.03] K = ± .0005 [±0.013] P (BETWEEN DOWEL PIN HOLES) = ± .0008 [±0.02] F6 AND R6 = ± .0005 [±0.013] F3, R9, AND R10 = ± .0010 [±0.03] R8 = ± .005 [±0.13]

•A CLOSED REFLECTS THE LARGEST POSSIBLE CLOSED DIMENSION.
A OPEN REFLECTS THE SMALLEST POSSIBLE OPEN DIMENSION.

FLAT JAW DETAIL



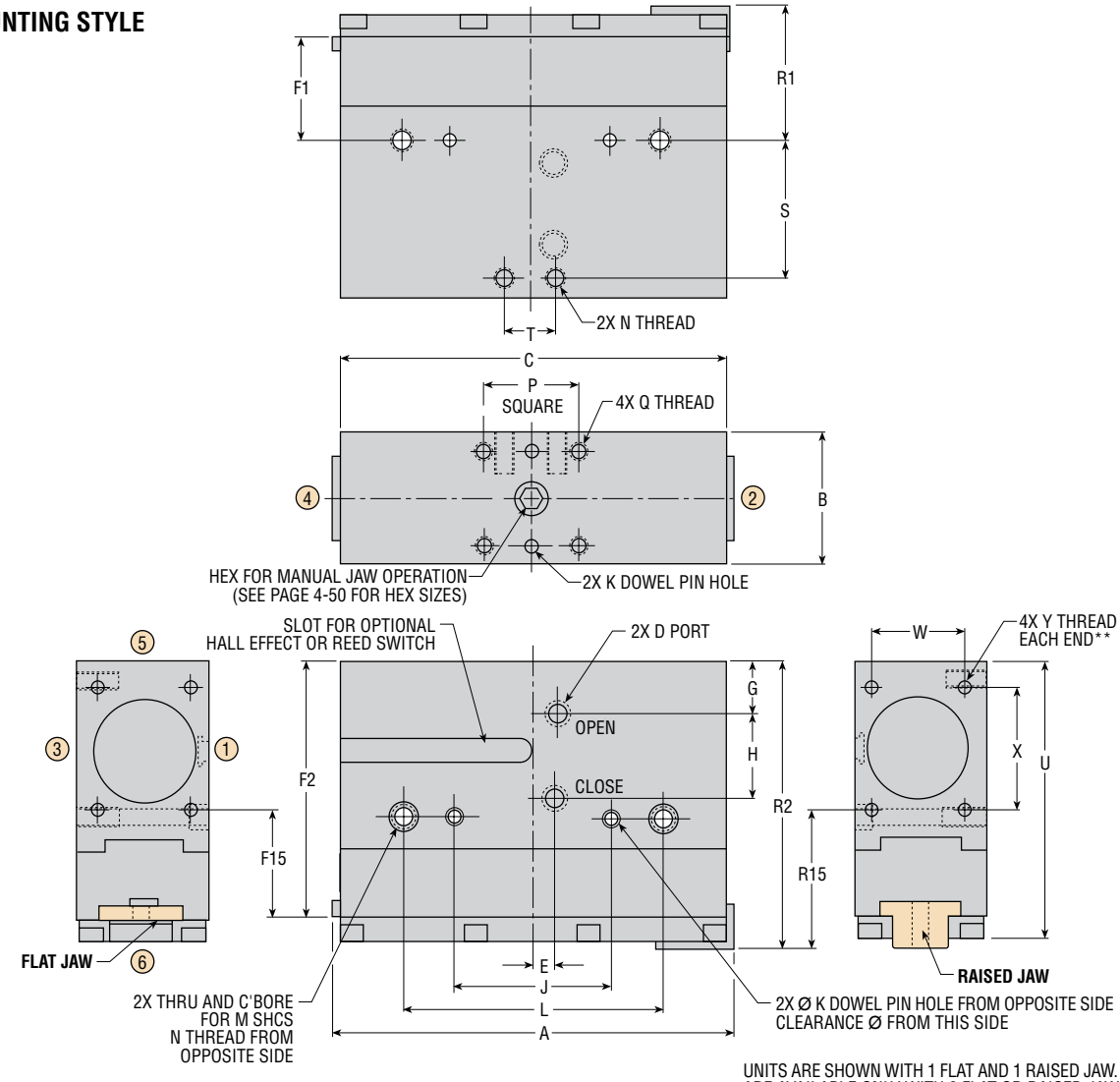
RAISED JAW DETAIL



All dimensions are reference only unless specifically toleranced.

DIMENSIONS: SHURGRIP SERIES GRC PARALLEL GRIPPERS

FULL MOUNTING STYLE
GRC1xx
GRC2xx
GRC5xx
GRC6xx



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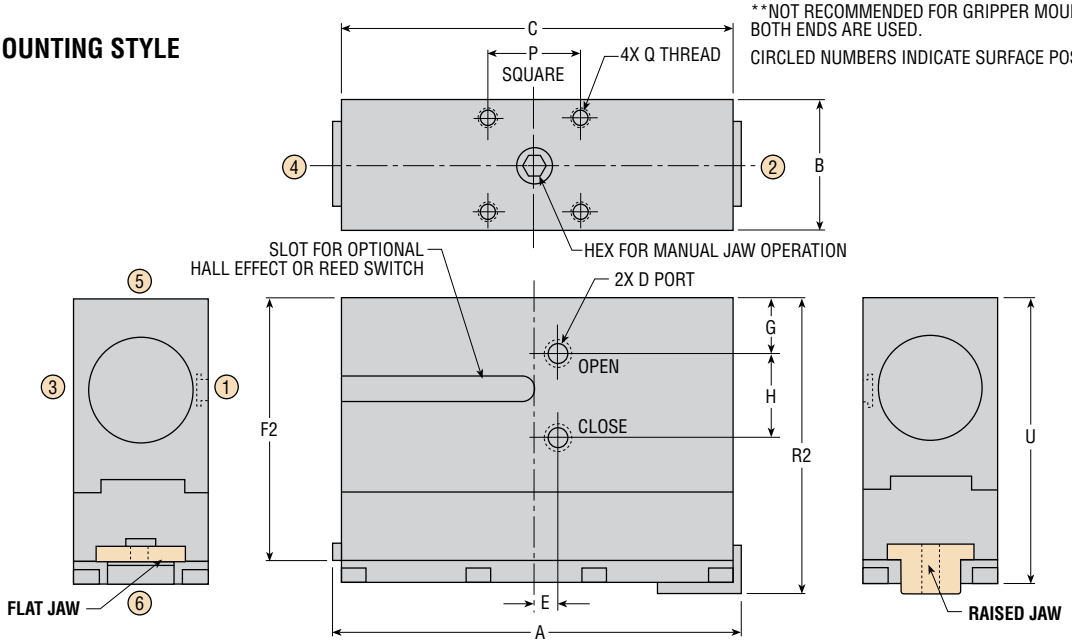
BOTTOM MOUNTING STYLE
GRC3xx
GRC4xx
GRC7xx
GRC8xx



All dimensions are reference only unless specifically toleranced.

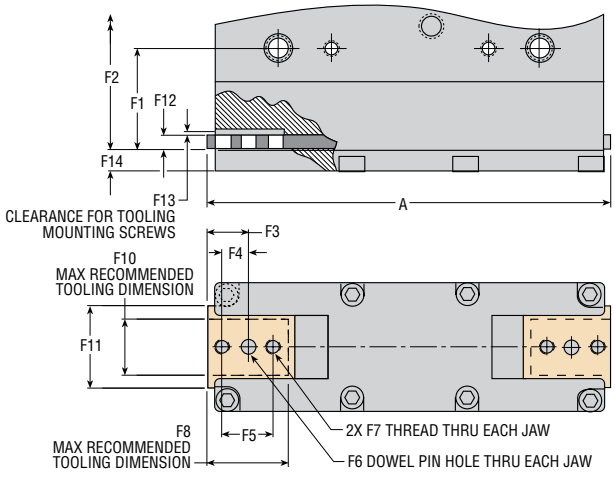
DIMENSIONS: SHURGRIP SERIES GRC PARALLEL GRIPPERS

LETTER DIM	MODEL NO. GRCx3x in	GRCx3x mm	GRCx4x in	GRCx4x mm	GRCx5x in	GRCx5x mm	GRCx6x in	GRCx6x mm
NOMINAL JAW TRAVEL	1.00	25.5	1.53	39	2.00	51	3.07	78
A CLOSED •	4.715	119.7	6.230	158.2	7.550	191.7	10.345	262.7
A OPEN •	5.655	143.6	7.705	195.8	9.495	241.2	13.355	339.2
B	1.575	40.0	2.046	52.0	2.638	67.0	3.936	100.0
C	4.570	116.0	6.004	152.5	7.320	186.0	10.080	256.0
D	10-32	M5 x 0.8	1/8 NPT	1/8 BSP	1/8 NPT	1/8 BSP	1/4 NPT	1/4 BSP
E	.354	9.0	.354	9.0	.551	14.0	—	—
G	.630	16.0	.820	21.0	1.004	25.5	1.030	26.0
H	.910	23.0	1.299	33.0	1.535	39.0	2.559	65.0
J**	1.654	42.00	2.441	62.00	3.150	80.00	4.724	120.00
K**	.1884 x .25 DP	5.02 x 6.0	.1884 x .310 DP	5.02 X 8.0	.2509 x .350 DP	6.02 x 9.0 DP	.3759 x .450 DP	10.02 x 12.0 DP
L	2.953	75.0	4.016	102.0	5.905	150.0	7.874	200.0
M	#10	M5	1/4	M6	5/16	M8	3/8	M10
N	1/4-20 x .47 DP	M6 x 1.0 x 12 DP	5/16-18 x .630	M8 X 1.25 x 16.0 DP	3/8-16 x .750 DP	M10 x 1.5 x 19.0	1/2-13 x 1.000 DP	M14 x 2.0 x 28.0 DP
P**	1.1810	30.00	1.4570	37.00	1.9680	50.00	2.9920	76.00
Q	10-24 x .38 DP	M5 x 0.8 x 9.5 DP	1/4-20 x .500	M6 x 1.0 x 12.0 DP	5/16-18 x .630 DP	M8 x 1.25 x 16.0 DP	3/8-16 x .750 DP	M10 x 1.5 x 19.0
S	1.614	41.0	2.165	55.0	2.678	68.0	3.740	95.0
T	.630	16.0	.826	21.0	1.063	27.0	1.890	48.0
U	3.323	84.5	4.432	112.5	5.604	142.5	7.735	196.5
W	1.162	29.5	1.496	38.0	2.008	51.0	3.071	78.0
X	1.378	35.0	1.929	49.0	2.244	57.0	3.071	78.0
Y	M4 x 0.7 x .32 DP	M4 x 0.7 x 8.0 DP	M5 x 0.8 x .350 DP	M5 x 0.8 x 9.0 DP	M6 x 1.0 x .411 DP	M6 x 1.0 x 10.5 DP	M8 x 1.25 x .630 DP	M8 x 1.25 x 16.0 DP
F1	1.182	30.0	1.617	41.0	2.127	54.0	2.952	75.0
F2	3.051	77. 5	4.080	103.5	5.153	131.0	7.124	181.0
F3**	.551	14.0	.610	15.5	.768	19.5	1.023	26.0
F4	.354	9.0	.394	10.0	.492	12.5	.689	17.5
F5	.709	18.0	.788	20.0	.984	25.0	1.378	35.0
F6**	.1884	5.02	.2509	6.02	.3134	8.02	.5009	12.02
F7	10-24	M5 x 0.8	1/4-20	M6 x 1.0	5/16-18	M8 x 1.25	3/8-16	M10 x 1.5
F8	1.102	28.0	1.220	31.0	1.535	39.0	2.047	52.0
F10	.591	15.0	.886	22.5	1.122	28.5	1.968	50.0
F11	.934	23.75	1.284	32.5	1.748	44.5	2.830	72.0
F12	.184	4.75	.258	6.5	.317	8.0	.436	11.0.
F13	.100	2.5	.125	3.0	.125	3.0	.250	6.25
F14	.272	7.0	.352	9.0	.451	11.5	.611	15.5
F15	1.372	35.0	1.745	44.25	2.410	61.25	3.383	86.0
R1	1.555	39.5	2.068	52.5	2.667	68.0	3.681	93.5
R2	3.424	87.0	4.532	115.0	5.702	145.0	7.853	199.5
R3	.551	14.0	.610	15.5	.768	19.5	1.023	26.0
R4	.354	9.0	.394	10.0	.492	12.5	.689	17.5
R5	.709	18.0	.788	20.0	.984	25.0	1.378	35.0
R6**	.1259 x .250 DP	4.02 x 6.0 DP	.1884 x .320 DP	5.02 x 8.0 DP	.2509 x .370 DP	6.02 x 9.0 DP	.3759 x .560 DP	10.02 x 14.0
R7	10-24 x .380 DP	M5 x 0.8 x 9.5 DP	1/4-20 x .500 DP	M6 x 1.0 x 12.5 DP	5/16-18 x .630 DP	M8 x 1.25 x 16.0 DP	3/8-16 x .787 DP	M10 x 1.5 x 20.0 DP
R8**	1.102	28.0	1.220	31.0	1.535	39.0	2.047	52.0
R9**	.2953	7.5	.5512	14.0	.7086	18.0	1.2992	33.0
R10**	.5906	15.00	.8858	22.50	1.1220	28.50	1.9685	50.00
R11	.934	23.75	1.284	32.5	1.748	44.50	2.830	72.0
R12	.557	14.25	.710	18.0	.866	22.0	1.165	29.5
R14	.101	2.5	.100	2.5	.098	2.5	.118	3.0
R15	1.743	44.25	2.195	55.75	2.958	75.25	4.111	104.5

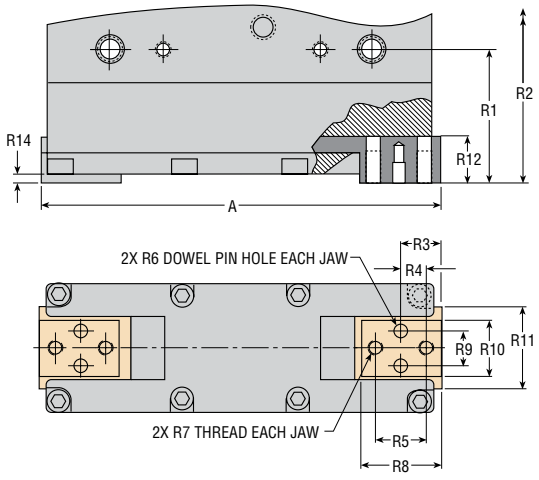
NOTES: 1) NUMBERS IN [ ] ARE IN MILLIMETERS
2) **TOLERANCE FOR DIMENSIONS: J = ± .0010 [±0.03] K = ± .0005 [±0.013] P (BETWEEN DOWEL PIN HOLES) = ± .0008 [±0.02]
F6 AND R6 = ± .0005 [±0.013] F3, R9, AND R10 = ± .0010 [±0.03] R8 = ± .005 [±0.13]

•A CLOSED REFLECTS THE LARGEST POSSIBLE CLOSED DIMENSION.
A OPEN REFLECTS THE SMALLEST POSSIBLE OPEN DIMENSION.

FLAT JAW DETAIL



RAISED JAW DETAIL



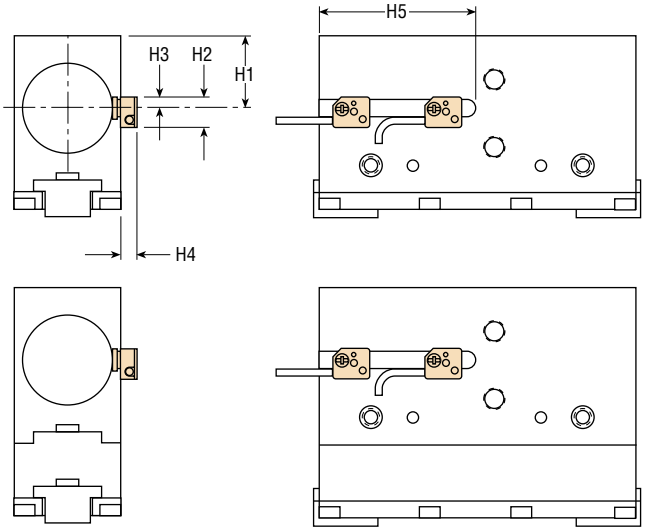
All dimensions are reference only unless specifically toleranced.

2 HALL EFFECT SWITCHES

This option equips the gripper with magnets on the rack for use with PHD Series 5360 Miniature Hall Effect Switches. These switches mount easily to the gripper using the "T" slot in the side of the body. Hall Effect Switches are ordered separately. No mounting kit required. See Switches and Sensors section for switch specifications.

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

LETTER DIM.	MODEL NUMBER							
	GRCx3x		GRCx4x		GRCx5x		GRCx6x	
	in	mm	in	mm	in	mm	in	mm
H1	.992	25.25	1.372	35.0	1.622	41.25	2.207	56.0
H2	.580	15.0	.580	15.0	.580	15.0	.580	15.0
H3	.224	5.75	.224	5.75	.224	5.75	.224	5.75
H4	.320	8.0	.320	8.0	.320	8.0	.320	8.0
H5	2.350	60.0	2.650	67.5	3.000	76.5	3.600	91.5



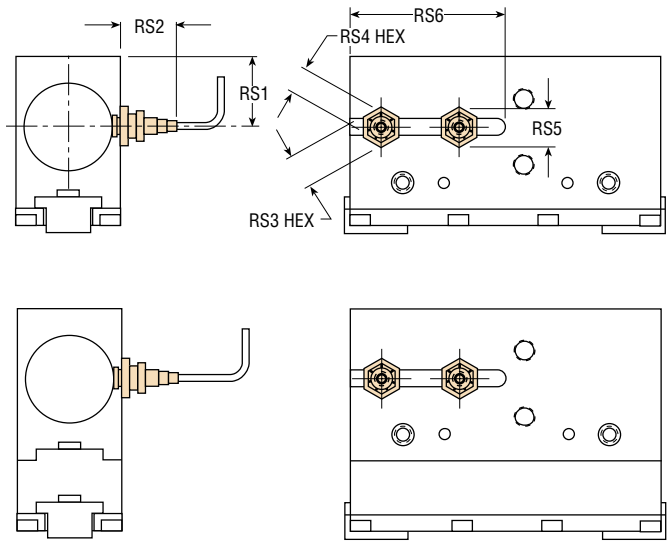
3 REED SWITCHES

This option equips the gripper with magnets on the rack for use with PHD Series 6200 Reed Switches and switch mounting kit 60513. These switches mount easily to the gripper using the "T" slot in the side of the body. Reed Switches and mounting kits are ordered separately.

PART NO.	DESCRIPTION
62002-1-02	8 mm Threaded Reed Switch with 2 meter cable

LETTER DIM.	MODEL NUMBER							
	GRCx3x		GRCx4x		GRCx5x		GRCx6x	
	in	mm	in	mm	in	mm	in	mm
Mtg Kit	60513		60513		60513		60513	
RS1	.992	25.25	1.372	35.0	1.622	41.25	2.207	56.0
RS2	.866	22.0	.866	22.0	.866	22.0	.866	22.0
RS3	.551	14.0	.551	14.0	.551	14.0	.551	14.0
RS4	.512	13.0	.512	13.0	.512	13.0	.512	13.0
RS5	.630	16.0	.630	16.0	.630	16.0	.630	16.0
RS6	2.350	60.0	2.650	67.5	3.000	76.5	3.600	91.5

EACH MOUNTING KIT CONTAINS: 1 BRACKET AND 1 NUT

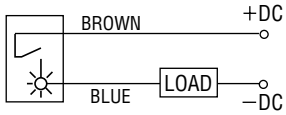


SPECIFICATIONS	62002-1-02
OPERATING PRINCIPLE	Magnetic Reed
ACTUATED BY	Target Magnet
INPUT VOLTAGE	4.5 to 24 VDC
OUTPUT TYPE	Contact Closure
POWER CAPACITY	10 Watt Max.
CURRENT RATING	.2 Amp Max.
CONTACT RESISTANCE	110 MOhm Max.
ENVIRONMENTAL	IEC IP67
OPERATING TEMP.	0° to 80°C

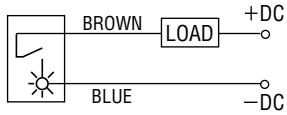
WIRING SCHEMATICS

MODEL NO. 62002-1-02 - NPN (SINK) OR PNP (SOURCE)
INPUT - 4.5-24 VDC
POWER CAPACITY - 10 WATT MAX.
LOAD CURRENT - .2 AMP MAX.

CABLED MODEL 62002 - PNP (SOURCE)



CABLED MODEL 62002 - NPN (SINK)



All dimensions are reference only unless specifically toleranced.

5 INTERNAL PROXIMITY SWITCH READY

(SHURGRIP model only) This option equips the gripper for use with metal sensing proximity switches. The switch is inserted into a cavity in the housing and senses a steel pin attached to the jaw. The slotted switch bracket allows the proximity switches to be adjusted to sense the jaw positions. The bracket covers the opening so contaminants do not enter the cavity causing a false signal.

Proximity Switches and mounting kit are ordered separately. See Switches and Sensors section for complete switch specifications.

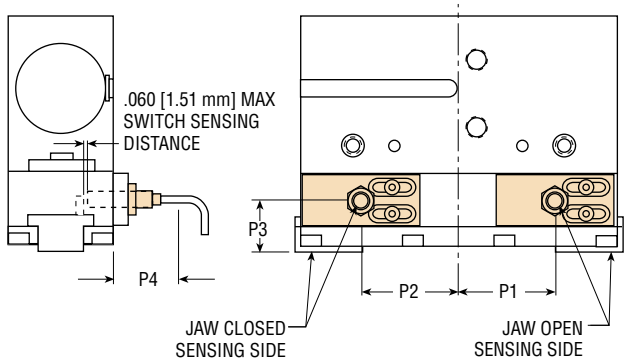
The lock housing is designed to accept the following size proximity switches:

GRCx32 4 mm Round Smooth
GRCx42 8 mm Threaded
GRCx52 8 mm Threaded
GRCx62 8 mm Threaded

PART NO.	DESCRIPTION
18430-001-02	4 mm Round NPN (Sink) 10-30 VDC, 2 m cable
18430-002-02	4 mm Round PNP (Source) 0-30 VDC, 2 m cable
51422-005-02	8 mm Threaded NPN (Sink) 5-30 VDC, 2 m cable
51422-006-02	8 mm Threaded PNP (Source) 5-30 VDC, 2 m cable

INSTALLATION

Adjust switch inward until it touches steel pin, then adjust outward .02 inch [0.5 mm] to set clear (do this with slide bracket in place). Adjust bracket to left or right to set switch position.



LETTER DIM.	MODEL NUMBER GRCx3x in	GRCx3x mm	GRCx4x in	GRCx4x mm	GRCx5x in	GRCx5x mm	GRCx6x in	GRCx6x mm
Mounting Kit	52309-02		52309-04		52309-06		52309-08	
P1	1.647	42.0	2.267	57.5	2.901	73.5	3.988	101.5
P2	.810	20.5	.455	11.5	1.300	33.0	1.971	50.0
P3	.675	17.0	1.078	27.5	1.247	31.5	1.537	39.0
P4	.576	14.5	1.042	26.5	1.042	26.5	1.042	26.5

REFERENCE DIMENSIONS ARE APPROXIMATIONS ONLY. ACTUAL DIMENSIONS WILL BE BASED ON ACTUAL SENSING LOCATION.

EACH PROXIMITY SWITCH MOUNTING KIT CONTAINS:
2 SOCKET HEAD CAP SCREWS
1 PROXIMITY SWITCH BRACKET

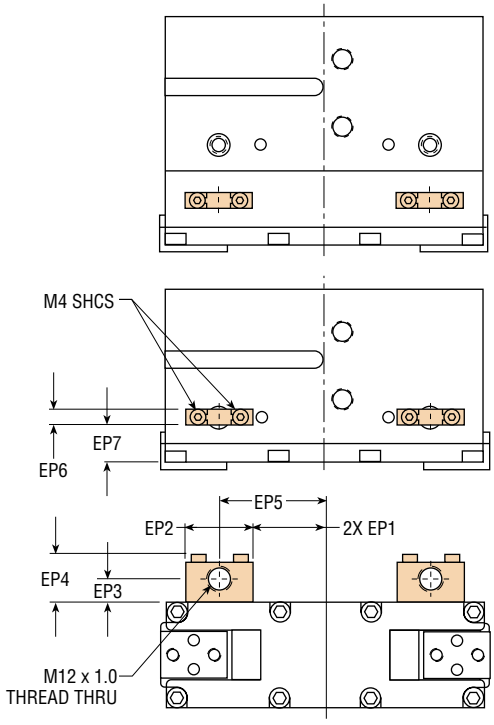
6 12 mm EXTERNAL PROXIMITY SWITCH READY

(Full mounting style required) This option provides threaded mounting holes for mounting 12 mm metal sensing proximity switches. The customer is required to design and mount a metal target for the switch to sense. Proximity Switches and mounting kit are ordered separately. See Switches and Sensors section for complete switch specifications.

PART NO.	DESCRIPTION
15561-001	NPN (Sink) 24 VDC
15561-002	PNP (Source) 24 VDC
15561-003	AC 117 VAC

LETTER DIM.	MODEL NUMBER GRCx3x in	GRCx3x mm	GRCx4x in	GRCx4x mm	GRCx5x in	GRCx5x mm	GRCx6x in	GRCx6x mm
Mounting Kit	60512		60512		60512		60512	
EP1	.851	21.5	1.383	35.0	1.560	39.5	3.311	84.0
EP2	1.250	32.0	1.250	32.0	1.250	32.0	1.250	32.0
EP3	.432	11.0	.432	11.0	.432	11.0	.432	11.0
EP4	.907	23.0	.907	23.0	.907	23.0	.907	23.0
EP5	1.476	37.5	2.008	51.0	2.185	55.5	3.937	100.0
EP6	.313	8.0	.313	8.0	.313	8.0	.313	8.0
EP7	.491	12.5	.751	19.1	1.203	30.5	1.048	26.6

EACH PROXIMITY SWITCH MOUNTING KIT CONTAINS:
2 SOCKET HEAD CAP SCREWS
1 PROXIMITY SWITCH BRACKET

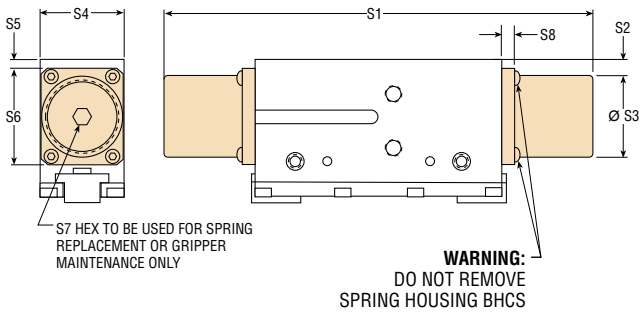


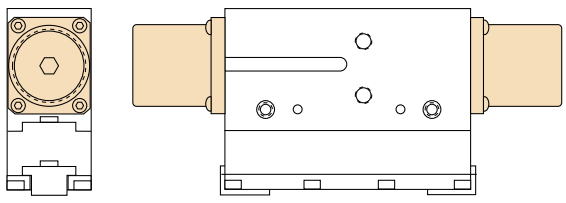
3 & 4 MEDIUM DUTY SPRING ASSIST

5 & 6 HEAVY DUTY SPRING ASSIST

(Full mounting style required) Springs can maintain spring grip force if air pressure is lost or increase grip force in one direction when used with air pressure. They can open or close the gripper without air pressure. Spring life in excess of 10 million cycles can be expected. For minimum operating pressures and spring forces, see specifications on page 4-41.

LETTER DIM.	MODEL NUMBER							
	GRCx3x		GRCx4x		GRCx5x		GRCx6x	
	in	mm	in	mm	in	mm	in	mm
S1	7.660	193.0	10.454	265.5	13.180	335.0	18.580	472.0
S2	.263	6.5	.387	9.75	.362	9.25	.356	9.0
S3	1.457	37.0	1.969	50.0	2.520	64.0	3.701	94.0
S4	1.536	39.0	2.008	51.0	2.598	66.0	3.818	97.0
S5	.086	2.25	.201	5.0	.199	5.0	.298	7.5
S6	1.812	46.0	2.341	59.5	2.846	72.25	3.818	97.0
S7	.315	8.0	.394	10.0	.394	10.0	.394	10.0
S8	.219	5.5	.307	7.75	.400	10.0	.400	10.0





2 4 SHURGRIP VERSION

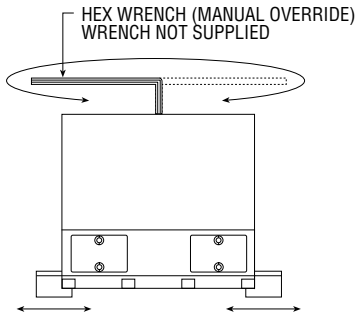
(Licensed under U.S. Patent No. 4768821)

The SHURGRIP version of the PHD Series GRC Gripper is intended to maintain a friction lock to restrain jaw movement in the event of loss or removal of air pressure. This is accomplished through the use of an internal friction lock clutch. Repeated vibration or shock after loss or removal of air pressure may cause the jaws to open slightly. Care must be taken to design the tooling attached to the gripper jaws to encapsulate the part. The tooling should also have a slight "spring" or "deflection action" to retain tension on the gripper mechanism. PHD is not responsible for lack of part retention resulting from improper tooling or maintenance of the gripper.

MANUAL JAW OPERATION (SHURGRIP ONLY)

Rotating the hex in the rear of gripper moves jaws open or closed for easy switch setup and tooling adjustments without operating the valve.

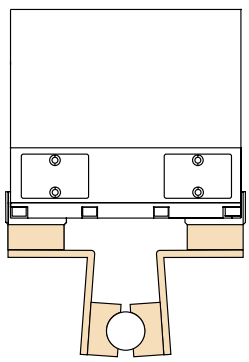
LETTER DIM.	MODEL NUMBER							
	GRCx3x		GRCx4x		GRCx5x		GRCx6x	
	in	mm	in	mm	in	mm	in	mm
HEX SIZE	5/32	4.0	5/32	4.0	5/16	8.0	5/16	8.0



SHURGRIP TOOLING

Care must be taken to design the tooling to encapsulate the part being grasped. On SHURGRIP versions, the tooling should have a slight "spring" or "deflection action" to retain tension on the gripper mechanism upon loss of air pressure.

PHD is not responsible for lack of part retention resulting from improper tooling or maintenance of the gripper.

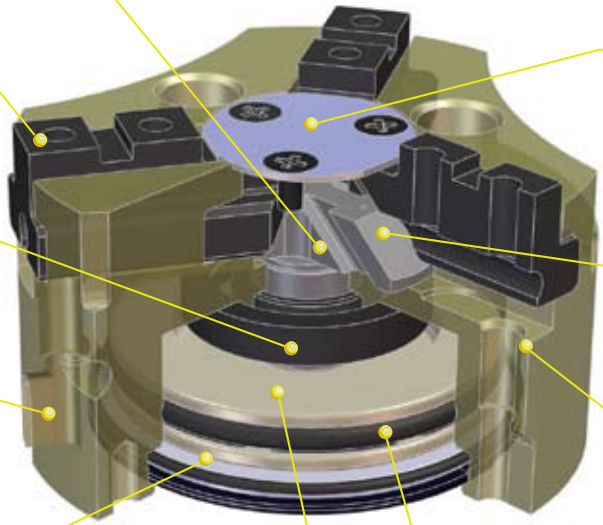


All dimensions are reference only unless specifically toleranced.

GRT

LOW PROFILE TO GRIP FORCE RATIOS

Eight Bore Sizes!



close tolerance jaw mechanism minimizes jaw play

hardened steel jaws provide male and female keys for precise placement of jaw tooling

shock pad standard on all sizes for impact absorption (except size 1)

hardcoated aluminum body with precision dowel holes provides accurate gripper mounting

spring assist available for higher grip forces or part retention upon loss of air pressure

large bore size provides high grip force to weight ratio

stainless steel cover protects drive mechanism and maintains lubrication

hardened steel cam driver provides high grip force and synchronous jaw movement

proximity switches available for sensing jaw position

fluoro-elastomer seals are available for fluid compatibility

Major Benefits

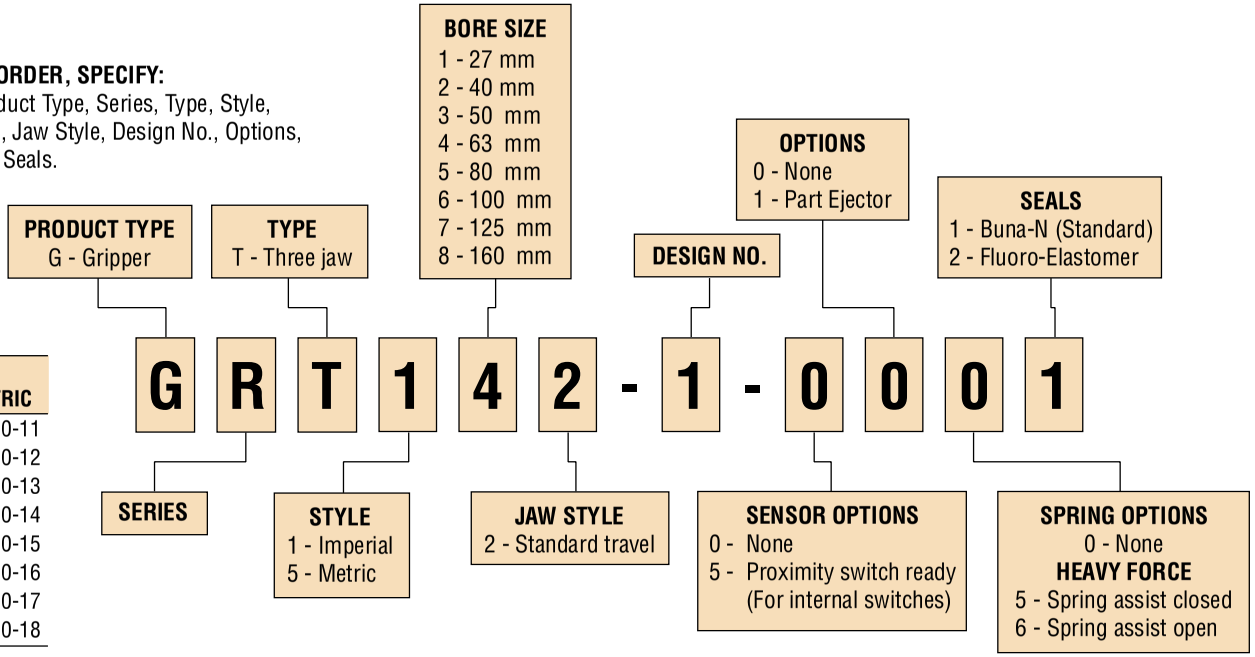
- 3 jaw design provides self-centering and maximum contact between part and jaw tooling
- Low profile to grip force and jaw travel ratios
- Eight sizes available in both imperial and metric versions
- Synchronous jaw motion
- Standard male and female keys on jaws
- Spring assist on open or close available
- Part ejector option assists in part location upon release
- 1-2 day shipping
- 10 million cycles minimum rated life with standard seals (includes spring assist units)

Industry Uses

- Assembly machine builders
- Light bulb manufacturing
- Packaging
- Automotive
- Robotics
- Golf equipment
- Plumbing fixtures

ORDERING DATA: SERIES GRT GRIPPERS

TO ORDER, SPECIFY:
Product Type, Series, Type, Style, Size, Jaw Style, Design No., Options, and Seals.



FINGER BLANKS

MODEL NUMBER	KIT NUMBER IMPERIAL	KIT NUMBER METRIC
GRTx12	62890-01	62890-11
GRTx22	62890-02	62890-12
GRTx32	62890-03	62890-13
GRTx42	62890-04	62890-14
GRTx52	62890-05	62890-15
GRTx62	62890-06	62890-16
GRTx72	62890-07	62890-17
GRTx82	62890-08	62890-18

INTERNAL PROXIMITY SWITCHES

GRIPPER SIZE	SWITCH DESCRIPTION	PART NO.
GRTx1, 2, 3, 4, & 5	4 mm Round NPN (Sink)	18430-001-02
	4 mm Round PNP (Source)	18430-002-02
GRTx6, 7, & 8	8 mm Threaded NPN (Sink)	51422-005-02
	8 mm Threaded PNP (Source)	51422-006-02

INTERNAL PROXIMITY SWITCH TARGET KITS

DIRECTION	KIT NUMBER GRTx1x	GRTx2x	GRTx3x	GRTx4x	GRTx5x	GRTx6x	GRTx7x	GRTx8x
JAWS OPENING	62805-00	62805-01	62805-02	62805-02	62805-02	62805-03	62805-04	62805-04
JAWS CLOSING	62806-00	62806-01	62806-01	62806-02	62806-03	62806-04	62806-05	62806-05

Kit includes: 1 Proximity Target, 1 Proximity Adjustment Screw, 2 Target Adjustment Screws

EXTERNAL PROXIMITY SWITCHES

GRIPPER SIZE	SWITCH DESCRIPTION	PART NO.
GRTx1, 2, 3, 4, & 5	8 mm Threaded NPN (Sink)	51422-005-02
	8 mm Threaded PNP (Source)	51422-006-02
GRTx6, 7, & 8	12 mm Threaded NPN (Sink)	15561-001
	12 mm Threaded PNP (Source)	15561-002
	12 mm Threaded AC 20-250 VAC	15561-003

EXTERNAL PROXIMITY SWITCH MOUNTING BRACKETS

KIT NUMBER GRTx1x	GRTx2x	GRTx3x	GRTx4x	GRTx5x	GRTx6x	GRTx7x	GRTx8x
61552-01	61552-02	61552-03	61552-04	61552-05	61552-06	61552-07	61552-08

Options may affect unit length. See unit dimension and options pages for adders.

UNIQUE GRIPPERS ARE AVAILABLE.
SEE PAGES 4-139 TO 4-164.

SPECIFICATIONS	SERIES GRT
OPERATING PRESSURE	
STANDARD UNIT	30 psi min to 100 psi max [2 bar min to 7 bar max] air
SPRING ASSIST UNIT	60 psi min to 100 psi max [4 bar min to 7 bar max] air
OPERATING TEMPERATURE	-20° to +180°F [-28° to +82°C]
RATED LIFE	10 million cycles minimum with standard seals (including spring assist units)
	7.5 million cycles minimum for part ejector springs
GRIP REPEATABILITY	Within ±0.002 in [±0.05 mm] of original centered position
CYCLE TIME	See table below
LUBRICATION	Factory lubricated for rated life
MAINTENANCE	Field repairable

SIZING AND APPLICATION ASSISTANCE
See PHD Product Sizing Catalog for specific and complete sizing information. Online sizing assistance is available at:
www.phdinc.com/apps/sizing

MODEL NO.	TOTAL DIAMETRAL JAW TRAVEL		TOTAL CLOSE GRIP FORCE AT 87 psi [6 bar]		GRIPPER WEIGHT		CLOSE OR OPEN TIME 87 psi [6 bar]	DISPLACEMENT		GRIP FORCE FACTOR G_F EXTERNAL GRIP		INTERNAL GRIP	
	in	mm	lb	N	lb	kg	sec.	in^3	cm^3	IMPERIAL	METRIC	IMPERIAL	METRIC
GRTx1x	0.236	6	44	196	0.27	0.12	.09	0.10	1.6	0.52	33	0.57	37
GRTx2x	0.315	8	112	499	0.59	0.27	.03	0.30	5	1.29	83	1.43	93
GRTx3x	0.472	12	168	747	0.95	0.43	.04	0.72	12	1.93	125	2.10	136
GRTx4x	0.630	16	218	971	1.75	0.80	.06	1.41	23	2.51	162	2.68	173
GRTx5x	0.787	20	378	1683	2.82	1.28	.07	3.00	49	4.35	281	4.61	297
GRTx6x	1.024	26	569	2531	5.1	2.32	.15	5.63	92	6.54	422	6.99	451
GRTx7x	1.260	32	880	3912	8.75	3.98	.30	10.75	176	10.11	652	10.67	688
GRTx8x	1.575	40	1452	6459	15.5	7.05	.40	21.92	359	16.69	1077	17.52	1131

Minimum Operating Pressure is 30 psi [2 bar] for standard unit and 60 psi [4 bar] for spring assist unit.

HEAVY SPRING

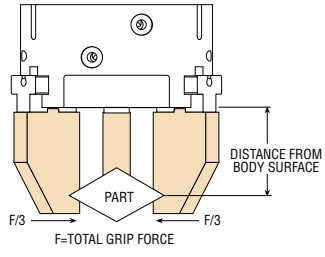
MODEL NO.	S_F SPRING GRIP FORCE MINIMUM		S_F SPRING GRIP FORCE MAXIMUM		SPRING ASSIST GRIPPER WEIGHT		CLOSE OR OPEN TIME 87 psi [6 bar] IN sec WITH SPRING	AGAINST SPRING	SPRING ONLY
	lb	N	lb	N	lb	kg			
GRTx1x	9	40	18	80	0.34	0.15	.08	.14	.14
GRTx2x	14	62	52	231	0.74	0.34	.02	.05	.04
GRTx3x	28	125	82	365	1.18	0.54	.04	.10	.10
GRTx4x	49	218	110	498	2.15	0.98	.05	.12	.10
GRTx5x	118	525	232	1032	3.92	1.78	.08	.16	.12
GRTx6x	193	858	341	1517	6.99	3.17	.11	.21	.15
GRTx7x	263	1170	498	2215	11.1	5.04	.15	.36	.24
GRTx8x	324	1441	591	2629	20.6	9.34	.27	.48	.40

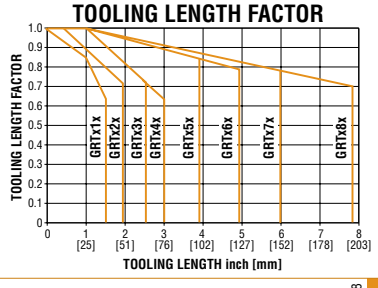
MODEL NO.	TOOLING LENGTH MAXIMUM		TOOLING WEIGHT MAX. PER JAW	
	in	mm	lb	kg
GRTx1x	1.5	40	0.17	0.08
GRTx2x	1.97	50	0.30	0.14
GRTx3x	2.56	65	0.72	0.33
GRTx4x	2.95	75	1.25	0.57
GRTx5x	3.94	100	2.65	1.20
GRTx6x	4.92	125	4.50	2.05
GRTx7x	5.91	150	8.80	4.00
GRTx8x	7.87	200	16.00	7.27

Spring grip force (S_F) varies with spring compression. The minimum spring grip force values occur with the spring at least compression (jaws fully closed on spring close units and fully open on spring open units). The maximum spring grip force values occur with the spring at most compression (jaws fully open on spring close units and fully closed on spring open units).

TOOLING LENGTH FACTOR

Tooling should be designed so that the grip point is as close to the body surface as possible. When the grip point moves away, jaw friction increases, which decreases grip force. The G_F information given above is for zero tooling length (body surface). The graph shows how force decreases as the grip point moves away from the body surface.





GRIP FORCE CALCULATION EQUATIONS:

IMPERIAL:

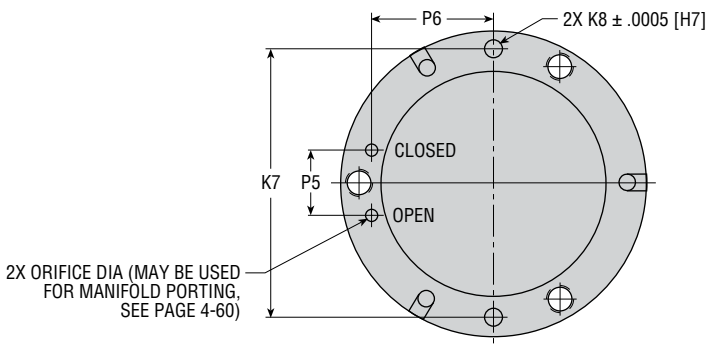
TOTAL GRIP FORCE [lb] = (Pressure [psi] x G_F) x Tooling Length Factor

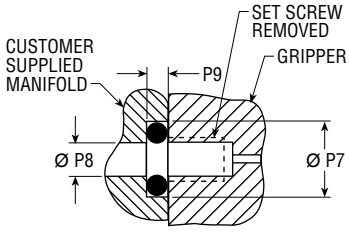
TOTAL GRIP FORCE WITH SPRINGS [lb] = ((Pressure [psi] x G_F) ± S_F [lb]) x Tooling Length Factor

METRIC:

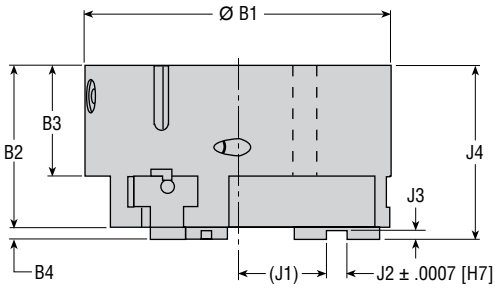
TOTAL GRIP FORCE [N] = (Pressure [bar] x G_F) x Tooling Length Factor

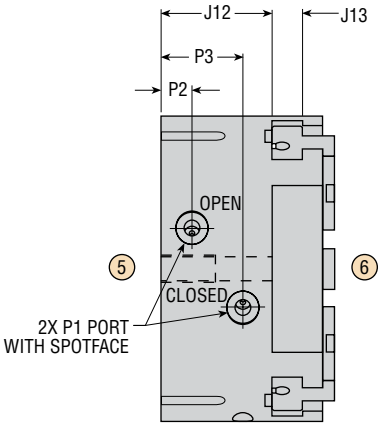
TOTAL GRIP FORCE WITH SPRINGS [N] = ((Pressure [bar] x G_F) ± S_F [N]) x Tooling Length Factor

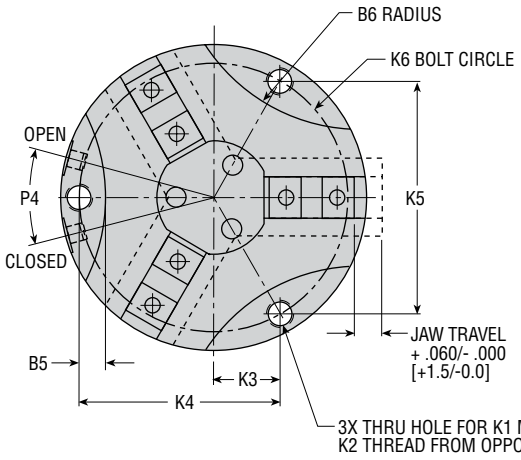


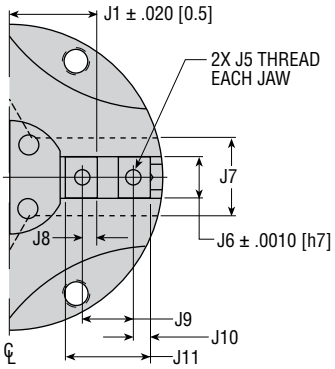


MANIFOLD PORTING DIMENSIONS
FOR CUSTOMER USE
(DIMENSIONS REQUIRED
ON CUSTOMER MOUNTING SURFACE)









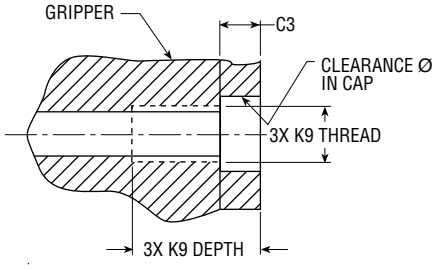
NOTES:
1) SPRING ASSIST OPTION AFFECTS UNIT DIMENSIONS. SEE PAGE 4-56 FOR INFORMATION.
2) CIRCLED NUMBERS INDICATE POSITION.

All dimensions are reference only unless specifically toleranced.

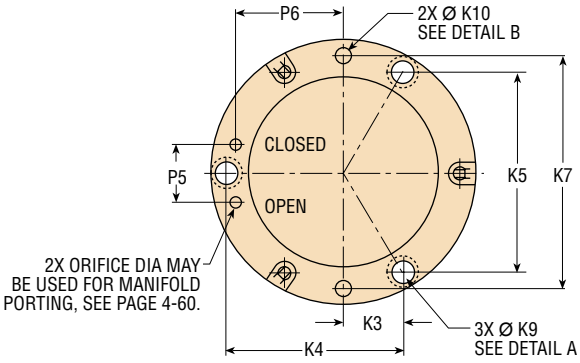
LETTER DIM	MODEL NUMBER															
	GRTx1x		GRTx2x		GRTx3x		GRTx4x		GRTx5x		GRTx6x		GRTx7x		GRTx8x	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
JAW TRAVEL	.118	3.0	.157	4.0	.236	6.0	.315	8.0	.394	10.0	.512	13.0	.630	16.0	.787	20.0
B1	1.850	47.0	2.441	62.0	2.835	72.0	3.543	90.0	4.173	106.0	5.275	134.0	6.339	161.0	7.953	202.0
B2	1.004	25.5	1.279	32.5	1.575	40.0	1.870	47.5	2.205	56.0	2.559	65.0	2.992	76.0	3.563	90.5
B3	.748	19.0	.905	23.0	1.103	28.0	1.279	32.5	1.496	38.0	1.732	44.0	1.968	50.0	2.303	58.5
B4	.057	1.4	.157	4.0	.118	3.0	.098	2.5	.157	4.0	.118	3.0	.156	4.0	.197	5.0
B5	.165	4.2	.207	5.3	.197	5.0	.295	7.5	.393	10.0	.492	12.5	.708	18.0	.966	24.5
B6	.165	4.2	1.496	38.0	2.244	57.0	2.244	57.0	2.992	76.0	3.996	101.5	5.000	127.0	5.256	133.5
J1 CLOSED	.642	16.3	.787	20.0	.886	22.5	1.024	26.0	1.260	32.0	1.476	37.5	1.831	46.5	2.206	56.0
J2	.0787	2.0	.1582	4.0	.1582	4.0	.2369	6.0	.2369	6.0	.3157	8.0	.3157	8.0	.3944	10.0
J3	.039	1.0	.079	2.0	.079	2.0	.079	2.0	.098	2.5	.098	2.5	.118	3.0	.158	4.0
J4	1.061	26.9	1.436	36.5	1.694	43.0	1.968	50.0	2.362	60.0	2.677	68.0	3.148	80.0	3.760	95.5
J5	4-40	M3 x 0.5	8-32	M4 x 0.7	8-32	M4 x 0.7	10-24	M5 x 0.8	1/4-20	M6 x 1.0	5/16-18	M8 x 1.25	3/8-16	M10 x 1.5	1/2-13	M12 x 1.75
	x .157 DP	x 4.0 DP	x .197 DP	x 5.0 DP	x .250 DP	x 6.5 DP	x .295 DP	x 7.5 DP	x .400 DP	x 10.0 DP	x .410 DP	x 10.5 DP	x .563 DP	x 14.0 DP	x .750 DP	x 19.0 DP
J6	.3146	8.0	.3927	10.0	.3927	10.0	.4714	12.0	.5502	14.0	.6683	17.0	.7864	20.0	.9832	25.0
J7	.561	14.2	.670	17.0	.709	18.0	.906	23.0	1.063	27.0	1.260	32.0	1.575	40.0	1.890	48.0
J8	.108	2.74	.138	3.5	.157	4.0	.177	4.5	.216	5.5	.275	7.0	.335	8.5	.413	10.5
J9	.295	7.5	.433	11.0	.472	12.0	.590	15.0	.669	17.0	.865	22.0	.985	25.0	1.220	31.0
J10	.119	3.0	.157	4.0	.177	4.5	.197	5.0	.216	5.5	.276	7.0	.334	8.5	.413	10.5
J11	.533	13.5	.748	19.0	.827	21.0	.984	25.0	1.102	28.0	1.418	36.0	1.653	42.0	2.047	52.0
J12	.667	16.9	.905	23.0	1.103	28.0	1.279	32.5	1.496	38.0	1.732	44.0	1.968	50.0	2.303	58.5
J13	.177	4.5	.197	5.0	.276	7.0	.354	9.0	.433	11.0	.472	12.0	.551	14.0	.630	16.0
K1	#5	M3	#8	M4	#10	M5	1/4	M6	1/4	M6	5/16	M8	5/16	M8	3/8	M10
K2	8-32	M4 x 0.7	10-32	M5 x 0.8	1/4-20	M6 x 1.0	5/16-18	M8 x 1.25	5/16-18	M8 x 1.25	3/8-16	M10 x 1.5	3/8-16	M10 x 1.5	1/2-13	M12 x 1.75
	x .394 DP	x 10 DP	x .375 DP	x 9.5 DP	x .500 DP	x 12.0 DP	x .625 DP	x 16.0 DP	x .625 DP	x 16.0 DP	x .750 DP	x 19.0 DP	x .750 DP	x 19.0 DP	x 1.00 DP	x 25.5 DP
K3	.374	9.50	.527	13.39	.620	15.75	.778	19.76	.945	24.00	1.181	30.00	1.447	36.75	1.821	46.25
K4	1.122	28.50	1.580	40.13	1.860	47.24	2.333	59.26	2.834	71.98	3.543	89.99	4.340	110.24	5.463	138.76
K5	1.296	32.92	1.824	46.33	2.148	54.56	2.693	68.40	3.273	83.13	4.091	103.91	5.012	127.30	6.308	160.22
K6	1.496	38.0	2.106	53.5	2.480	63.0	3.110	79.0	3.779	96.0	4.724	120.0	5.787	147.0	7.283	185.0
K7	1.496	38.0	2.106	53.5	2.480	63.0	3.110	79.0	3.779	96.0	4.724	120.0	5.787	147.0	7.283	185.0
K8	.1268	3.0	.1580 x	4.0 x	.1580 x	4.0 x	.1973 x	5.0 x	.1973 x	5.0 x	.2367 x	6.0 x	.2367 x	6.0 x	.3155 x	8.0 x
	x .237 DP	x 6.0 DP	.315 DP	8.0 DP	.315 DP	8.0 DP	.394 DP	10.0 DP	.394 DP	10.0 DP	.470 DP	12.0 DP	.470 DP	12.0 DP	.620 DP	15.75 DP
P1	10-32	M5 x 0.8	10-32	M5 x 0.8	10-32	M5 x 0.8	10-32	M5 x 0.8	1/8 NPT	1/8 BSP	1/8 NPT	1/8 BSP	1/8 NPT	1/8 BSP	1/8 NPT	1/8 BSP
P2	.231	5.9	.256	6.5	.295	7.5	.355	9.0	.453	11.5	.472	12.0	.551	14.0	.669	17.0
P3	.492	12.5	.669	17.0	.827	21.0	.946	24.0	1.043	26.5	1.299	33.0	1.496	38.0	1.791	45.5
P4	39°	39°	26°	26°	30°	30°	30°	30°	30°	30°	30°	30°	30°	30°	30°	30°
P5	.484	12.3	.551	14.0	.630	16.0	.768	19.5	.945	24.0	1.181	30.0	1.457	37.0	1.850	47.0
P6	.670	17.0	.984	25.0	1.181	30.0	1.437	36.5	1.772	45.0	2.205	56.0	2.717	69.0	3.465	88.0
P7	.276	7.0	.276	7.0	.276	7.0	.315	8.0	.315	8.0	.354	9.0	.354	9.0	.354	9.0
P8	.098	2.5	.098	2.5	.098	2.5	.138	3.5	.138	3.5	.177	4.5	.177	4.5	.177	4.5
P9	.048	1.2	.048	1.2	.048	1.2	.048	1.2	.048	1.2	.048	1.2	.048	1.2	.048	1.2

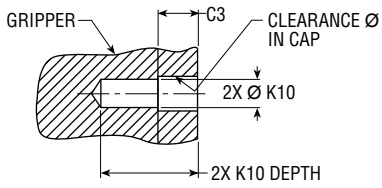
5 & 6 HEAVY FORCE SPRING ASSIST

Springs can maintain spring grip force if air pressure is lost or increase grip force in one specific direction when used with air pressure. Spring life in excess of 10 million cycles can be expected. For minimum operating pressures and spring grip forces, see table on page 4-53.

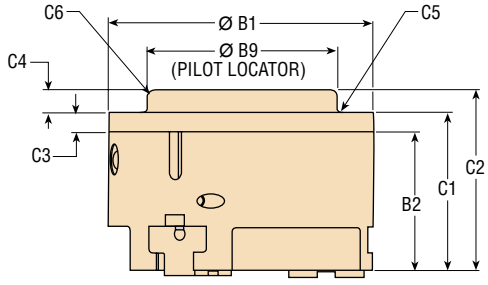


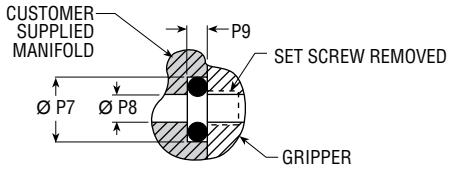
K9 MOUNTING DIMENSIONS DETAIL A





K10 MOUNTING PIN DIMENSIONS DETAIL B





MANIFOLD PORTING DIMENSIONS
FOR CUSTOMER USE
(DIMENSIONS REQUIRED ON CUSTOMER MOUNTING SURFACE)

LETTER	MODEL NUMBER															
	GRTx1x		GRTx2x		GRTx3x		GRTx4x		GRTx5x		GRTx6x		GRTx7x		GRTx8x	
DIM	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
Ø B1	1.850	47.0	2.441	62.0	2.835	72.0	3.543	90.0	4.173	106.0	5.275	134.0	6.339	161.0	7.953	202.0
B2	1.004	25.5	1.279	32.5	1.575	40.0	1.870	47.5	2.205	56.0	2.559	65.0	2.992	76.0	3.563	90.5
Ø B9 MAX	1.0650	27.1	1.6535	42.00	2.0079	51.00	2.5591	65.00	3.2283	82.00	4.0157	102.00	5.0394	128.00	6.2992	160.00
Ø B9 MIN	1.0610	26.9	1.6490	41.89	2.0034	50.89	2.5526	64.83	3.2218	81.83	4.0092	101.83	5.0329	127.83	6.2927	159.83
C1	1.240	31.5	1.515	38.5	1.811	46.0	2.146	54.5	2.559	65.0	2.913	74.0	3.425	87.0	4.075	103.5
C2	1.358	34.5	1.732	44.0	2.106	54.0	2.442	62.0	2.992	76.0	3.524	90.0	4.173	106.0	5.059	128.5
C3	.236	6.0	.236	6.0	.236	6.0	.276	7.0	.354	9.0	.354	9.0	.433	11.0	.512	13.0
C4	.118	3.0	.217	6.0	.295	8.0	.296	8.0	.433	11.0	.611	16.0	.748	19.0	.984	25.0
C5	.015	.4	.040	1	.040	1	.050	1.3	.050	1.3	.060	1.5	.110	2.8	.135	3.4
C6	.030	.8	.080	2	.080	2	.110	2.8	.110	2.8	.220	5.6	.220	5.6	.220	5.6
K3	.374	9.5	.527	13.39	.620	15.75	.778	19.76	.945	24.0	1.181	30.0	1.447	36.75	1.821	46.25
K4	1.122	28.5	1.580	40.13	1.860	47.24	2.333	59.26	2.834	71.98	3.543	89.99	4.340	110.24	5.463	138.76
K5	1.296	32.9	1.824	46.33	2.148	54.56	2.693	68.40	3.273	83.13	4.091	103.91	5.012	127.30	6.308	160.22
K7	1.496	38.0	2.106	53.5	2.480	63.0	3.110	79.0	3.779	96.0	4.724	120.0	5.787	147.0	7.283	185.0
K9	8-32 x .394 DP	M4 x 0.7 x .394 DP	10-32 x .611 DP	M5 x 0.8 x 16.0 DP	1/4-20 x .736 DP	M6 x 1.0 x 19.0 DP	5/16-18 x .901 DP	M8 x 1.25 x 23.0 DP	5/16-18 x .979 DP	M8 x 1.25 x 25.0 DP	3/8-16 x 1.104 DP	M10 x 1.5 x 28.0 DP	3/8-16 x 1.183 DP	M10 x 1.5 x 30.0 DP	1/2-13 x 1.512 DP	M12 x 1.75 x 38.0 DP
K10	0.1268 x .315 DP	3.0 x .315 DP	.1580 x .551 DP	4.0 x 14.0 DP	.1580 x .551 DP	4.0 x 14.0 DP	.1973 x .670 DP	5.0 x 26.0 DP	.1973 x .748 DP	5.0 x 19.0 DP	.2367 x .824 DP	6.0 x 21.0 DP	.2367 X .903 DP	6.0 x 23.0 DP	.3155 x 1.132 DP	10.0 x 29.0 DP
P5	.484	12.3	.551	14.0	.630	16.0	.768	19.5	.945	24.0	1.181	30.0	1.457	37.0	1.850	47.0
P6	.670	17.0	.984	25.0	1.181	30.0	1.437	36.5	1.772	45.0	2.205	56.0	2.717	69.0	3.465	88.0
Ø P7	.276	7.0	.276	7.0	.276	7.0	.315	8.0	.315	8.0	.354	9.0	.354	9.0	.354	9.0
Ø P8	.098	2.5	.098	2.5	.098	2.5	.138	3.5	.138	3.5	.177	4.5	.177	4.5	.177	4.5
P9	.048	1.2	.048	1.2	.048	1.2	.048	1.2	.048	1.2	.048	1.2	.048	1.2	.048	1.2

All dimensions are reference only unless specifically toleranced.

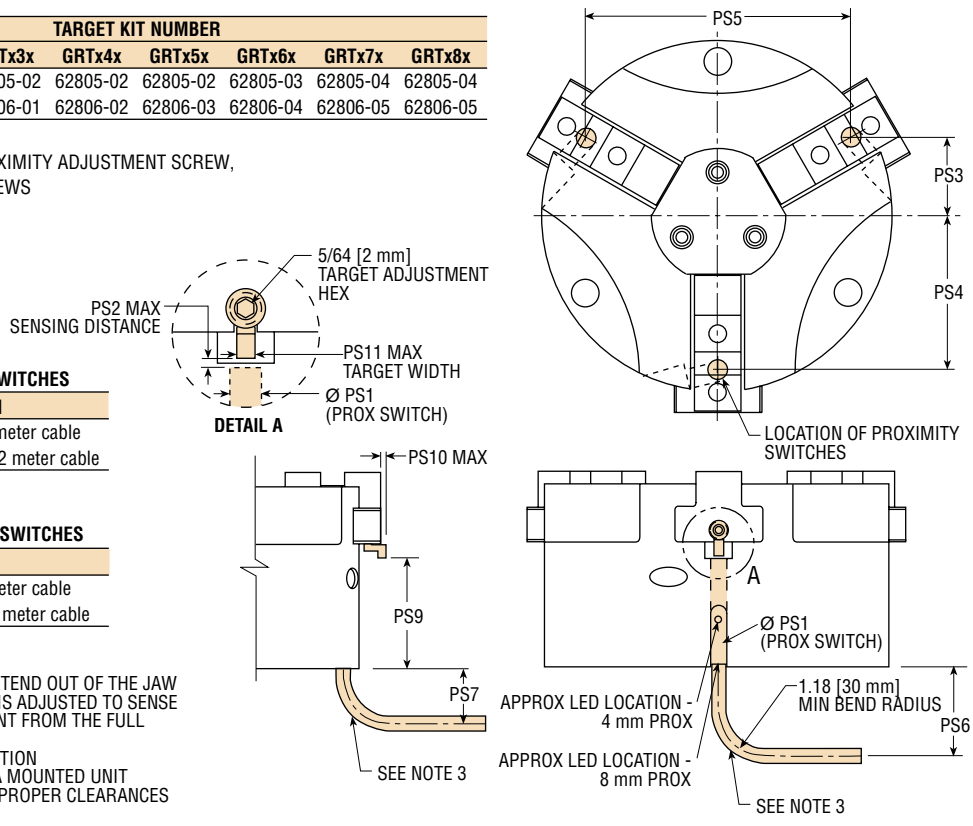
5 PROXIMITY SWITCH READY-INTERNAL

This option equips the gripper with sleeves to provide for the mounting of up to three round proximity switches. Target Kits and Proximity Switches are ordered separately. See Switches and Sensors section for complete switch specifications. The adjustable positioning target assembly is protected under U.S. Patent No. 6019409.

LETTER DIM	MODEL NUMBER															
	GRTx1x		GRTx2x		GRTx3x		GRTx4x		GRTx5x		GRTx6x		GRTx7x		GRTx8x	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
PS1	4mm ROUND		4mm ROUND		4mm ROUND		4mm ROUND		4mm ROUND		8mm THREADED		8mm THREADED		8mm THREADED	
PS2	.020	.5	.020	.5	.020	.5	.020	.5	.020	.5	.030	.76	.030	.76	.030	.76
PS3	.388	9.86	.527	13.37	.620	15.75	.778	19.75	.945	24.0	1.181	30.0	1.447	36.75	1.821	46.25
PS4	.775	19.69	1.053	26.75	1.240	31.5	1.555	39.5	1.890	48.0	2.362	60.0	2.894	73.5	3.642	92.5
PS5	1.342	34.09	1.824	46.33	2.148	54.55	2.693	68.41	3.273	83.13	4.091	103.91	5.012	127.30	6.307	160.20
PS6	1.21	30.7	1.42	36.0	1.22	31.0	1.18	30.0	1.18	30.0	1.18	30.0	.94	24.0	.98	25.0
PS7	1.21	30.7	1.42	36.0	1.22	31.0	1.04	26.5	.83	21.0	1.18	30.0	.94	24.0	.61	15.5
PS9	.555	14.1	.773	19.6	.971	24.7	1.147	29.1	1.364	34.6	1.524	38.7	1.760	44.7	2.095	53.2
PS10	.030	.75	.030	.75	.030	.75	.030	.75	.060	1.5	.167	4.25	.276	7.0	.404	10.25
PS11	.157	4.0	.157	4.0	.157	4.0	.157	4.0	.157	4.0	.315	8.0	.315	8.0	.315	8.0

SENSING DIRECTION	TARGET KIT NUMBER							
	GRTx1x	GRTx2x	GRTx3x	GRTx4x	GRTx5x	GRTx6x	GRTx7x	GRTx8x
JAWS OPENING	62805-00	62805-01	62805-02	62805-02	62805-02	62805-03	62805-04	62805-04
JAWS CLOSING	62806-00	62806-01	62806-01	62806-02	62806-03	62806-04	62806-05	62806-05

EACH KIT WILL MOUNT ONE SWITCH.
KIT INCLUDES: 1 PROXIMITY TARGET, 1 PROXIMITY ADJUSTMENT SCREW, 2 TARGET ADJUSTMENT SCREWS



4 mm ROUND INDUCTIVE PROXIMITY SWITCHES

PART NUMBER	DESCRIPTION
18430-001-02	NPN (Sink) 10-30 VDC, 2 meter cable
18430-002-02	PNP (Source) 10-30 VDC, 2 meter cable

8 mm THREADED INDUCTIVE PROXIMITY SWITCHES

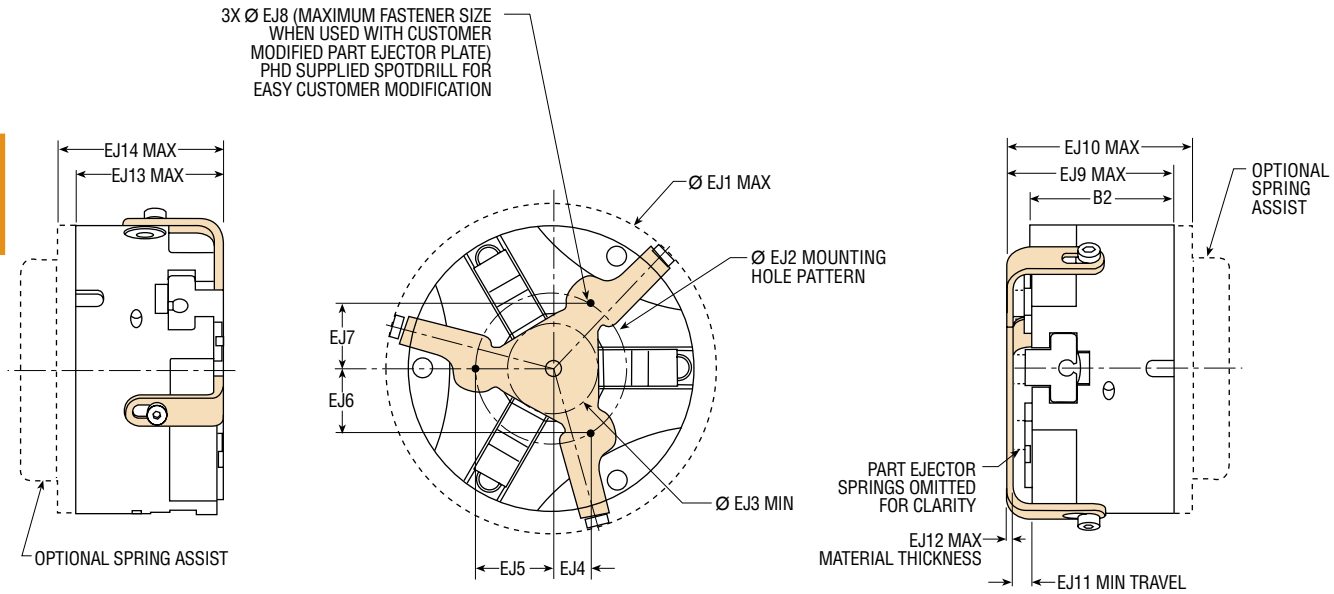
PART NUMBER	DESCRIPTION
51422-005-02	NPN (Sink) 5-30 VDC, 2 meter cable
51422-006-02	PNP (Source) 5-30 VDC, 2 meter cable

NOTES:
1) (PS10) THE PROX TARGET MAY EXTEND OUT OF THE JAW WHEN THE JAWS CLOSE. TARGET IS ADJUSTED TO SENSE LESS THAN .039 [1 mm] MOVEMENT FROM THE FULL CLOSED POSITION
2) JAWS SHOWN IN FULL OPEN POSITION
3) INSTALLATION OF SWITCHES ON A MOUNTED UNIT MAY NOT BE POSSIBLE WITHOUT PROPER CLEARANCES IN FIXTURE

1 PART EJECTOR

This option equips the gripper with a spring actuated part ejector. When grip force is removed, the part ejector can push the part against a positive stop. This allows accurate part location and isolates forces due to location within the gripper mechanism, protecting the rest of the automation device. Spring life in excess of 7.5 million cycles can be expected.

MODEL NO.	PART EJECTOR TOTAL SPRING FORCE	
	lb	N
GRTx1x	3 - 5	13 - 22
GRTx2x	4.5 - 8.4	20 - 37
GRTx3x	7.5 - 11	33 - 51
GRTx4x	11 -18	51 - 80
GRTx5x	20 - 28	88 - 124
GRTx6x	27 - 38	121 - 167
GRTx7x	35 - 56	157 - 248
GRTx8x	74 - 96	330 - 427



PART EJECTOR COMPRESSED

PART EJECTOR EXTENDED

LETTER DIM	MODEL NUMBER															
	GRTx1x		GRTx2x		GRTx3x		GRTx4x		GRTx5x		GRTx6x		GRTx7x		GRTx8x	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
B2	1.004	25.5	1.279	32.5	1.575	40.0	1.870	47.5	2.205	56.0	2.559	65.0	2.992	76.0	3.563	90.5
Ø EJ1	2.330	59.2	3.239	82.0	3.633	92.0	4.312	110.0	4.940	125.0	6.083	155.0	7.384	188.0	8.983	228.0
Ø EJ2	N/A	N/A	1.318	33.5	1.510	38.4	1.892	48.0	2.264	57.5	2.784	70.7	3.296	83.7	4.014	102.0
Ø EJ3	.700	17.8	.766	19.5	.872	22.1	1.022	25.9	1.376	34.9	1.572	39.9	1.924	48.8	2.458	62.4
EJ4	N/A	N/A	.330	8.0	.378	10.0	.473	12.0	.566	14.0	.696	18.0	.824	21.0	1.004	26.0
EJ5	N/A	N/A	.659	17.0	.755	19.0	.946	24.0	1.132	29.0	1.392	35.0	1.648	42.0	2.007	51.0
EJ6	N/A	N/A	.571	14.0	.654	17.0	.819	21.0	.980	25.0	1.206	31.0	1.427	36.0	1.738	44.0
EJ7	N/A	N/A	.571	14.0	.654	17.0	.819	21.0	.980	25.0	1.206	31.0	1.427	36.0	1.738	44.0
Ø EJ8	N/A	N/A	#2	M2	#6	M3	#8	M4	#10	M5	5/16	M8	3/8	M10	1/2	M12
EJ9	1.126	28.6	1.552	39.4	1.966	49.9	2.275	57.8	2.614	66.4	3.061	77.7	3.572	90.7	4.221	107.2
EJ10	1.362	34.6	1.788	45.4	2.202	56.0	2.551	64.8	2.960	75.2	3.415	86.7	4.006	101.8	4.734	120.3
EJ11	.062	1.6	.121	3.0	.239	6.0	.239	6.0	.239	6.0	.318	8.0	.396	10.1	.474	12.1
EJ12	.062	1.6	.113	2.9	.113	2.9	.128	3.3	.128	3.3	.143	3.7	.143	3.7	.143	3.7
EJ13	1.061	26.9	1.404	35.7	1.700	43.2	2.010	51.1	2.345	59.6	2.714	68.9	3.147	79.9	3.718	94.4
EJ14	1.297	32.9	1.533	38.9	1.829	46.4	2.164	55.0	2.577	65.4	2.931	74.4	3.443	87.4	4.093	103.9

All dimensions are reference only unless specifically toleranced.

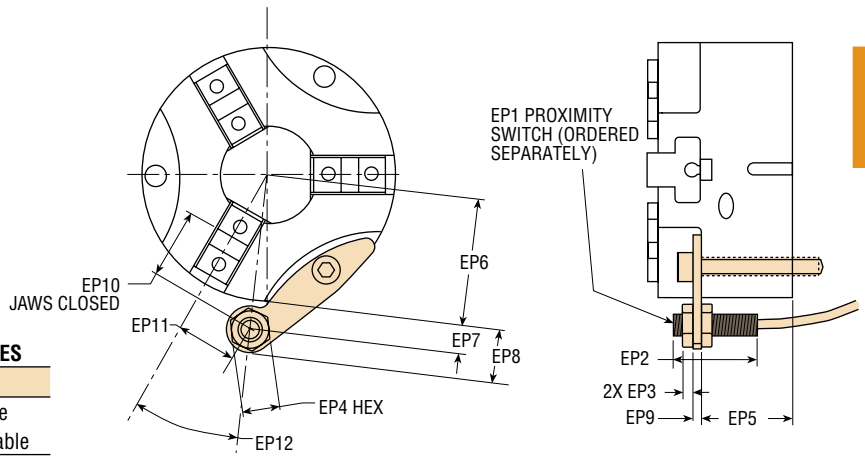
PROXIMITY SWITCHES - EXTERNAL

This accessory provides for the external mounting of round metal sensing proximity switches. Up to six switches may be mounted using multiple brackets. The user is required to design and mount targets for the switch to sense. Proximity Switches are ordered separately. See Switches and Sensors section for complete switch specifications.

LETTER	MODEL NUMBER															
	GRTx1x		GRTx2x		GRTx3x		GRTx4x		GRTx5x		GRTx6x		GRTx7x		GRTx8x	
DIM	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
EP1	8mm THREADED		8mm THREADED		8mm THREADED		8mm THREADED		8mm THREADED		12mm THREADED		12mm THREADED		12mm THREADED	
EP2	1.772	45.0	1.772	45.0	1.772	45.0	1.772	45.0	1.772	45.0	2.362	60.0	2.362	60.0	2.362	60.0
EP3	.157	4.0	.157	4.0	.157	4.0	.157	4.0	.157	4.0	.157	4.0	.157	4.0	.157	4.0
EP4	.512	13.0	.512	13.0	.512	13.0	.512	13.0	.512	13.0	.669	17.0	.669	17.0	.669	17.0
EP5	.748	19.0	.905	23.0	1.103	28.0	1.279	32.5	1.496	38.0	1.732	44.0	1.968	50.0	2.303	58.5
EP6	.925	23.5	1.221	31.0	1.418	36.0	1.772	45.0	2.087	53.0	2.638	67.0	3.170	80.5	3.977	101.0
EP7	.377	9.6	.413	10.5	.419	10.6	.403	10.25	.443	11.25	.512	13.0	.492	12.5	.515	13.1
EP8	.702	17.8	.738	18.75	.744	18.9	.728	18.5	.768	19.5	.935	23.75	.915	23.25	.938	23.8
EP9	.060	1.5	.105	2.7	.105	2.7	.105	2.7	.105	2.7	.105	2.7	.105	2.7	.105	2.7
EP10	.483	12.3	.693	17.6	.817	20.8	.983	25.0	1.077	27.4	1.433	36.4	1.522	38.7	1.944	49.4
EP11	.648	16.5	.689	17.5	.688	17.5	.836	21.2	.968	24.6	1.207	30.7	1.401	35.6	1.723	43.8
EP12	30°	30°	25°	25°	22.0°	22.0°	22.5°	22.5°	22.5°	22.5°	22.5°	22.5°	22.5°	22.5°	22.5°	22.5°

MOUNTING BRACKETS

PART NUMBER	BRACKET NUMBER
GRTx12	61552-01
GRTx22	61552-02
GRTx32	61552-03
GRTx42	61552-04
GRTx52	61552-05
GRTx62	61552-06
GRTx72	61552-07
GRTx82	61552-08



8 mm THREADED INDUCTIVE PROXIMITY SWITCHES

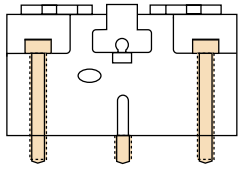
PART NUMBER	DESCRIPTION
51422-005-02	NPN (Sink) 5-30 VDC, 2 meter cable
51422-006-02	PNP (Source) 5-30 VDC, 2 meter cable

12 mm THREADED INDUCTIVE PROXIMITY SWITCHES

PART NUMBER	DESCRIPTION
15561-001	NPN (Sink) 10-30 VDC, 3 meter cable
15561-002	PNP (Source) 10-30 VDC, 3 meter cable
15561-003	AC 20-250 VAC, 3 meter cable

GRIPPER MOUNTING KIT

Gripper mounting kits are available. The kit includes three socket head cap screws. Part ejector option does not affect mounting kits listed below.

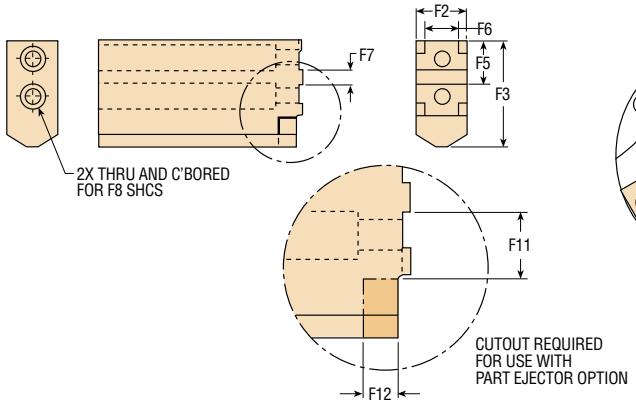


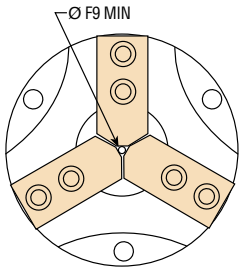
STANDARD UNIT	MODEL NUMBER															
	GRT112	GRT512	GRT122	GRT522	GRT132	GRT532	GRT142	GRT542	GRT152	GRT552	GRT162	GRT562	GRT172	GRT572	GRT182	GRT582
KIT NUMBER	61620-01	62813-01	61620-02	62813-02	61620-03	62813-03	61620-04	62813-04	61620-05	62813-05	61620-06	62813-06	61620-07	62813-07	61620-08	62813-08
FASTENER (SHCS)	5-40 x 1-1/4	M3 x 0.5 x 25	8-32 x 1-1/4	M4 x 0.7 x 30	10-24 x 1-1/2	M5 x 0.8 x 40	1/4-20 x 1-3/4	M6 x 1.0 x 45	1/4-20 x 2	M6 x 1.0 x 50	5/16-18 x 2-1/4	M8 x 1.25 x 50	5/16-18 x 2-1/2	M8 x 1.25 x 65	3/8-16 x 3	M10 x 1.5 x 80

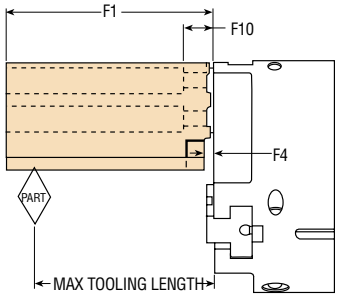
SPRING ASSIST UNIT	MODEL NUMBER															
	GRT112	GRT512	GRT122	GRT522	GRT132	GRT532	GRT142	GRT542	GRT152	GRT552	GRT162	GRT562	GRT172	GRT572	GRT182	GRT582
KIT NUMBER	64128-01	64129-01	64128-02	64129-02	64128-03	64129-03	64128-04	64129-04	64128-05	64129-05	64128-06	64129-06	64128-07	64129-07	64128-08	64129-08
FASTENER (SHCS)	6-32 x 1-1/4	M3 x 0.5 x 30	8-32 x 1-1/2	M4 x 0.7 x 35	10-24 x 1-3/4	M5 x 0.8 x 45	1/4-20 x 2	M6 x 1.0 x 50	1/4-20 x 2-1/2	M6 x 1.0 x 60	5/16-18 x 2-3/4	M8 x 1.25 x 62	5/16-18 x 3	M8 x 1.25 x 75	3/8-16 x 3-1/2	M10 x 1.5 x 90

FINGER BLANKS

This accessory provides jaw tooling blanks which can easily be machined to meet specific application requirements. Each aluminum blank has key geometry to precisely mate and align with the Series GRT Gripper jaw. One finger blank is supplied per kit.







LETTER DIM	MODEL NUMBER															
	GRTx1x		GRTx2x		GRTx3x		GRTx4x		GRTx5x		GRTx6x		GRTx7x		GRTx8x	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
F1	1.632	41.5	2.165	55.0	2.756	70.0	3.150	80.0	4.331	110.0	5.315	135.0	6.299	160.0	8.465	215.0
F2	.500	12.70	.625	15.88	.625	15.88	.750	19.05	1.000	25.40	1.250	31.75	1.500	38.10	1.750	44.45
F3	.980	24.9	1.260	32.0	1.380	35.1	1.633	41.5	1.938	49.2	2.407	61.1	2.900	73.7	3.442	87.4
F4	.096	2.4	.196	5.0	.157	4.0	.137	3.5	.196	5.0	.157	4.0	.196	5.0	.236	6.0
F5	.375	9.5	.531	13.5	.551	14.0	.679	17.25	.748	19.0	1.023	26.0	1.161	29.5	1.339	34.0
F6	.3156	8.0	.3938	10.0	.3938	10.0	.4725	12.0	.5513	14.0	.6694	17.0	.7875	20.0	.9850	25.0
F7	.0777	2.0	.1570	4.0	.1570	4.0	.2356	6.0	.2357	6.0	.3145	8.0	.3145	8.0	.3932	10.0
F8 SHCS	4-40 x 5/8	M3 x 0.5 x 16.0	8-32 x 1/2	M4 x 0.7 x 12.0	8-32 x 5/8	M4 x 0.7 x 16.0	10-24 x 5/8	M5 x 0.8 x 16.0	1/4-20 x 3/4	M6 x 1.0 x 20.0	5/16-18 x 1	M8 x 1.25 x 25.0	3/8-16 x 1	M10 x 1.5 x 25.0	1/2-13 x 1-1/2	M12 x 1.75 x 40.0
F9	.065	1.65	.065	1.65	.065	1.65	.091	2.30	.091	2.3	.133	3.35	.133	3.35	.157	3.90
F10	.541	13.7	.490	12.4	.523	13.3	.438	11.1	.576	14.6	.694	17.6	.623	15.8	1.048	26.6
F11	.280	7.1	.278	7.0	.319	8.1	.388	9.9	.416	10.6	.535	13.6	.691	17.6	.809	20.5
F12	.110	2.8	.171	4.3	.328	8.3	.362	9.2	.299	7.6	.439	11.2	.480	12.2	.517	13.1

MODEL NUMBER	TOOLING LENGTH		WEIGHT PER FINGER BLANK	
	in	mm	lb	kg
GRTx1x	1.495	38	.059	.027
GRTx2x	1.97	50	.12	.05
GRTx3x	2.56	65	.17	.08
GRTx4x	2.95	75	.29	.13
GRTx5x	3.94	100	.63	.29
GRTx6x	4.92	125	1.25	.57
GRTx7x	5.91	150	2.06	.95
GRTx8x	7.87	200	3.85	1.75

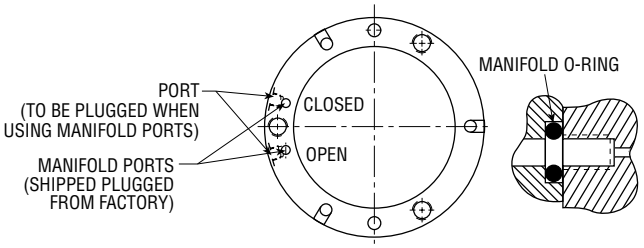
MODEL NUMBER	KIT NUMBER*	
	IMPERIAL	METRIC
GRTx1x	62890-01	62890-11
GRTx2x	62890-02	62890-12
GRTx3x	62890-03	62890-13
GRTx4x	62890-04	62890-14
GRTx5x	62890-05	62890-15
GRTx6x	62890-06	62890-16
GRTx7x	62890-07	62890-17
GRTx8x	62890-08	62890-18

* ONE FINGER BLANK IS SUPPLIED PER KIT.
(THREE KITS REQUIRED TO EQUIP EACH GRIPPER).

MANIFOLD SEAL KIT

All Series GRT grippers have manifold porting as standard. Port plugs must first be removed when using this feature.

See pages 4-54 and 4-55 for dimensions.



MANIFOLD KIT INCLUDES

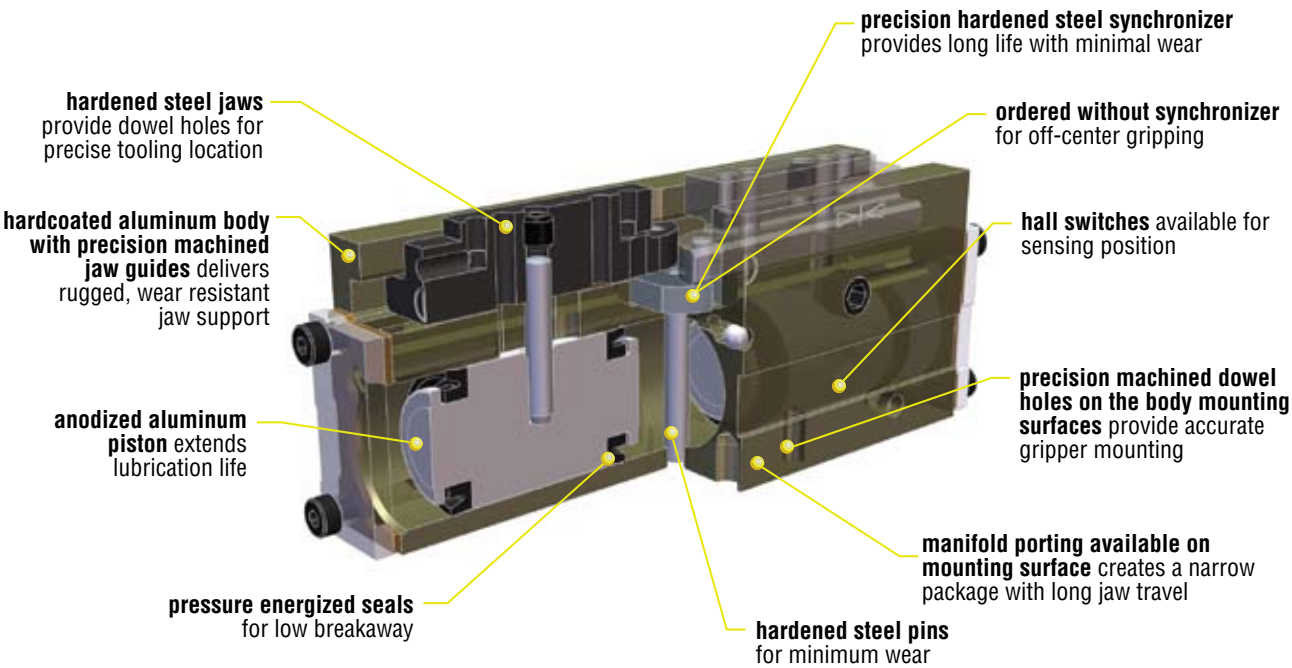
2 PORT PLUGS
2 MANIFOLD O-RING SEALS

	MODEL NUMBER															
	GRT112	GRT512	GRT122	GRT522	GRT132	GRT532	GRT142	GRT542	GRT152	GRT552	GRT162	GRT562	GRT172	GRT572	GRT182	GRT582
KIT NUMBER: (STD SEALS)	61553-01-1	61553-05-1	61553-01-1	61553-05-1	61553-01-1	61553-05-1	61553-02-1	61553-06-1	61553-03-1	61553-07-1	61553-04-1	61553-08-1	61553-04-1	61553-08-1	61553-04-1	61553-08-1
(FLUORO-ELAS-TOMER SEALS)	61553-01-2	61553-05-2	61553-01-2	61553-05-2	61553-01-2	61553-05-2	61553-02-2	61553-06-2	61553-03-2	61553-07-2	61553-04-2	61553-08-2	61553-04-2	61553-08-2	61553-04-2	61553-08-2
O-RING SIZE	.157 ID x .059 CS	4.0 ID x 1.5 CS	.157 ID x .059 CS	4.0 ID x 1.5 CS	.157 ID x .059 CS	4.0 ID x 1.5 CS	.197 ID x .059 CS	5.0 ID x 1.5 CS	.197 ID x .059 CS	5.0 ID x 1.5 CS	.236 ID x .059 CS	6.0 ID x 1.5 CS	.236 ID x .059 CS	6.0 ID x 1.5 CS	.236 ID x .059 CS	6.0 ID x 1.5 CS

All dimensions are reference only unless specifically toleranced.

GRL

NARROW WIDTH WITH LONG TRAVELS



Major Benefits

- Synchronous jaw motion (may be ordered without synchronizer for offset gripping)
- Narrow width, low profile and long travel lengths
- Manifold porting option
- Two jaw travels per bore size
- Two sizes available in both imperial and metric versions
- 1-2 day shipping
- 6 million cycles minimum rated life

Industry Uses

- Assembly machine builders
- Light bulb manufacturing
- Cosmetics
- Bearing manufacturing
- Packaging
- Golf equipment
- Semiconductor

ORDERING DATA: SERIES GRL GRIPPERS

TO ORDER SPECIFY:
Product Line, Series, Type, Synchronization, Jaw, Design No., Size, Total Jaw Travel, and Options required.

SERIES
Regular Duty

SYNCHRONIZATION
0 - Non-synchronized
1 - Synchronized

DESIGN NO.
(See Note 1)
1 - Imperial
5 - Metric

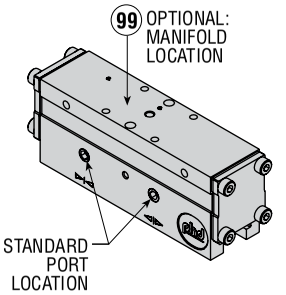
OPTIONS
(OMIT IF NOT REQUIRED)
MANIFOLD OPTIONS
L11-UB99 - Manifold option in location 99
UNIT OPTIONS
E - Hall Switch Ready

G	R	L	1	2	-	1	-	14	x	13	-	L11-UB99

PRODUCT LINE
G - Gripper

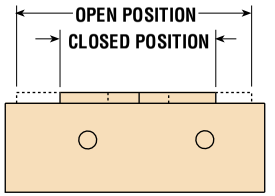
TYPE
Narrow Body Parallel

JAW
Style 2



BORE SIZE Diameter mm	(in)	MINIMUM TOTAL JAW TRAVEL Total Travel Per Bore Size mm	(in)
14	(.551)	7	(.276)
14	(.551)	13	(.512)
16	(.630)	20	(.787)
16	(.630)	26	(1.024)

TOTAL JAW TRAVEL =
(OPEN POSITION - CLOSED POSITION)



6 mm SQUARE HALL EFFECT SWITCHES

PART NUMBER	COLOR	DESCRIPTION
55803-1-02	Yellow	NPN (Sink) 4.5-24 VDC, 2 meter cable
55804-1-02	Red	PNP (Source) 4.5-24 VDC, 2 meter cable
55823-1	Yellow	NPN (Sink) 4.5-24 VDC, Quick Connect
55824-1	Red	PNP (Source) 4.5-24 VDC, Quick Connect

NOTE:
1) Design number indicates imperial or metric mounting holes, dowel pin holes, and ports.

HALL EFFECT SWITCH MOUNTING KIT

PART NUMBER	DESCRIPTION
68487-1	Switch Mounting Kit

Each mounting kit contains:
1 6 mm square switch bracket
1 mounting screw

UNIQUE GRIPPERS ARE AVAILABLE.
SEE PAGES 4-139 TO 4-164.

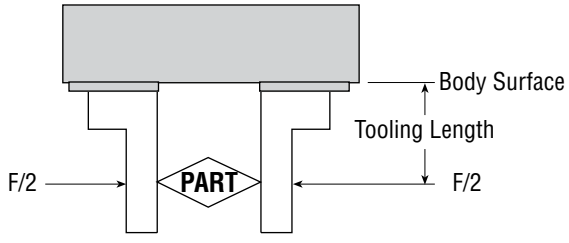
SPECIFICATIONS	SERIES GRL
OPERATING PRESSURE	
STANDARD UNIT	5 psi min to 100 psi max [.4 bar min to 7 bar max] air
OPERATING TEMPERATURE	-20° to +180°F [-28° to +82°C]
RATED LIFE	6 million cycles minimum
GRIP REPEATABILITY	Within ±0.002 in [±0.05 mm] of original centered position
CYCLE TIME	See table below
LUBRICATION	Factory lubricated for rated life
MAINTENANCE	Field repairable

SIZE	MINIMUM TOTAL JAW TRAVEL		TOTAL CLOSE GRIP FORCE AT 87 psi [6 bar]		GRIPPER WEIGHT		CLOSE OR OPEN TIME 87 psi [6 bar]	DISPLACEMENT		GRIP FORCE FACTOR G_F EXTERNAL GRIP		INTERNAL GRIP	
	in	mm	lb	N	lb	kg	sec	in^3	cm^3	IMPERIAL	METRIC	IMPERIAL	METRIC
GRL 14x7	0.28	7	28	124	0.18	0.08	0.085	.067	1.1	0.32	21	0.32	21
GRL 14x13	0.51	13	30	132	0.24	0.11	0.100	.128	2.1	0.34	22	0.34	22
GRL 16x20	0.79	20	41	182	0.39	0.18	0.110	.245	4.0	0.47	30	0.47	30
GRL 16x26	1.02	26	41	182	0.47	0.21	0.120	.319	5.2	0.47	30	0.47	30

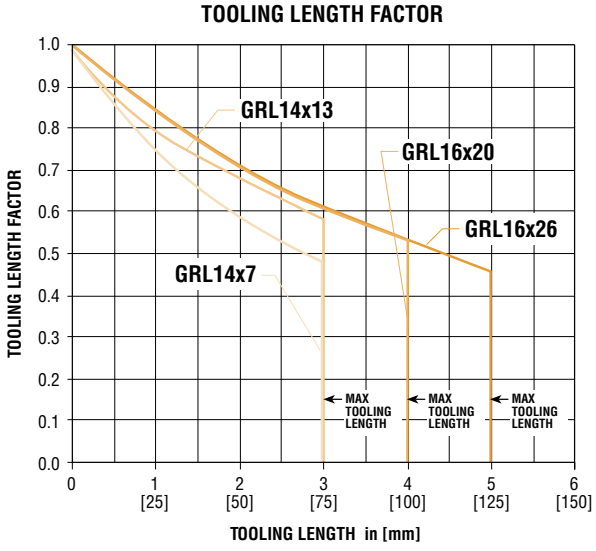
GRL

TOOLING LENGTH FACTOR

Jaw tooling should be designed so that the grip point is as close to the body surface as possible. As the grip point is moved away from the body surface, the applied moment causes jaw friction to increase, resulting in reduced effective grip force. The Grip Force Factor (G_F) values given in the table above are for zero tooling length (body surface).



F=TOTAL GRIP FORCE



GRIP FORCE CALCULATION EQUATIONS:

IMPERIAL:

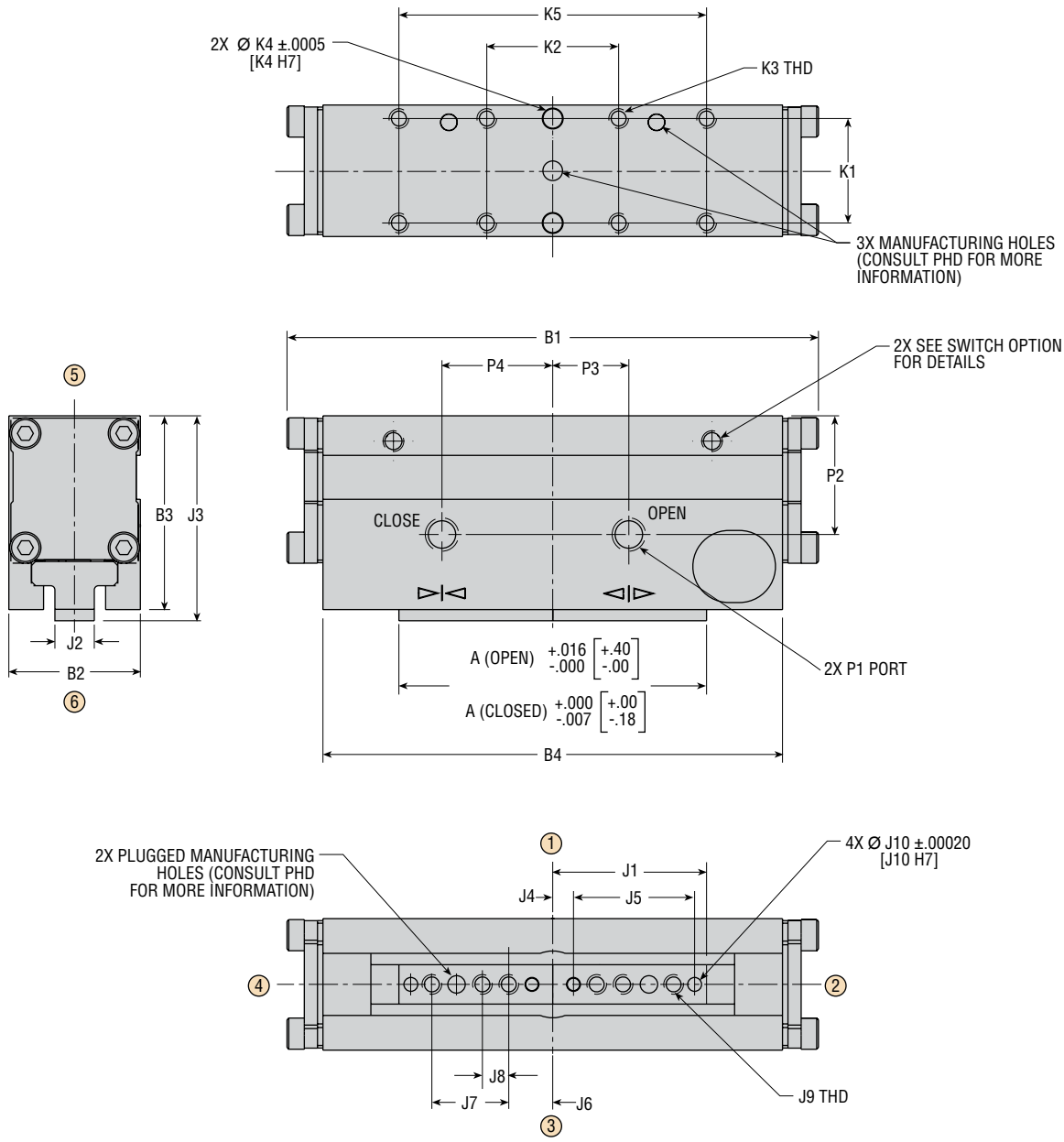
TOTAL GRIP FORCE [lb] = (Pressure [psi] x G_F) x Tooling Length Factor

METRIC:

TOTAL GRIP FORCE [N] = (Pressure [bar] x G_F) x Tooling Length Factor

SIZING AND APPLICATION ASSISTANCE

See PHD Product Sizing Catalog for specific and complete sizing information.
Online sizing assistance is available at: ***www.phdinc.com/apps/sizing***



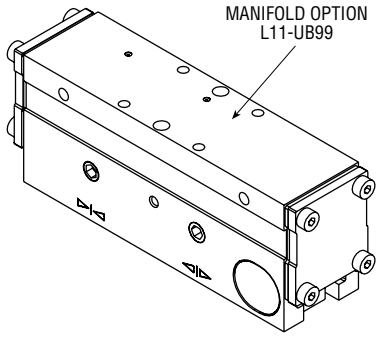
NOTES:
1) NUMBERS IN [ ] ARE mm.
2) CIRCLED NUMBERS INDICATE POSITIONS.
3) ALL DIMENSIONS ARE CENTERED ON CENTERLINE OF UNIT UNLESS OTHERWISE SPECIFIED.

All dimensions are reference only unless specifically toleranced.

LETTER DIM	MODEL NUMBER							
	GRLx2-x-14x7		GRLx2-x-14x13		GRLx2-x-16x20		GRLx2-x-16x26	
	in	mm	in	mm	in	mm	in	mm
MIN TRAVEL PER JAW	.138	3.5	.256	6.5	.394	10.0	.512	13.0
A CLOSED	1.500	38.1	1.750	44.5	2.250	57.2	2.625	66.7
A OPEN	1.778	45.2	2.264	57.5	3.042	77.3	3.653	92.8
B1	2.316	58.8	3.022	76.8	3.905	99.2	4.614	117.2
B2	.748	19.0	.748	19.0	.874	22.2	.874	22.2
B3	1.102	28.0	1.102	28.0	1.230	31.2	1.230	31.2
B4	1.908	48.5	2.614	66.4	3.497	88.8	4.206	106.8
J1	.750	19.1	.875	22.2	1.125	28.6	1.313	33.3
J2	.2240	5.69	.2240	5.69	.2240	5.69	.2240	5.69
J3	1.162	29.5	1.162	29.5	1.281	32.5	1.281	32.5
J4	.118	3.0	.118	3.0	.118	3.0	.118	3.0
J5	.5709	14.50	.6890	17.50	.9055	23.00	1.1024	28.00
J6	.250	6.4	.250	6.4	.250	6.4	.250	6.4
J7	.312	7.92	.438	11.11	.625	15.88	.750	19.05
J8	—	—	—	—	.250	6.35	.250	6.35
J9	4 x 4-40 x .190 DP	4 x M3 x 0.5 x 4.8 DP	4 x 4-40 x .190 DP	4 x M3 x 0.5 x 4.8 DP	6 x 5-40 x .190 DP	6 x M3 x 0.5 x 4.8 DP	6 x 5-40 x .190 DP	6 x M3 x 0.5 x 4.8 DP
J10	.07893 x .118 DP	2.0 x 3.0 DP	.07893 x .118 DP	2.0 x 3.0 DP	.07893 x .118 DP	2.0 x 3.0 DP	.07893 x .118 DP	2.0 x 3.0 DP
K1	.594	15.1	.594	15.1	.656	16.7	.656	16.7
K2	.750	19.1	.750	19.1	1.000	25.4	1.000	25.4
K3	4 x 4-40 x .150 DP	4 x M3 x 0.5 x 3.8 DP	4 x 4-40 x .150 DP	4 x M3 x 0.5 x 3.8 DP	8 x 5-40 x .197 DP	8 x M3 x 0.5 x 5.0 DP	8 x 5-40 x .197 DP	8 x M3 x 0.5 x 5.0 DP
K4	.0947 x .157 DP	3.0 x 4.0 DP	.0947 x .157 DP	3.0 x 4.0 DP	.1259 x .157 DP	3.0 x 4.0 DP	.1259 x .157 DP	3.0 x 4.0 DP
K5	—	—	—	—	1.772	45.0	1.772	45.0
P1	10-32	M5 x 0.8	10-32	M5 x 0.8	10-32	M5 x 0.8	10-32	M5 x 0.8
P2	.675	17.1	.675	17.1	.778	19.8	.778	19.8
P3	.296	7.5	.433	11.0	.512	13.0	.689	17.5
P4	.354	9.0	.630	16.0	1.220	31.0	1.575	40.0

L11-UB99

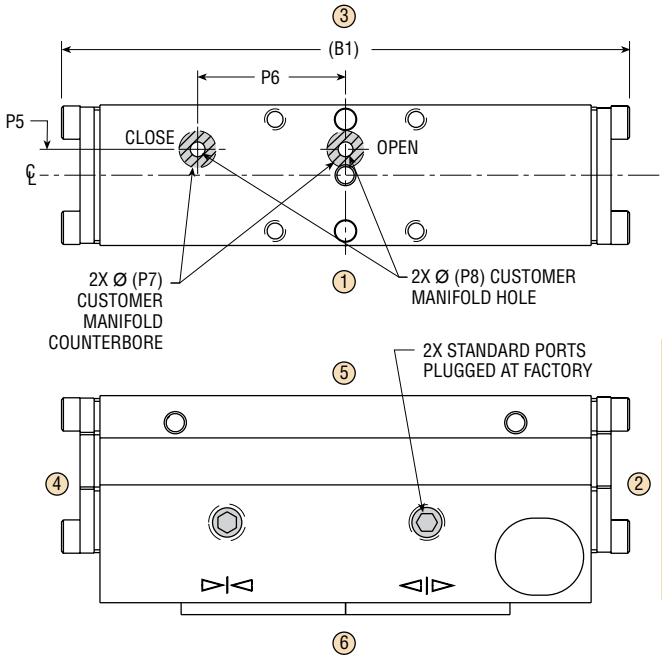
This option configures the gripper for manifold mounting on the standard mounting surface. The standard ports are plugged. O-rings are provided for sealing between the gripper and the manifold.

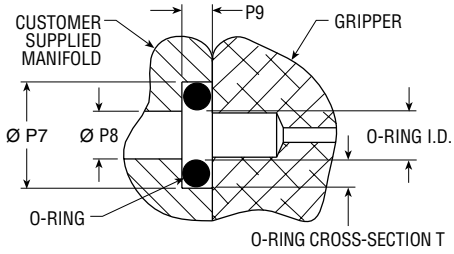


TYPE	MANIFOLD REPLACEMENT KIT NUMBER			
	GRLx2-x-14x7	GRLx2-x-14x13	GRLx2-x-16x20	GRLx2-x-16x26
IMPERIAL	68221-14-1-1	68221-14-1-1	68221-16-1-1	68221-16-1-1
METRIC	68221-14-5-1	68221-14-5-1	68221-16-5-1	68221-16-5-1

Manifold kit includes port plugs and o-rings.

MANIFOLD OPTION L11-UB99





MANIFOLD PORTING DIMENSIONS

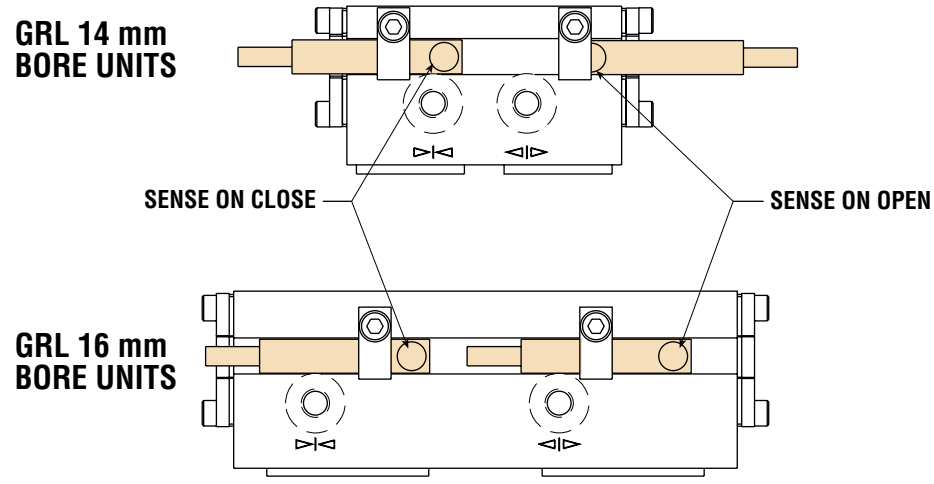
FOR CUSTOMER USE
(DIMENSIONS REQUIRED
ON CUSTOMER MOUNTING SURFACE)

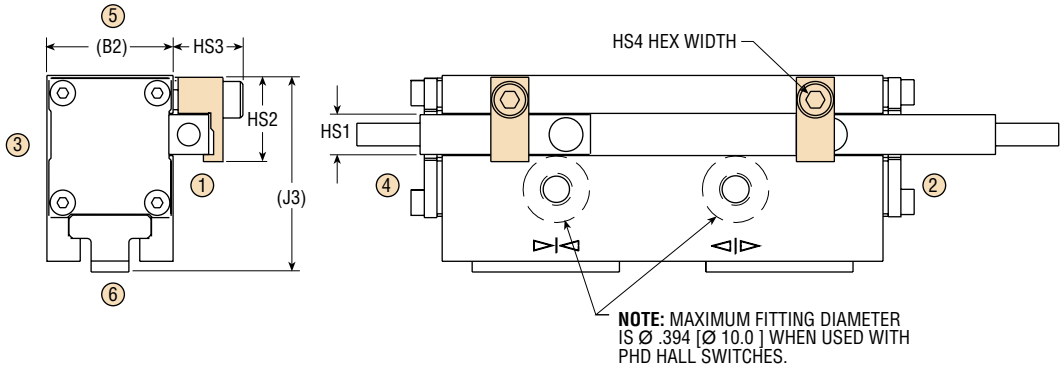
LETTER DIM	MODEL NUMBER							
	GRLx2-x-14x7		GRLx2-x-14x13		GRLx2-x-16x20		GRLx2-x-16x26	
	in	mm	in	mm	in	mm	in	mm
(B1)	2.316	58.8	3.022	76.8	3.905	99.2	4.614	117.2
P5	.138	3.5	.138	3.5	.157	4.0	.157	4.0
P6	.787	20.0	.787	20.0	1.378	35.0	1.378	35.0
P7	.197	5.0	.197	5.0	.197	5.0	.197	5.0
P7 O-RING (I.D. X T)	2 mm x 1.5 mm		2 mm x 1.5 mm		2 mm x 1.5 mm		2 mm x 1.5 mm	
P8	.078	2.0	.078	2.0	.078	2.0	.078	2.0
P9	.048	1.2	.048	1.2	.048	1.2	.048	1.2

NOTES:
1) ALL DIMENSIONS ARE CENTERED ON CENTERLINE OF UNIT UNLESS OTHERWISE SPECIFIED.
2) CIRCLED NUMBERS INDICATE POSITIONS.

E

The -E option is comprised of Hall Effect magnets installed in the pistons to actuate PHD 6 mm square Hall Effect Switches. PHD Hall Effect Switches and mounting kits are required in addition to the -E option and are sold separately. See charts below for switches and mountings.





-E HALL SWITCH READY

LETTER DIM	MODEL NUMBER							
	GRLx2-x-14x7		GRLx2-x-14x13		GRLx2-x-16x20		GRLx2-x-16x26	
	in	mm	in	mm	in	mm	in	mm
(B2)	.748	19.0	.748	19.0	.874	22.2	.874	22.2
(J3)	1.162	29.5	1.162	29.5	1.281	32.5	1.281	32.5
HS1	6 mm SQUARE		6 mm SQUARE		6 mm SQUARE		6 mm SQUARE	
HS2	.511	13.0	.511	13.0	.611	15.5	.611	15.5
HS3	.420	10.7	.420	10.7	.420	10.7	.420	10.7
HS4 HEX	2.5 mm		2.5 mm		2.5 mm		2.5 mm	

6 mm SQUARE HALL EFFECT SWITCHES

PART NO.	COLOR	DESCRIPTION
55803-1-02	Yellow	NPN (Sink) 4.5-24 VDC, 2 meter cable
55804-1-02	Red	PNP (Source) 4.5-24 VDC, 2 meter cable
55823-1	Yellow	NPN (Sink) 4.5-24 VDC, Quick Connect
55824-1	Red	PNP (Source) 4.5-24 VDC, Quick Connect

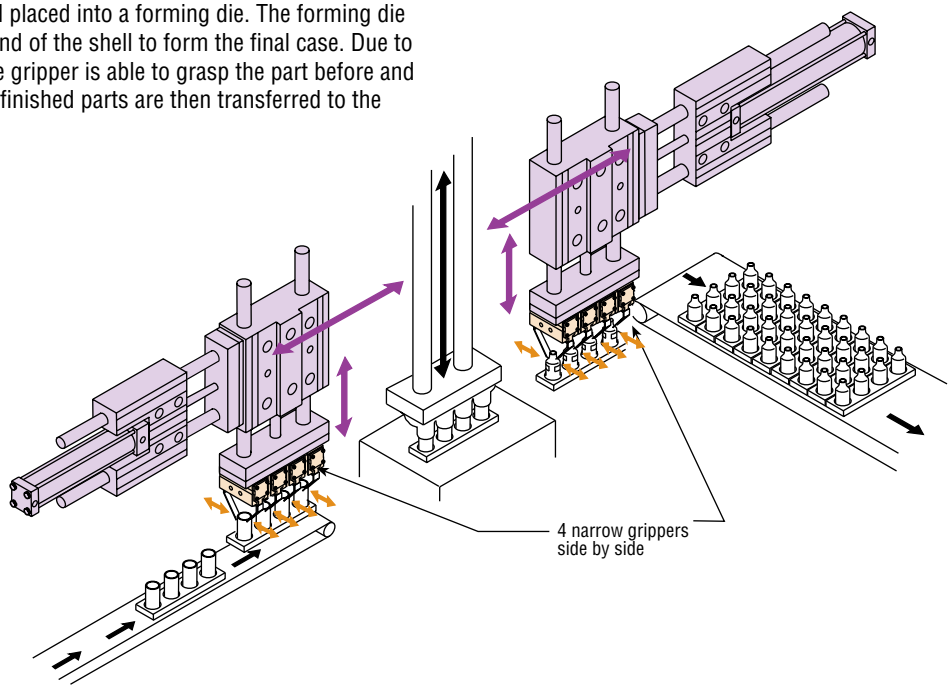
HALL EFFECT SWITCH MOUNTING KIT

PART NO.	DESCRIPTION
68487-1	Switch Mounting Kit

Each mounting kit contains:
1 6 mm square switch bracket
1 mounting screw

MULTIPLE PART TRANSFER

In this application example the narrow profile long stroke capability of this gripper allows for multiple parts to be transferred simultaneously. Four of the preformed cosmetic case shells are grasped and placed into a forming die. The forming die coins and tapers the end of the shell to form the final case. Due to the long jaw travel, the gripper is able to grasp the part before and after it is formed. The finished parts are then transferred to the next operation.

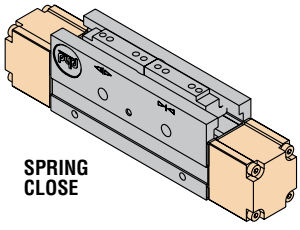


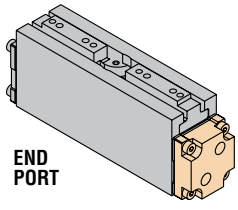
PHD UNLIMITED™ UNIQUE SOLUTIONS

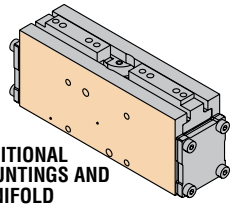
Illustrations shown are for concept only. Other variations include:

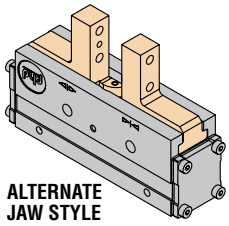
- Smaller or larger bore sizes and strokes
- Stroke adjustment on open
- Fluid compatibility
- Alternate materials

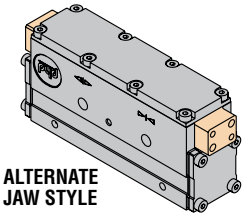
Contact PHD, Inc. with your product requirements.

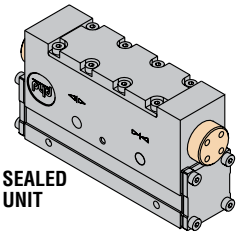

SPRING CLOSE


END PORT


ADDITIONAL MOUNTINGS AND MANIFOLD

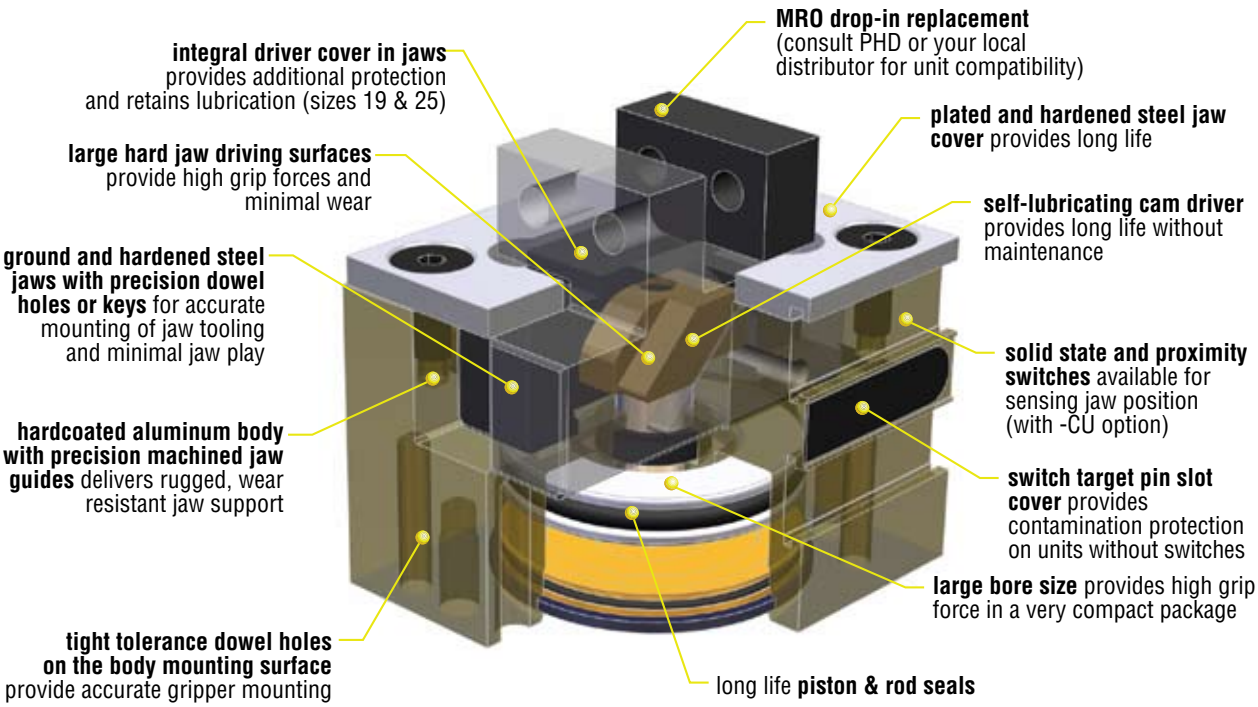

ALTERNATE JAW STYLE


ALTERNATE JAW STYLE


SEALED UNIT

GRF

LOW PROFILE, HIGH FORCE



Major Benefits

- Competitive interchange opportunity
- Jaw covers help prevent contamination and maintain lubrication by covering jaw working mechanisms at all times
- One or two jaw travels per size available
- Four total sizes available in both imperial and metric versions
- Low profile
- 1-2 day shipping
- 6 million cycles minimum rated life

Industry Uses

- Assembly machine builders
- Light bulb manufacturing
- Powdered metal
- Medical
- Cosmetics
- Semiconductor
- Vehicle lighting equipment

ORDERING DATA: SERIES GRF GRIPPERS

TO ORDER SPECIFY:
Product Line, Series, Type, Grip, Jaw, Design No., Size, Total Jaw Travel, and Options required.

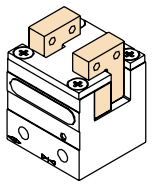
SERIES	GRIP	DESIGN NO.					OPTIONS	
Regular Duty	High Force	(See Note)					(OMIT IF NOT REQUIRED)	SENSOR OPTION
		1 - Imperial						CU - Sensor Ready
G	R	F	3	3	- 1 -	28	x 6 -	CU

PRODUCT LINE	TYPE	JAW STYLE
G - Gripper	Short Parallel Replacement	1 - (Size 19) 4 - (Size 25) 3 - (Size 28 & 32)

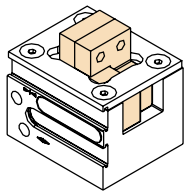
SIZE	BORE SIZE Diameter mm	(in)	MINIMUM TOTAL JAW TRAVEL Total Travel Per Bore Size mm	(in)
19	19	(.748)	4.5	(.177)
25	25	(.984)	6.5	(.256)
28	27	(1.063)	6	(.250)
28	27	(1.063)	10	(.394)
32	32	(1.260)	8	(.315)
32	32	(1.260)	13	(.512)

NOTE: Design number indicates imperial or metric mounting holes, dowel pin holes, and ports.

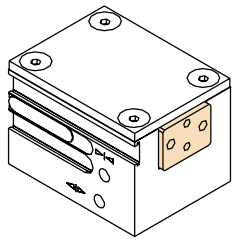
Please refer to the Accessories section for switch and kit information.



SIZE 19
JAW STYLE 1



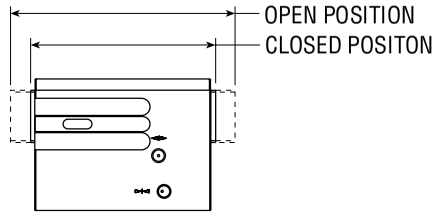
SIZE 25
JAW STYLE 4



SIZE 28/32
JAW STYLE 3

UNIQUE GRIPPERS ARE AVAILABLE.
SEE PAGES 4-139 TO 4-164.

TOTAL JAW TRAVEL =
OPEN POSITION - CLOSED POSITION



6 mm SQUARE INDUCTIVE PROXIMITY SWITCHES (SIZE 19)

PART NUMBER	DESCRIPTION
18431-001-02	NPN (Sink) 10-30 VDC, 2 meter cable
18431-002-02	PNP (Source) 10-30 VDC, 2 meter cable

4 mm ROUND INDUCTIVE PROXIMITY SWITCHES (SIZE 25, 28, & 32)

PART NUMBER	DESCRIPTION
18430-001-02	NPN (Sink) 10-30 VDC, 2 meter cable
18430-002-02	PNP (Source) 10-30 VDC, 2 meter cable

SERIES 5580 HALL EFFECT SWITCHES (SIZE 19)

PART NUMBER	DESCRIPTION
55803-1-02	NPN (Sink) 4.5-24 VDC, 2 meter cable
55804-1-02	PNP (Source) 4.5-24 VDC, 2 meter cable
55823-1	NPN (Sink) 4.5-24 VDC, Quick Connect
55824-1	PNP (Source) 4.5-24 VDC, Quick Connect

SERIES 6790 SOLID STATE & REED SWITCHES (SIZE 25, 28, & 32)

PART NUMBER	DESCRIPTION
67923-1	NPN (Sink) Solid State 4.5-30 VDC, Quick Connect
67903-1-02	NPN (Sink) Solid State 4.5-30 VDC, 2 meter cable
67903-1-05	NPN (Sink) Solid State 4.5-30 VDC, 5 meter cable
67924-1	PNP (Source) Solid State 4.5-30 VDC, Quick Connect
67904-1-02	PNP (Source) Solid State 4.5-30 VDC, 2 meter cable
67904-1-05	PNP (Source) Solid State 4.5-30 VDC, 5 meter cable
67922-1	PNP (Source) or NPN (Sink) DC Reed 4.5-30 VDC, Quick Connect
67902-1-02	PNP (Source) or NPN (Sink) DC Reed 4.5-30 VDC, 2 meter cable
67902-1-05	PNP (Source) or NPN (Sink) DC Reed 4.5-30 VDC, 5 meter cable
63549-02	2 meter Cordset with Quick Connect
63549-05	5 meter Cordset with Quick Connect
67929-2	AC Reed, Current Limited, Quick Connect

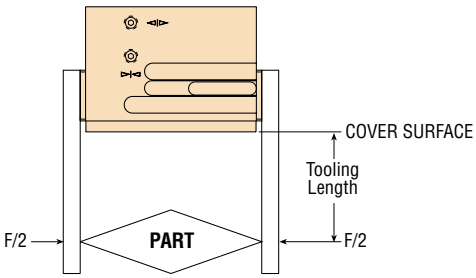
SPECIFICATIONS	SERIES GRF
OPERATING PRESSURE	
STANDARD UNIT	30 psi min to 100 psi max [2 bar min to 7 bar max] air
OPERATING TEMPERATURE	-20° to +180°F [-28° to +82°C]
RATED LIFE	6 million cycles minimum
GRIP REPEATABILITY	Within ±0.002 in [±0.05 mm] of original centered position
CYCLE TIME	See table below
LUBRICATION	Factory lubricated for rated life
MAINTENANCE	Field repairable

SIZE	MINIMUM TOTAL JAW TRAVEL		TOTAL CLOSE GRIP FORCE AT 87 psi [6 bar]		GRIPPER WEIGHT		CLOSE OR OPEN TIME 87 psi [6 bar]	DISPLACEMENT		GRIP FORCE FACTOR G_F EXTERNAL GRIP		GRIP FORCE FACTOR G_F INTERNAL GRIP	
	in	mm	lb	N	lb	kg	sec	in^3	cm^3	IMPERIAL	METRIC	IMPERIAL	METRIC
19 x 4.5	0.177	4.5	30	135	0.19	0.09	0.08	0.068	1.1	0.35	23	0.38	25
25 x 6.5	0.256	6.5	35	156	0.28	0.13	0.11	0.134	2.2	0.40	26	0.43	28
28 x 6	0.250	6	77	341	0.54	0.24	0.13	0.182	3.0	0.88	57	0.93	60
28 x 10	0.394	10	48	213	0.54	0.24	0.13	0.182	3.0	0.55	36	0.59	38
32 x 8	0.315	8	116	516	1.0	0.45	0.16	0.335	5.5	1.33	86	1.42	92
32 x 13	0.512	13	85	378	1.0	0.45	0.16	0.335	5.5	0.98	63	1.04	67

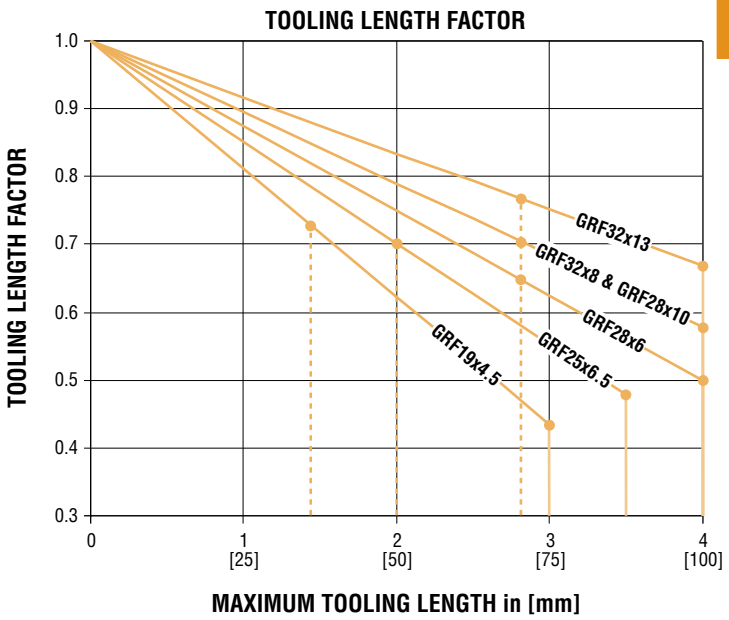
TOOLING LENGTH FACTOR

Jaw tooling should be designed so that the grip point is as close to the cover surface as possible. As the grip point is moved away from the cover surface, the applied moment causes jaw friction to increase, resulting in reduced effective grip force. The Grip Force Factor (G_F) values given in the table above are for zero tooling length (cover surface).

The Tooling Length Factor graph shows maximum tooling lengths at 40 psi and 100 psi. Refer to sizing software for maximum tooling lengths at other pressures.



F = Total Grip Force



NOTE:
At 100 psi [7 bar]
At 40 psi [2.76 bar]

SIZING AND APPLICATION ASSISTANCE
See PHD Product Sizing Catalog for specific and complete sizing information.
Online sizing assistance is available at:
www.phdinc.com/apps/sizing

GRIP FORCE CALCULATION EQUATIONS:

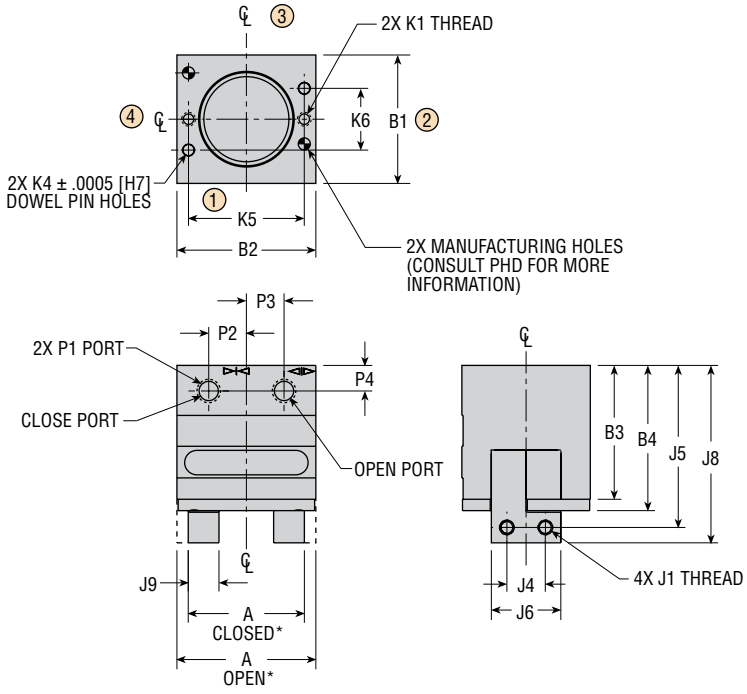
IMPERIAL:

TOTAL GRIP FORCE [lb] = (Pressure [psi] x G_F) x Tooling Length Factor

METRIC:

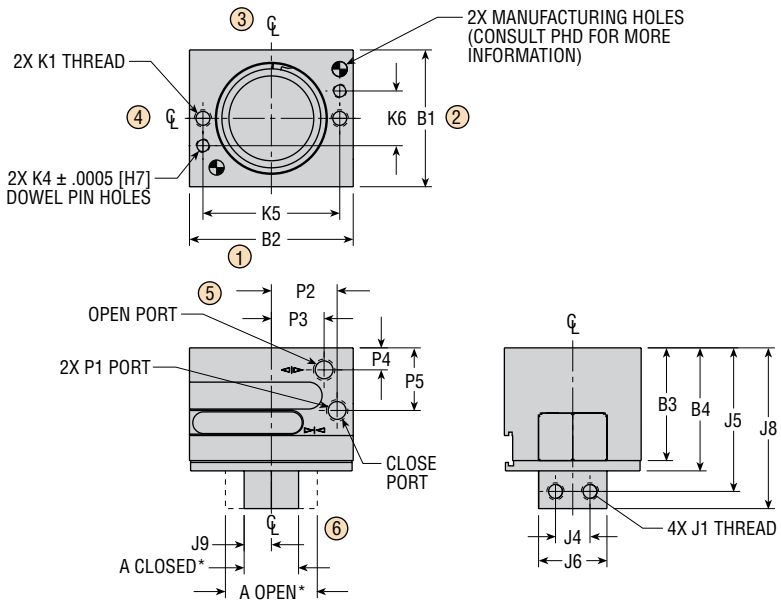
TOTAL GRIP FORCE [N] = (Pressure [bar] x G_F) x Tooling Length Factor

GRF31-x-19



LETTER DIMENSION	MODEL GRF31-x-19x4.5 in	mm
MIN. TRAVEL PER JAW	.088	2.25
A CLOSED*	.960	24.4
A OPEN*	1.130	28.7
B1	1.042	26.5
B2	1.127	28.6
B3	1.086	27.6
B4	1.178	29.9
J1	6-32	M3 x .5
J4	.313	7.94
J5	1.314	33.4
J6	.5615	14.26
J8	1.439	36.6
J9	.2490	6.32
K1	4-40 x .375 DP	M3 x .5 x 9.5 DP
K4	.0943 x .250 DP	3.0 x 6.0 DP
K5	.9375	23.81
K6	.5000	12.70
P1	10-32	M5 x .8
P2	.305	7.7
P3	.305	7.7
P4	.207	5.3

GRF34-x-25

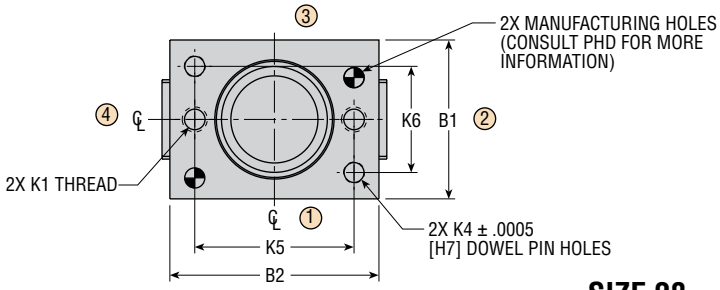


LETTER DIMENSION	MODEL GRF34-x-25x6.5 in	mm
MIN. TRAVEL PER JAW	.128	3.25
A CLOSED*	.500	12.7
A OPEN*	.750	19.1
B1	1.252	31.8
B2	1.498	38.0
B3	1.032	26.2
B4	1.126	28.6
J1	6-32	M4 x .7
J4	.315	8.00
J5	1.314	33.4
J6	.6245	15.86
J8	1.471	37.4
J9	.2490	6.32
K1	6-32 x .375 DP	M4 x .7 x 9.5 DP
K4	.1255 x .250 DP	3.0 x 6.0 DP
K5	1.2500	31.75
K6	.5000	12.70
P1	10-32	M5 x .8
P2	.601	15.3
P3	.482	12.2
P4	.202	5.1
P5	.573	14.6

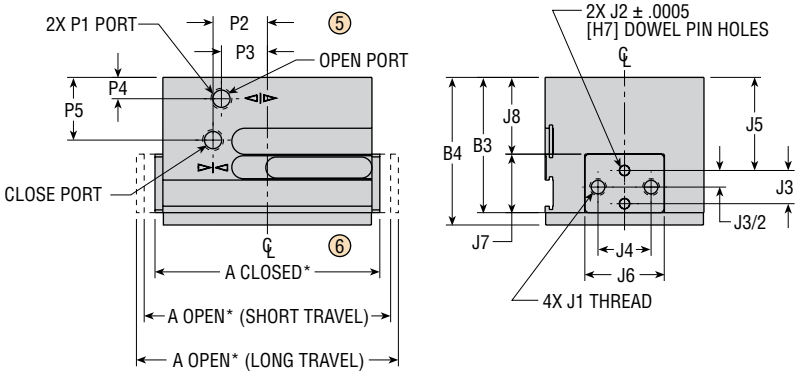
NOTES:
1) DESIGNATED ℄ IS CENTERLINE OF UNIT
2) METRIC INFORMATION SHOWN IN [ ]
3) * A OPEN REFLECTS THE SMALLEST POSSIBLE OPEN DIMENSION
   A CLOSED REFLECTS THE LARGEST POSSIBLE CLOSED DIMENSION
4) CIRCLED NUMBERS INDICATE POSITIONS

All dimensions are reference only unless specifically toleranced.

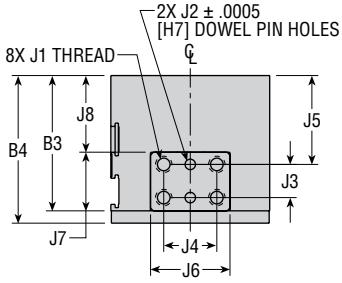
GRF33-x-28 & GRF33-x-32



SIZE 28



SIZE 32

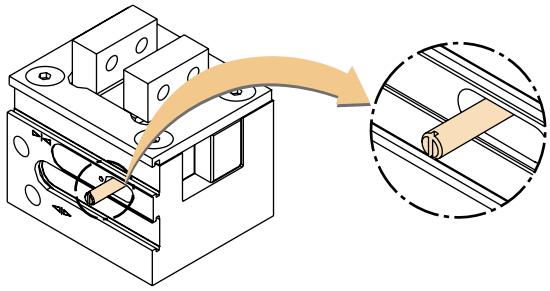


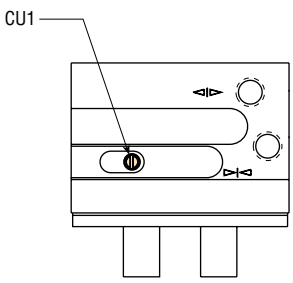
NOTES:
1) DESIGNATED ℄ IS CENTERLINE OF UNIT
2) METRIC INFORMATION SHOWN IN [ ]
3) * A OPEN REFLECTS THE SMALLEST POSSIBLE OPEN DIMENSION
   A CLOSED REFLECTS THE LARGEST POSSIBLE CLOSED DIMENSION
4) CIRCLED NUMBERS INDICATE POSITIONS

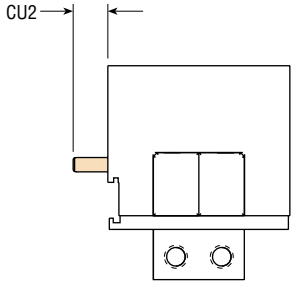
LETTER DIMENSION	MODEL GRF33-x-28 in	MODEL GRF33-x-28 mm	MODEL GRF33-x-32 in	MODEL GRF33-x-32 mm
MIN. TRAVEL PER JAW (SHORT TRAVEL)	.118	3.0	.157	4.0
MIN. TRAVEL PER JAW (LONG TRAVEL)	.197	5.0	.256	6.5
A CLOSED*	2.126	54.0	2.690	68.3
A OPEN SHORT*	2.370	60.2	3.000	76.2
A OPEN LONG*	2.500	63.5	3.190	81.0
B1	1.498	38.0	1.616	41.0
B2	1.968	50.0	2.522	64.1
B3	1.276	32.4	1.705	43.3
B4	1.392	35.4	1.866	47.4
J1	8-32 x .315 DP	M4 x .7 x 8.0 DP	10-32 x .394 DP	M5 x .8 x 10 DP
J2	.0947 x .197 DP	2.5 x 5.0 DP	.1283 x .236 DP	4.0 x 6.0 DP
J3	.3125	7.94	.375	9.5
J4	.500	12.7	.6875	17.46
J5	.878	22.3	1.121	28.5
J6	.7477	19.0	.9840	25.0
J7	.5509	14.0	.7477	19.0
J8	.724	18.4	.956	24.3
K1	1/4-20 x .500 DP	M6 x 1.0 x 12.5 DP	1/4-20 x .591 DP	M6 x 1.0 x 15.0 DP
K4	.1880 x .374 DP	5.0 x 9.5 DP	.1880 x .256 DP	5.0 x 6.5 DP
K5	1.5000	38.1	2.0000	50.8
K6	1.000	25.4	.7500	19.05
P1	10-32	M5 x .8	10-32	M5 x .8
P2	.512	13.0	.591	15.0
P3	.433	11.0	.591	15.0
P4	.202	5.1	.236	6.0
P5	.592	15.0	.807	20.5

CU SENSOR READY

With this option the gripper includes a target pin attached to the jaw for use with inductive proximity switches as well as the Solid State and Reed switches. Switches and switch mounting kits are required in addition to the CU option and are sold separately. See Accessories pages for switches and mounting kits.







LETTER DIM	MODEL NUMBER							
	GRF31-x-19x4.5		GRF34-x-25x6.5		GRF33-x-28x6 or 10		GRF33-x-32x8 or 13	
	in	mm	in	mm	in	mm	in	mm
CU1	.098	2.5	.098	2.5	.098	2.5	.098	2.5
CU2	.321	8.2	.238	6.0	.185	4.7	.256	6.5

All dimensions are reference only unless specifically toleranced.

PROXIMITY SWITCHES (-CU OPTION REQUIRED)

6 mm SQUARE INDUCTIVE PROXIMITY SWITCHES (SIZE 19)

PART NUMBER	DESCRIPTION
18431-001-02	NPN (Sink) 10-30 VDC, 2 meter cable
18431-002-02	PNP (Source) 10-30 VDC, 2 meter cable

4 mm ROUND INDUCTIVE PROXIMITY SWITCHES (SIZE 25, 28, & 32)

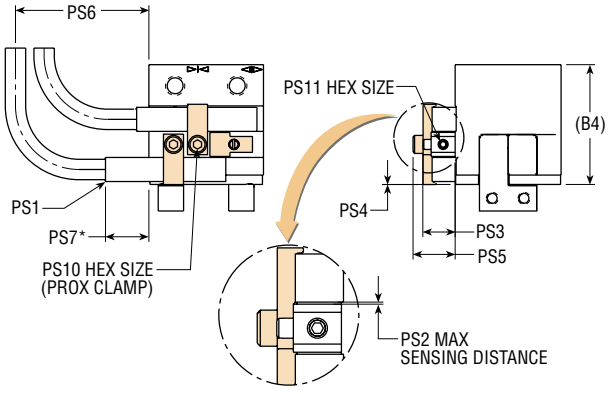
PART NUMBER	DESCRIPTION
18430-001-02	NPN (Sink) 10-30 VDC, 2 meter cable
18430-002-02	PNP (Source) 10-30 VDC, 2 meter cable

PROXIMITY SWITCH MOUNTING KITS

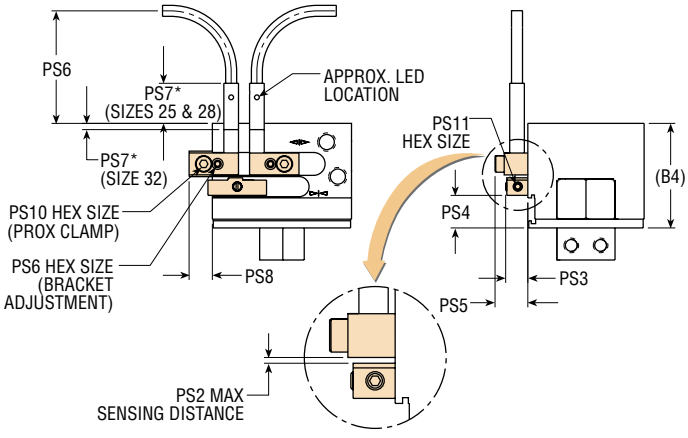
SIZE	KIT NUMBER
19	73722-19
25	73722-25
28	73722-28
32	73722-32

NOTES:
1) Each kit includes 1 target, 2 switch mounting brackets, and fasteners for mounting. Switches sold separately.
2) See switches and sensors section for additional switch information and complete specification.

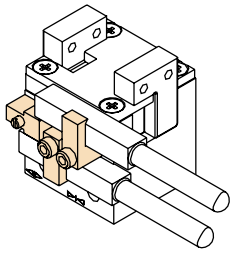
GRF SIZE 19



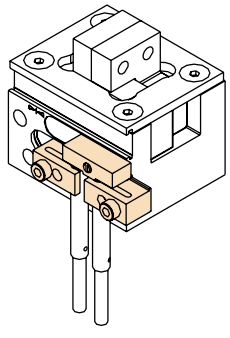
GRF SIZES 25, 28 & 32



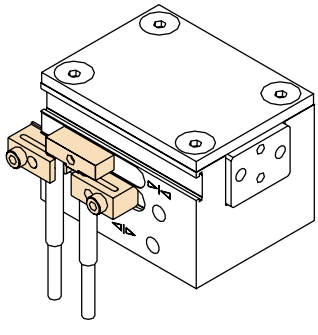
GRF SIZE 19



GRF SIZE 25



GRF SIZE 28 & 32



LETTER DIM	SIZE 19 in	19 mm	25 in	25 mm	28 in	28 mm	32 in	32 mm
PS1	6 mm SQUARE		4 mm ROUND		4 mm ROUND		4 mm ROUND	
PS2	.031	.8	.020	.5	.020	.5	.020	.5
PS3	.340	8.6	.236	6.0	.236	6.0	.276	7.0
PS4	.001	.0	.354	9.0	.454	11.5	.551	14.0
PS5	.440	11.2	.393	10.0	.393	10.0	.393	10.0
PS6	1.370	34.8	1.377	35.0	1.218	30.9	.860	21.8
PS7*	.450	11.4	.435	11.0	.276	7.0	.082	2.1
PS8	—	—	.256	6.5	.165	4.2	.050	1.3
PS9	—	—	.051	1.3	.051	1.3	.051	1.3
PS10	.079	2.0	.079	2.0	.079	2.0	.079	2.0
PS11	.051	1.3	.051	1.3	.051	1.3	.051	1.3
(B4)	1.178	29.9	1.130	28.7	1.395	35.4	1.847	46.9

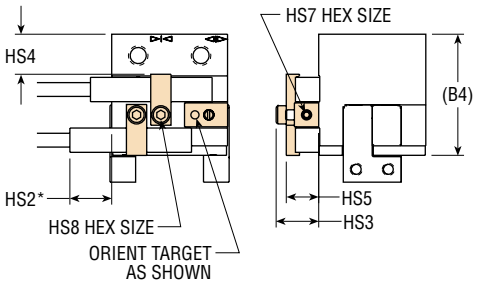
NOTES:
1) * INDICATES BOTTOM OF PROXIMITY SWITCH BARREL OR END OF 6 mm SQUARE PROXIMITY SWITCH, DOES NOT INCLUDE CABLE.
2) KITS REQUIRE THE -CU OPTION.

SERIES 6790 & 5580 SWITCHES (-CU OPTION REQUIRED)

SERIES 5580 HALL EFFECT SWITCHES (SIZE 19)

PART NUMBER	DESCRIPTION
55803-1-02	NPN (Sink) 4.5-24 VDC, 2 meter cable
55804-1-02	PNP (Source) 4.5-24 VDC, 2 meter cable
55823-1	NPN (Sink) 4.5-24 VDC, Quick Connect
55824-1	PNP (Source) 4.5-24 VDC, Quick Connect

GRF SIZE 19

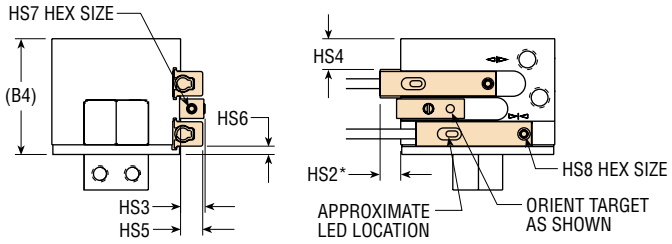


SERIES 6790 SOLID STATE & REED SWITCHES (SIZE 25, 28, & 32)

PART NUMBER	DESCRIPTION
67923-1	NPN (Sink) Solid State 4.5-30 VDC, Quick Connect
67903-1-02	NPN (Sink) Solid State 4.5-30 VDC, 2 meter cable
67903-1-05	NPN (Sink) Solid State 4.5-30 VDC, 5 meter cable
67924-1	PNP (Source) Solid State 4.5-30 VDC, Quick Connect
67904-1-02	PNP (Source) Solid State 4.5-30 VDC, 2 meter cable
67904-1-05	PNP (Source) Solid State 4.5-30 VDC, 5 meter cable
67922-1	PNP (Source) or NPN (Sink) DC Reed 4.5-30 VDC, Quick Connect
67902-1-02	PNP (Source) or NPN (Sink) DC Reed 4.5-30 VDC, 2 meter cable
67902-1-05	PNP (Source) or NPN (Sink) DC Reed 4.5-30 VDC, 5 meter cable
63549-02	2 meter Cordset with Quick Connect
63549-05	5 meter Cordset with Quick Connect
67929-2	AC Reed, Current Limited, Quick Connect

NOTE: Switch set screw torque to 16 in-oz [.11 Nm] max.

GRF SIZE 25

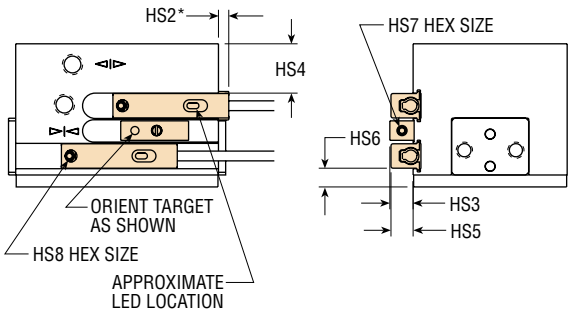


SWITCH MOUNTING KITS

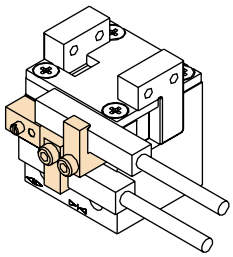
SIZE	HALL	REED	SOLID STATE
19	73723-19	–	–
25	–	76113-25	76112-25
28	–	76113-28	76112-28
32	–	76113-32	76112-32

Each kit includes target, switch mounting brackets, and fasteners for mounting. Switches sold separately.

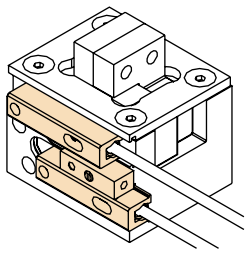
GRF SIZES 28 & 32



GRF SIZE 19



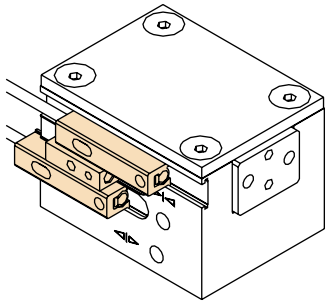
GRF SIZE 25



LETTER DIM	SIZE 19 in	19 mm	25 in	25 mm	28 in	28 mm	32 in	32 mm
HS1	Series 5580		Series 6790		Series 6790		Series 6790	
HS2	.430	10.9	.220	5.6	.040	1.0	.040	1.0
HS3	.435	11.0	.236	6.0	.236	6.0	.266	6.8
HS4	.380	9.7	.315	8.0	.483	12.3	.835	21.2
HS5	.340	8.6	.260	6.6	.246	6.2	.214	5.4
HS6	—	—	.060	1.5	.185	4.7	.282	7.2
HS7 HEX	.051	1.3	.051	1.3	.051	1.3	.051	1.3
HS8 HEX	.079	2.0	.051	1.3	.051	1.3	.051	1.3
(B4)	1.178	28.7	1.126	28.7	1.395	35.4	1.847	46.9

NOTE: * INDICATES END OF SWITCH HOUSING, DOES NOT INCLUDE CABLE.

GRF SIZE 28 & 32



All dimensions are reference only unless specifically toleranced.

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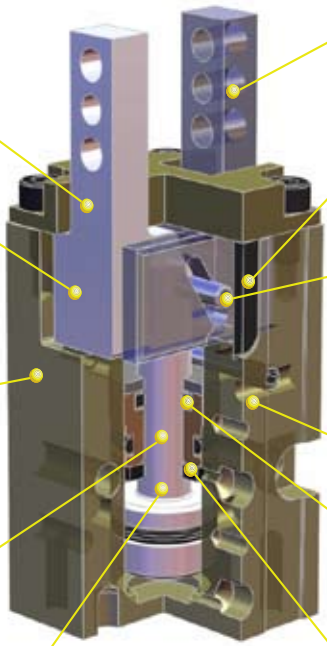
COMPACT SIZE WITH TWO JAW STYLES

JAW STYLE 1

JAW STYLE 2



maximum grip force direction (open or close) is customer selected on units with jaw style 2

close tolerance components minimize jaw play

hardcoated aluminum body with precision dowel holes provides a wear resistant jaw guide

stainless steel piston and rod for corrosion resistance

spring assist available on sizes 19x7x through 19x9x for higher grip force or part retention upon loss of air pressure

2 styles of hardened steel jaws provide dowel holes or male keys for precise location of tooling

switch pin slot is covered on units without switches for contamination protection

pin driver keyed to body for centering repeatability

hall or proximity switches available for sensing position

fluoro-elastomer seals are available for fluid compatibility

shock pad is standard on all sizes for impact absorption

Major Benefits

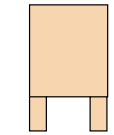
- Compact size
- Spring assist on open or close
  Spring assist available on sizes 19x7x through 19x9x
  Spring assist available in four sizes, two jaw styles, two jaw travels
- Mounting holes on one or three surfaces
- Jaw travel adjustment kits available
- 1 day shipping
- 10 million cycles minimum rated life with standard seals (includes spring assist units)

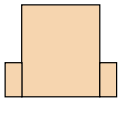
Industry Uses

- Assembly machine builders
- Light bulb manufacturing
- Vehicle lighting equipment
- Medical
- Batteries
- Bearing manufacturing

ORDERING DATA: SERIES 190 & 191 PARALLEL GRIPPERS

TO ORDER SPECIFY:
Model, Design No., Sensor or Switch Ready Options, Maximum Force, Spring Options, and Seals.


JAW STYLE 1


JAW STYLE 2

DESIGN NO.

MAXIMUM FORCE REVERSED JAW MOVEMENT
0 - Maximum Force on Open
5 - Maximum Force on Close
(Available on Jaw Style 2 only)

SPRING OPTIONS
0 - None
3 - Spring Assist Close
(Available with -x53x Option combination only)
4 - Spring Assist Open
(Available with -x04x Option combination only.)
(Not available on 19x6x size.)

SEALS
1 - Buna-N (Standard)
2 - Fluoro-Elastomer

19171 - 2 - 0 5 3 1

MODEL	BORE SIZE mm	BORE SIZE in	190 MODELS FULL MOUNTING IMPERIAL	190 MODELS FULL MOUNTING METRIC	191 MODELS BOTTOM MOUNTING IMPERIAL	191 MODELS BOTTOM MOUNTING METRIC
JAW STYLE 1			**JAW STYLE 1**	**JAW STYLE 1**	**JAW STYLE 1**	**JAW STYLE 1**
19x6x	8.7	.343	19060	19065	19160	19165
19x7x	12.7	.500	19070	19075	19170	19175
19x8x	19	.750	19080	19085	19180	19185
19x9x	25.4	1.00	19090	19095	19190	19195
JAW STYLE 2 SHORT TRAVEL			**JAW STYLE 2 SHORT TRAVEL**	**JAW STYLE 2 SHORT TRAVEL**	**JAW STYLE 2 SHORT TRAVEL**	**JAW STYLE 2 SHORT TRAVEL**
19x6x	8.7	.343	19061	19066	19161	19166
19x7x	12.7	.500	19071	19076	19171	19176
19x8x	19	.750	19081	19086	19181	19186
19x9x	25.4	1.00	19091	19096	19191	19196
LONG TRAVEL			**LONG TRAVEL**	**LONG TRAVEL**	**LONG TRAVEL**	**LONG TRAVEL**
19x6x	8.7	.343	19062	19067	19162	19167
19x7x	12.7	.500	19072	19077	19172	19177
19x8x	19	.750	19082	19087	19182	19187
19x9x	25.4	1.00	19092	19097	19192	19197

SENSOR OR SWITCH OPTIONS
0 - Plain
4 - Hall Effect Sensor/Set Point Module Ready (See note 1.)(Not available with Spring Option)
5 - Proximity Switch Ready
(6 mm square or Hall Effect proximity switches)

NOTES:
1) Sensor must be used with a PHD Set Point Module.
2) Switches and all kits must be ordered separately.

UNIQUE GRIPPERS ARE AVAILABLE.
SEE PAGES 4-139 TO 4-164.

HALL EFFECT SENSOR KITS

GRIPPER MODEL	PART NUMBER IMPERIAL	PART NUMBER METRIC
19x6x	18674-04	18057-04
19x7x	18675-04	18058-04
19x8x	18676-04	18059-04
19x9x	18677-04	18060-04

Sensors must be ordered separately. See Switches and Sensors section.

SWITCH BRACKETS & TARGET KITS FOR USE WITH: PHD SERIES 5580 SWITCHES

GRIPPER MODEL	PART NUMBER IMPERIAL	PART NUMBER METRIC
19x6x	59794-1	55770
19x7x	59795-1	55771
19x8x	55772	55772
19x9x	55773	55773

Switches must be ordered separately. See Switches and Sensors section.

SWITCH BRACKETS & TARGETS FOR INDUCTIVE PROXIMITY SWITCHES

GRIPPER MODEL	PART NUMBER IMPERIAL	PART NUMBER METRIC
19x6x	59792-1	18432
19x7x	59793-1	18437
19x8x	18438	18438
19x9x	18439	18439

Switches must be ordered separately. See Switches and Sensors section.

SPECIFICATIONS	SERIES 190 & 191
OPERATING PRESSURE	30 psi min to 150 psi max [2 bar min to 10 bar max] air
OPERATING TEMPERATURE	-20° to +180°F [-28° to +82°C]
RATED LIFE	10 million cycles minimum with standard seals (including spring assist units)
GRIP REPEATABILITY	Within ±0.002 in [±0.05 mm] of original centered position
LUBRICATION	Factory lubricated for rated life
MAINTENANCE	Field repairable

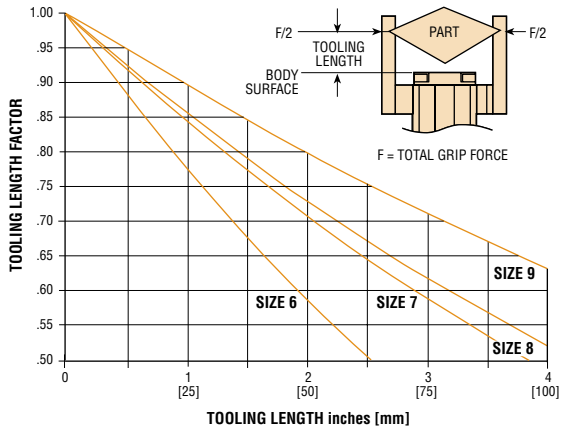
GRIPPER NO.	DISPLACEMENT		GRIPPER WEIGHT STANDARD		GRIPPER WEIGHT SPRING ASSIST		GRIP FORCE FACTOR G_F MAX. DIRECTION		GRIP FORCE FACTOR G_F MIN. DIRECTION		SPRING ASSIST GRIP FORCE S_F	
	in^3	cm^3	lb	kg	oz	g	Imperial*	Metric*	Imperial	Metric	Imperial	Metric
19x60 & 19x65	.012	0.2	0.11	0.05	—	—	.061	3.93	.049	3.16	—	—
19x61 & 19x66	.012	0.2	0.11	0.05	—	—	.061	3.93	.049	3.16	—	—
19x62 & 19x67	.012	0.2	0.13	0.06	—	—	.037	2.39	.029	1.87	—	—
19x70 & 19x75	.036	0.6	0.24	0.11	0.26	0.12	.122	7.87	.092	5.93	2.230	9.99
19x71 & 19x76	.036	0.6	0.25	0.11	0.26	0.12	.122	7.87	.092	5.93	2.230	9.99
19x72 & 19x77	.036	0.6	0.27	0.12	0.28	0.12	.093	6.00	.069	4.45	1.690	7.57
19x80 & 19x85	.110	1.8	0.64	0.29	0.65	0.29	.250	16.13	.210	13.55	4.280	19.17
19x81 & 19x86	.110	1.8	0.67	0.30	0.68	0.31	.250	16.13	.210	13.55	4.280	19.17
19x82 & 19x87	.110	1.8	0.71	0.32	0.73	0.33	.150	9.68	.130	8.39	2.630	11.78
19x90 & 19x95	.250	4.1	1.44	0.65	1.47	0.67	.490	31.61	.370	23.87	8.700	38.98
19x91 & 19x96	.250	4.1	1.46	0.66	1.48	0.67	.490	31.61	.370	23.87	8.700	38.98
19x92 & 19x97	.250	4.1	1.62	0.73	1.64	0.74	.270	17.42	.200	12.90	4.760	21.32

*Maximum grip force direction is always open (internal grip) on all Series 190 and 191 Jaw Style One units. (19x60, 19x65, 19x70, 19x75, 19x80, 19x85, 19x90, and 19x95)

TOOLING LENGTH FACTOR

Jaw tooling should be designed so that the grip point is as close to the body surface as possible. As the grip point is moved away from the body surface, the applied moment causes jaw friction to increase, resulting in reduced effective grip force. The grip force factor (G_F) values given in the table above are for zero tooling length (body surface).

TOOLING LENGTH FACTOR



GRIP FORCE CALCULATION EQUATIONS:

IMPERIAL:

TOTAL GRIP FORCE [lb] = (Pressure [psi] x G_F) x Tooling Length Factor

TOTAL GRIP FORCE WITH SPRINGS [lb] = ((Pressure [psi] x G_F) ± S_F [lb]) x Tooling Length Factor

METRIC:

TOTAL GRIP FORCE [N] = (Pressure [bar] x G_F) x Tooling Length Factor

TOTAL GRIP FORCE WITH SPRINGS [N] = ((Pressure [bar] x G_F) ± S_F [N]) x Tooling Length Factor

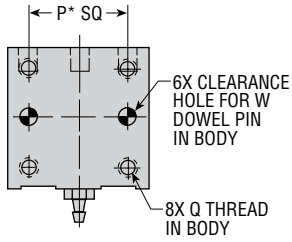
SIZING AND APPLICATION ASSISTANCE

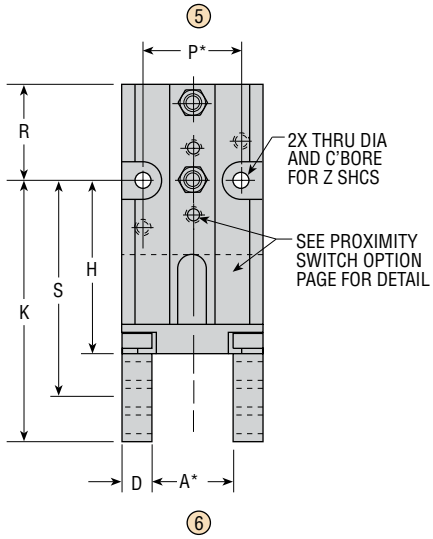
See PHD Product Sizing Catalog for specific and complete sizing information.
Online sizing assistance is available at: ***www.phdinc.com/apps/sizing***

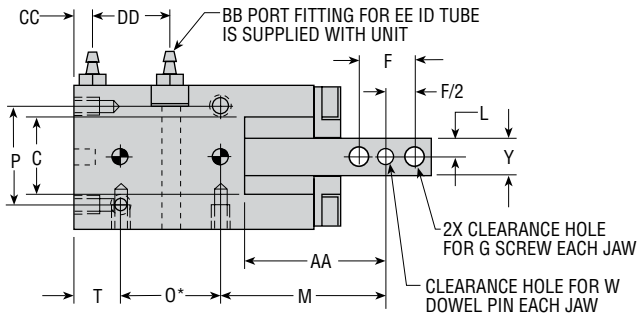
FULL MOUNTING IN POSITIONS 3 & 4

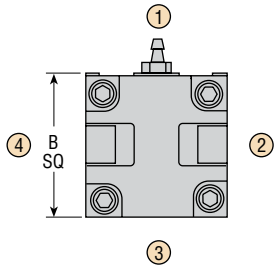
LETTER DIM.	MODEL NUMBER 19060 in	19065 mm	19070 in	19075 mm	19080 in	19085 mm	19090 in	19095 mm
NOMINAL JAW TRAVEL	.157	4	.276	7	.394	10	.512	13
A CLOSED**	.315	7.75	.345	8.75	.581	14.75	.700	17.75
A OPEN**	.403	10.25	.540	13.75	.915	23.25	1.150	29.25
B	.787	20.0	1.024	26.0	1.496	38.0	1.968	50.0
C	.398	10.0	.555	14.0	.791	20.0	1.027	26.0
D	.177	4.5	.215	5.5	.256	6.5	.394	10.0
F	.312	8.0	.375	10.0	.500	12.0	.625	16.0
G	#4	M2.5	#5	M3	#8	M4	#10	M5
H	1.012	25.5	1.289	32.0	1.635	41.0	2.081	53.0
K	1.563	39.5	1.937	48.5	2.500	63.5	3.242	82.5
L	.098	2.5	.138	3.5	.196	5.0	.256	6.5
M	1.031	26.01	1.249	31.0	1.624	41.0	2.108	53.5
O*	.5310	14.0	.6875	18.0	.8430	22.0	1.0940	28.0
P*	.550	14.0	.710	18.0	1.100	28.0	1.535	39.0
Q	4-40 x .19 DP	M3 x 0.5 x 4.5 DP	6-32 x .22 DP	M3 x 0.5 x 4.5 DP	8-32 x .28 DP	M4 x 0.7 x 6.0 DP	10-24 x .38 DP	M5 x 0.8 x 7.5 DP
R	.601	15.5	.681	18.0	.785	20.5	.870	22.0
S	1.312	33.0	1.624	40.0	2.062	52.0	2.655	67.5
T	.351	8.5	.367	9.0	.380	9.5	.322	8.0
W	3/32	2.5	1/8	3.0	1/8	4.0	3/16	5.0
Y	.196	5.0	.276	7.0	.393	10.0	.511	13.0
Z	#4	M3	#6	M3	#8	M4	#10	M5
AA	.871	22.0	1.045	26.0	1.412	36.0	1.854	47.0
BB	10-32	M3 x 0.5	10-32	M3 x 0.5	10-32	M5 x 0.8	10-32	M5 x 0.8
CC	.167	3.0	.176	3.5	.193	5.5	.153	4.5
DD	.465	12.5	.505	14.5	.592	15.0	.750	19.5
EE	1/16	2.5	1/16	2.5	1/16	3.0	1/16	3.0

NOTES:
1) *TOLERANCE BETWEEN DOWEL PIN HOLES IS ± .0008 [± 0.02]
2) NUMBERS IN [ ] ARE FOR METRIC UNITS AND ARE IN mm
3) CIRCLED NUMBERS INDICATE POSITIONS.
4) **A CLOSED REFLECTS THE LARGEST POSSIBLE CLOSED DIMENSION.
   A OPEN REFLECTS THE SMALLEST POSSIBLE OPEN DIMENSION.









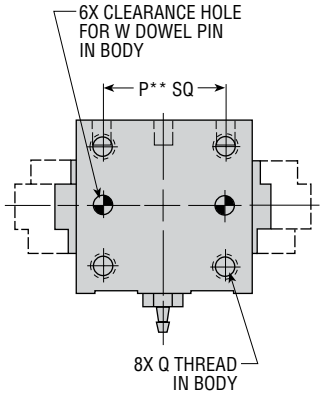
All dimensions are reference only unless specifically toleranced.

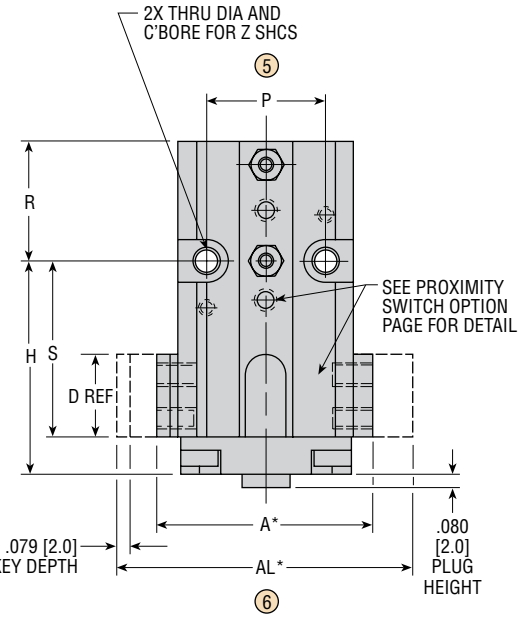
FULL MOUNTING IN POSITIONS 3 & 4

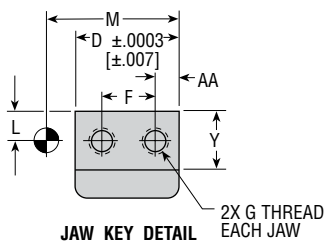
LETTER DIM.	MODEL NUMBER 19061/62 in	19066/67 mm	19071/72 in	19076/77 mm	19081/82 in	19086/87 mm	19091/92 in	19096/97 mm
NOMINAL JAW TRAVEL								
SHORT	.157	4	.276	7	.394	10	.512	13
LONG	.315	8	.433	11	.630	16	.866	22
A CLOSED*	1.054	26.75	1.329	33.75	1.841	46.75	2.353	59.75
A OPEN*	1.151	29.25	1.545	39.25	2.175	55.25	2.805	71.25
AL CLOSED*	1.447	36.75	1.802	45.75	2.353	59.75	2.865	72.75
AL OPEN*	1.702	43.25	2.175	55.25	2.923	74.25	3.671	93.25
B	.787	20.0	1.024	26.0	1.496	38.0	1.968	50.0
C	.398	10.0	.555	14.0	.791	20.0	1.027	26.0
D	.3937	10.0	.4921	12.5	.7480	19.0	.9842	25.0
F	.188	5.0	.250	6.5	.375	10.0	.625	12.0
G	3-56 x .18 DP	M2.5 x 0.45 x 5.0 DP	6-32 x .28 DP	M3 x 0.5 x 6.0 DP	8-32 x .32 DP	M4 x 0.7 x 8.0 DP	10-24 x .38 DP	M5 x 0.8 x 10.0 DP
H	1.012	25.5	1.289	32.0	1.635	41.0	2.081	53.0
K	.159	4.0	.204	5.0	.212	5.5	.254	6.5
L	.098	2.5	.138	3.5	.197	5.0	.256	6.5
M	.553	14.0	.696	17.5	.960	24.0	1.238	31.5
O**	.5310	14.0	.6875	18.0	.8430	22.0	1.0940	28.0
P**	.550	14.0	.710	18.0	1.100	28.0	1.535	39.0
Q	4-40 x .19 DP	M3 x 0.5 x 4.5 DP	6-32 x .22 DP	M3 x 0.5 x 4.5 DP	8-32 x .28 DP	M4 x 0.7 x 6.0 DP	10-24 x .38 DP	M5 x 0.8 x 7.5 DP
R	.601	15.5	.681	18.0	.785	20.5	.870	22.0
S	.834	21.0	1.071	26.5	1.398	35.0	1.785	45.5
T	.351	8.5	.367	9.0	.380	9.5	.322	8.0
W	3/32	2.5	1/8	3.0	1/8	4.0	3/16	5.0
Y	.1970 ±.0006	5.0 ±0.015	.2756 ±.0006	7.0 ±0.015	.3940 ±.0007	10.0 ±0.018	.5118 ±.0008	13.0 ±0.020
Z	#4	M3	#6	M3	# 8	M4	# 10	M5
AA	.103	2.5	.121	3.0	.186	4.5	.180	6.5
BB	10-32	M3 x 0.5	10-32	M3 x 0.5	10-32	M5 x 0.8	10-32	M5 x 0.8
CC	.167	3.0	.176	3.5	.193	5.5	.153	4.5
DD	.465	12.5	.505	14.5	.592	15.0	.750	19.5
EE	1/16	2.5	1/16	2.5	1/16	3.0	1/16	3.0

NOTES:

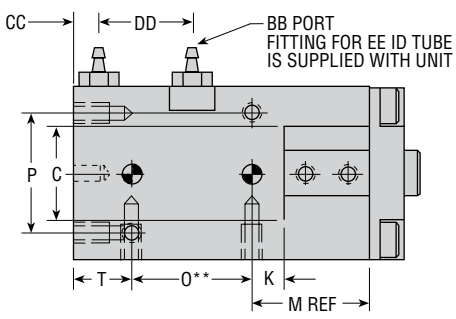
1) *A CLOSED & OPEN ARE FOR MODELS 19061, 71, 81, 91, 66, 76, 86, & 96
   AL CLOSED & OPEN ARE FOR MODELS 19062, 72, 82, 92, 67, 77, 87, & 97
2) **TOLERANCE BETWEEN DOWEL PIN HOLES IS ± .0008 [±0.02]
3) CIRCLED NUMBERS INDICATE POSITIONS.
4) *A OR AL CLOSED REFLECTS THE LARGEST POSSIBLE CLOSED DIMENSION.
   A OR AL OPEN REFLECTS THE SMALLEST POSSIBLE OPEN DIMENSION.

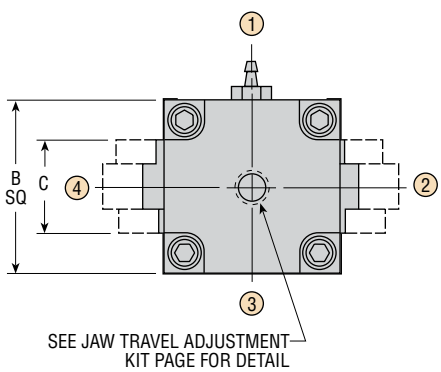






JAW KEY DETAIL

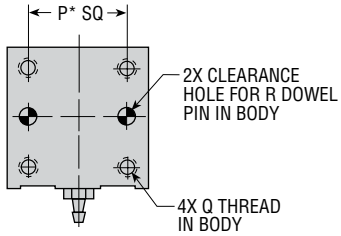


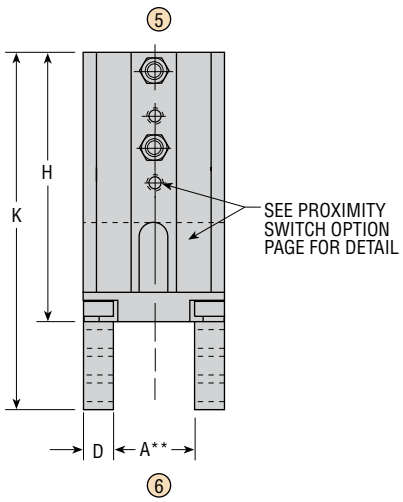


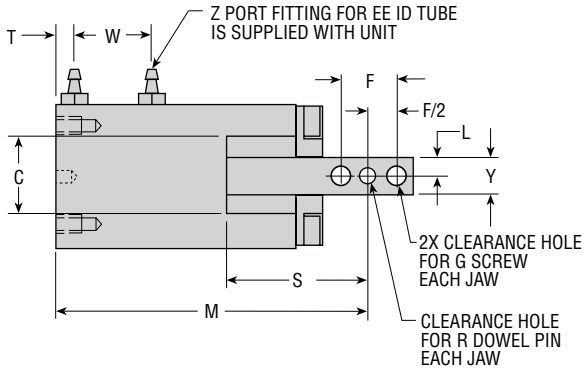
BOTTOM MOUNTING ONLY

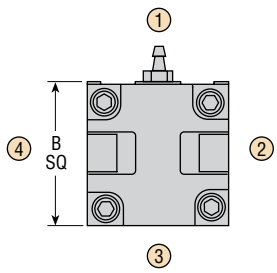
LETTER DIM.	MODEL NUMBER 19160 in	19165 mm	19170 in	19175 mm	19180 in	19185 mm	19190 in	19195 mm
NOMINAL JAW TRAVEL	.157	4	.276	7	.394	10	.512	13
A CLOSED**	.315	7.75	.345	8.75	.581	14.75	.700	17.75
A OPEN**	.403	10.25	.540	13.75	.915	23.25	1.150	29.25
B	.787	20.0	1.024	26.0	1.496	38.0	1.968	50.0
C	.398	10.0	.555	14.0	.791	20.0	1.027	26.0
D	.177	4.5	.215	5.5	.256	6.5	.394	10.0
F	.312	8.0	.375	10.0	.500	12.0	.625	16.0
G	#4	M2.5	#5	M3	#8	M4	#10	M5
H	1.613	41.0	1.970	50.0	2.420	61.5	2.951	75.0
K	2.164	55.0	2.618	66.5	3.285	83.5	4.112	104.5
L	.098	2.5	.138	3.5	.196	5.0	.256	6.5
M	1.913	48.5	2.305	58.5	2.847	72.5	3.525	89.5
P*	.550	14.0	.710	18.0	1.100	28.0	1.535	39.0
Q	4-40 x .19 DP	M3 x 0.5 x 4.5 DP	6-32 x .22 DP	M3 x 0.5 x 4.5 DP	8-32 x .28 DP	M4 x 0.7 x 6.0 DP	10-24 x .38 DP	M5 x 0.8 x 7.5 DP
R	3/32	2.5	1/8	3.0	1/8	4.0	3/16	5.0
S	.871	22.0	1.045	26.0	1.412	36.0	1.854	47.0
T	.167	3.0	.176	3.5	.193	5.5	.153	4.5
W	.465	12.5	.505	14.5	.592	15.0	.750	19.5
Y	.196	5.0	.276	7.0	.393	10.0	.511	13.0
Z	10-32	M3 x 0.5	10-32	M3 x 0.5	10-32	M5 x 0.8	10-32	M5 x 0.8
EE	1/16	2.5	1/16	2.5	1/16	3.0	1/16	3.0

NOTES:
1) *TOLERANCE BETWEEN DOWEL PIN HOLES IS ± .0008 [± 0.02]
2) NUMBERS IN [ ] ARE FOR METRIC UNITS AND ARE IN mm
3) CIRCLED NUMBERS INDICATE POSITIONS.
4) **A CLOSED REFLECTS THE LARGEST POSSIBLE CLOSED DIMENSION.
A OPEN REFLECTS THE SMALLEST POSSIBLE OPEN DIMENSION.









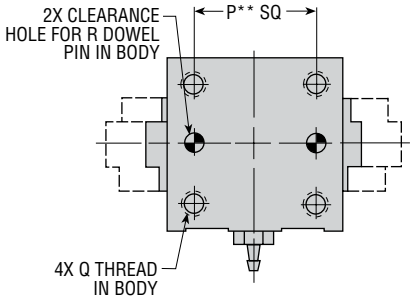
All dimensions are reference only unless specifically toleranced.

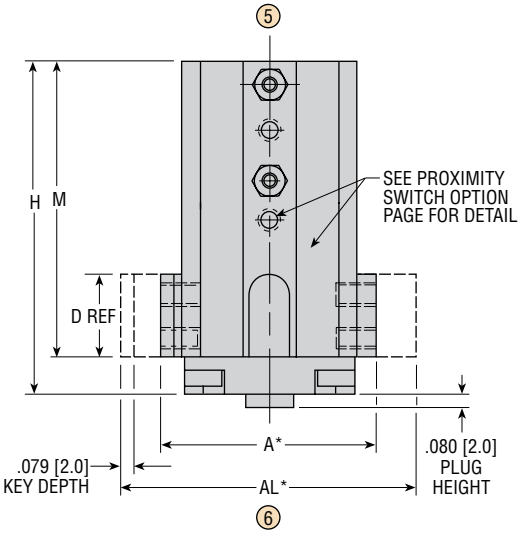
BOTTOM MOUNTING ONLY

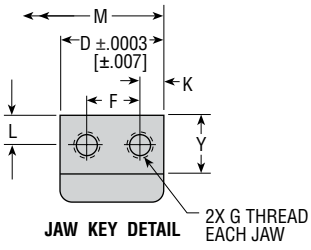
LETTER DIM.	MODEL NUMBER 19161/62 in	19166/67 mm	19171/72 in	19176/77 mm	19181/82 in	19186/87 mm	19191/92 in	19196/97 mm
NOMINAL JAW TRAVEL								
SHORT	.157	4	.276	7	.394	10	.512	13
LONG	.315	8	.433	11	.630	16	.866	22
A CLOSED*	1.054	26.75	1.329	33.75	1.841	46.75	2.353	59.75
A OPEN*	1.151	29.25	1.545	39.25	2.175	55.25	2.805	71.25
AL CLOSED*	1.447	36.75	1.802	45.75	2.353	59.75	2.865	72.75
AL OPEN*	1.702	43.25	2.175	55.25	2.923	74.25	3.671	93.25
B	.787	20.0	1.024	26.0	1.496	38.0	1.968	50.0
C	.398	10.0	.555	14.0	.791	20.0	1.027	26.0
D	.3937	10.0	.4921	12.5	.7480	19.0	.9842	25.0
F	.188	5.0	.250	6.5	.375	10.0	.625	12.0
G	3-56 x .18 DP	M2.5 x 0.45 x 5.0 DP	6-32 x .28 DP	M3 x 0.5 x 6.0 DP	8-32 x .32 DP	M4 x 0.7 x 8.0 DP	10-24 x .38 DP	M5 x 0.8 x 10.0 DP
H	1.613	41.0	1.970	50.0	2.420	61.5	2.951	75.0
K	.103	2.5	.121	3.0	.186	4.5	.180	6.5
L	.098	2.5	.138	3.5	.197	5.0	.256	6.5
M	1.435	36.5	1.752	44.5	2.183	55.5	2.655	67.5
P**	.550	14.0	.710	18.0	1.100	28.0	1.535	39.0
Q	4-40 x .19 DP	M3 x 0.5 x 4.5 DP	6-32 x .22 DP	M3 x 0.5 x 4.5 DP	8-32 x .28 DP	M4 x 0.7 x 6.0 DP	10-24 x .38 DP	M5 x 0.8 x 7.5 DP
R	3/32	2.5	1/8	3.0	1/8	4.0	3/16	5.0
T	.167	3.0	.176	3.5	.193	5.5	.153	4.5
W	.465	12.5	.505	14.5	.592	15.0	.750	19.5
Y	.1970 ±.0006	5.0 ±0.015	.2756 ±.0006	7.0 ±0.015	.3940 ±.0007	10.0 ±0.018	.5118 —	13.0 —
Z	10-32	M3 x 0.5	10-32	M3 x 0.5	10-32	M5 x 0.8	10-32	M5 x 0.8
EE	1/16	2.5	1/16	2.5	1/16	3.0	1/16	3.0

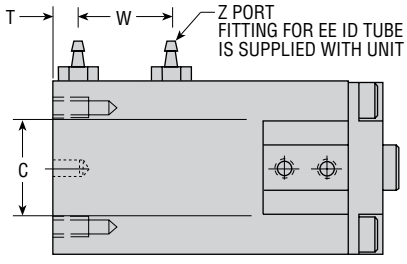
NOTES:

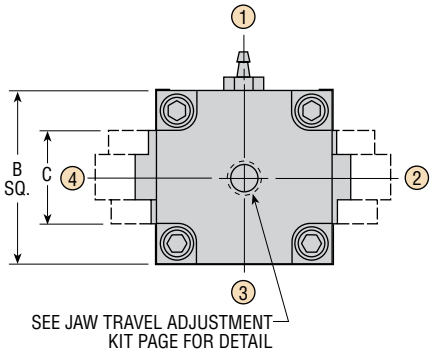
1) *A CLOSED AND OPEN ARE FOR MODELS 19161, 71, 81, 91, 66, 76, 86, & 96
   AL CLOSED & OPEN ARE FOR MODELS 19162, 72, 82, 92, 67, 77, 87, & 97
2) **TOLERANCE BETWEEN DOWEL PIN HOLES IS ± .0008 [±0.02]
3) CIRCLED NUMBERS INDICATE POSITIONS.
4) *A CLOSED REFLECTS THE LARGEST POSSIBLE CLOSED DIMENSION.
   A OPEN REFLECTS THE SMALLEST POSSIBLE OPEN DIMENSION.





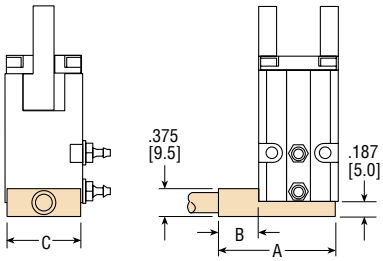






4 HALL SENSOR READY

This option provides unit installed with magnet for use with PHD Hall Sensor. Kits must be ordered separately.



MODEL NO.	KIT NO.		LETTER DIM.		
	IMPERIAL	METRIC	A	B	C
19x6x	18674-04	18057-04	1.431 [36.5]	.650 [16.5]	.777 [20.0]
19x7x	18675-04	18058-04	1.556 [39.5]	.550 [14.0]	.974 [25.0]
19x8x	18676-04	18059-04	1.800 [46.0]	.295 [7.5]	1.486 [38.0]
19x9x	18677-04	18060-04	2.272 [58.0]	.295 [7.5]	1.958 [50.0]

EACH HALL SENSOR KIT CONTAINS THE FOLLOWING ITEMS:
ONE SENSOR WITH A 12 FOOT [4 m] SHIELDED CABLE
TWO MOUNTING SCREWS
THE SENSOR MAY BE ROTATED TO ALLOW THE CABLE TO EXTEND FROM ANY SIDE OF UNIT EXCEPT THE PORT SIDE.

GRIPPERS CAN BE MOUNTED WITH THE SENSOR SANDWICHED BETWEEN THE MOUNTING PLATE AND THE GRIPPER.

NUMBERS IN [ ] ARE FOR METRIC UNITS AND ARE IN mm

5 PROXIMITY SWITCH READY

This option provides the grippers with a pin to mount a switch target for 6 mm square inductive or Hall Effect proximity switch. See additional information below for details on switch bracket/ target kits.

SERIES 5580 HALL EFFECT SWITCHES

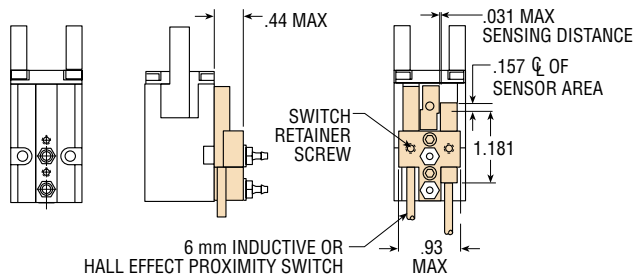
MODEL NO.	DESCRIPTION
55803-1-02	NPN 4.5-24 VDC with 2 meter cable
55804-1-02	PNP 4.5-24 VDC with 2 meter cable
55823-1	NPN 4.5-24 VDC with Quick Connect
55824-1	PNP 4.5-24 VDC with Quick Connect

6 mm SQUARE INDUCTIVE PROXIMITY SWITCHES

MODEL NO.	DESCRIPTION
18431-001-02	NPN 10-30 VDC with 2 meter cable
18431-002-02	PNP 10-30 VDC with 2 meter cable

SWITCH BRACKET AND TARGET KITS

FOR IMPERIAL MODELS 19x6x AND 19x7x ONLY



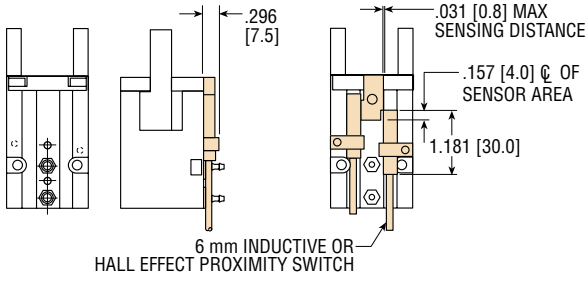
EACH SWITCH BRACKET & TARGET KIT CONTAINS THE FOLLOWING ITEMS:
1 TARGET WITH SCREW
BRACKET FOR 6 mm SQUARE SWITCH AND ALL MOUNTING COMPONENTS

SWITCHES ARE ORDERED SEPARATELY

FOR USE WITH: SERIES 5580 SWITCHES	
GRIPPER MODEL	SWITCH BRACKET & TARGET KIT
19x6x	59794-1
19x7x	59795-1

FOR USE WITH: 6 mm SQUARE INDUCTIVE PROXIMITY SWITCHES	
GRIPPER MODEL	SWITCH BRACKET & TARGET KIT
19x6x	59792-1
19x7x	59793-1

FOR IMPERIAL MODELS 19x8x & 19x9x METRIC MODELS 19x6x, 19x7x, 19x8x, & 19x9x



EACH SWITCH BRACKET & TARGET KIT CONTAINS THE FOLLOWING ITEMS:
1 TARGET WITH SCREW
2 SENSOR BRACKETS WITH MOUNTING SCREWS

SWITCHES ARE ORDERED SEPARATELY
NUMBERS IN [ ] ARE FOR METRIC UNITS AND ARE IN mm

FOR USE WITH: SERIES 5580 SWITCHES	
GRIPPER MODEL	SWITCH BRACKET & TARGET KIT
19x6x*	55770
19x7x*	55771
19x8x	55772
19x9x	55773

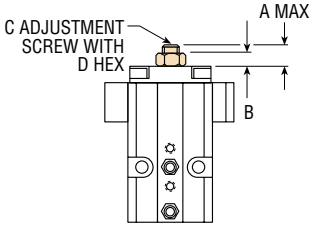
* METRIC UNITS ONLY

FOR USE WITH: 6 mm SQUARE INDUCTIVE PROXIMITY SWITCHES	
GRIPPER MODEL	SWITCH BRACKET & TARGET KIT
19x6x*	18432
19x7x*	18437
19x8x	18438
19x9x	18439

* METRIC UNITS ONLY

All dimensions are reference only unless specifically toleranced.

JAW TRAVEL ADJUSTMENT KIT



MODEL NO.	KIT NO.	LETTER DIM. A	B	C	D
19x6x	18433	.197 [5.0]	.094 [2.4]	[M3 x 10.0]	.05 [1.3]
19x7x	18434	.315 [8.0]	.157 [4.0]	[M5 x 14.0]	.094 [2.4]
19x8x	18435	.394 [10.0]	.197 [5.0]	[M6 x 18.0]	.125 [3.2]
19x9x	18436	.591 [15.0]	.315 [8.0]	[M10 x 22.0]	.188 [4.8]

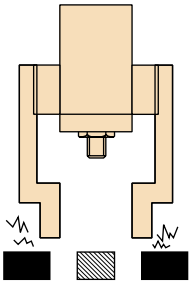
NUMBERS IN [ ] ARE FOR METRIC UNITS AND ARE IN mm

JAW TRAVEL ADJUSTMENT AVAILABLE ON STYLE 2 JAWS ONLY (19xx1, 19xx2, 19xx6, AND 19xx7 MODELS).

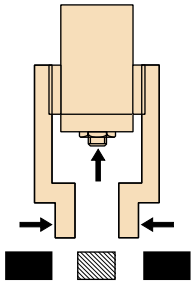
EACH JAW TRAVEL ADJUSTMENT KIT CONTAINS THE FOLLOWING ITEMS: ONE ADJUSTMENT SCREW AND NUT

TRAVEL CAN ONLY BE ADJUSTED IN THE MAX FORCE DIRECTION OF ANY MODEL.
EXAMPLE 1: A MAX FORCE CLOSE GRIPPER; TRAVEL IS ONLY VARIED IN THE CLOSE DIRECTION, TRAVEL IN THE OPEN DIRECTION REMAINS UNCHANGED.
EXAMPLE 2: A MAX FORCE OPEN GRIPPER; TRAVEL IS ONLY VARIED IN THE OPEN DIRECTION, TRAVEL IN THE CLOSE DIRECTION REMAINS UNCHANGED.

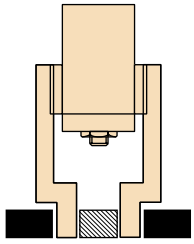
The Jaw Travel Adjustment Kit contains a screw and a lock nut used to limit the jaw opening on Jaw Style 2 parallel grippers. Jaw travel can be adjusted from zero opening to maximum opening. Below is one application example showing how the jaw travel adjustment kit can be of benefit. If the option of maximum grip force on jaw closure is specified, (-x5xx option) the adjustment kit will limit the travel in the closing direction.



With jaws fully open, the tooling hits the obstruction and the part cannot be gripped.



Turning jaw travel adjustment screw inward reduces the maximum open position; allowing the tooling to clear the obstruction.

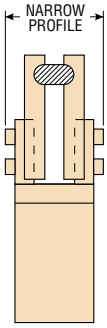


The part can now be gripped. (The jaw closed dimension is not affected by the jaw travel adjustment.)

JAW TOOLING

JAW STYLE 1

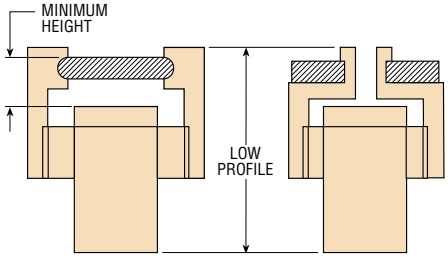
Jaw Style 1 is ideally suited for small parts. Simple tooling can provide a long narrowed profile for small parts or for reaching into confined areas.



JAW STYLE 2

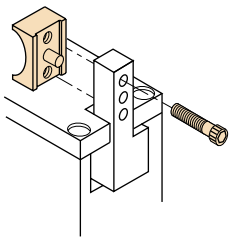
Jaw Style 2 allows simple tooling of wide parts. This type of tooling keeps the part close to the unit for a low profile package.

Jaw Style 2 provides the lowest profile assembly for internal gripping by keeping the tooling close to the gripper.



DOWEL PINS

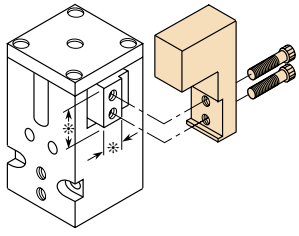
Style 1 jaw is provided with a dowel pin hole as a means of orienting and locating jaw tooling.



MALE KEY

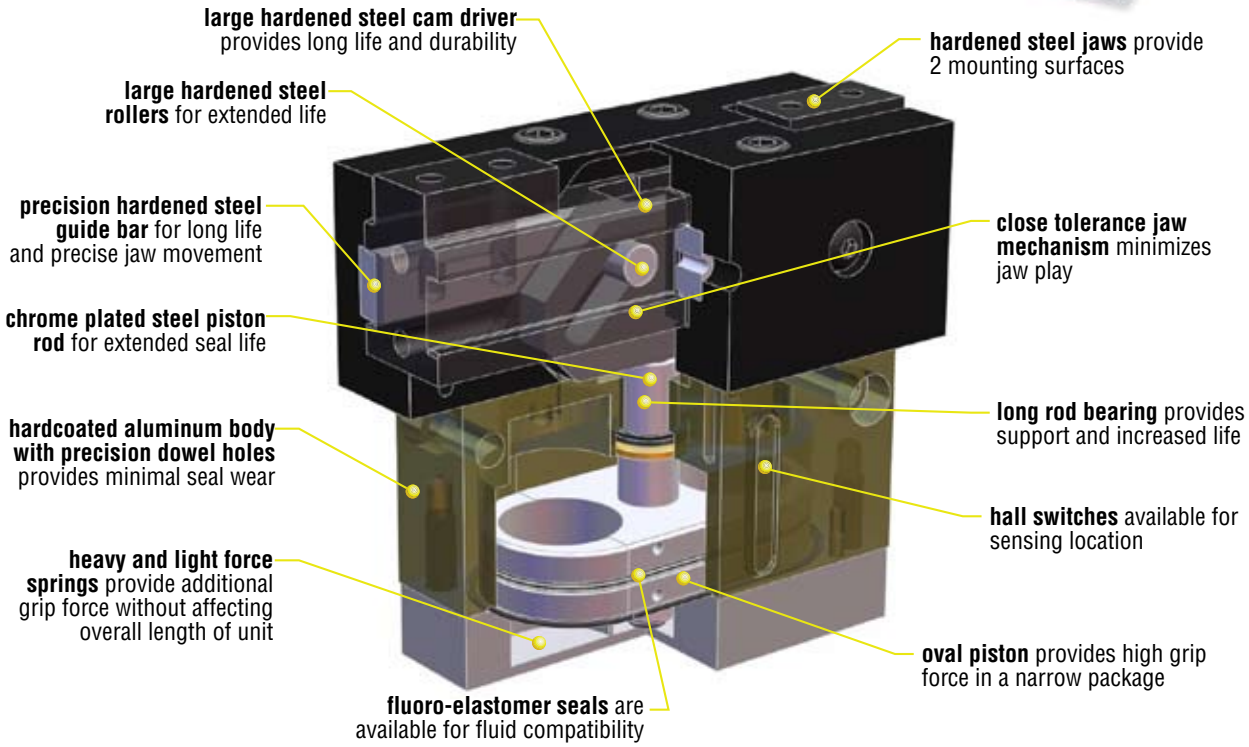
Style 2 jaws have a close tolerance* male key for orientation and precise location of jaw tooling.

Jaw tooling can be readily machined to include a mating slot for the jaw key.



5300 parallel

COMPACT SIZE WITH TWO JAW STYLES



Major Benefits

- Spring assist on open or close available in different forces
- High grip force to weight ratio
- Hardened steel jaw driver mechanism
- Close tolerance jaw mechanism minimizes jaw play
- Four sizes available in both imperial and metric versions
- 1-2 day shipping
- 5 million cycles minimum rated life with standard seals (includes spring assist units)

Industry Uses

- Assembly machine builders
- Material handling
- Robotics

TO ORDER SPECIFY:
Model, Design No., Options, and Seals.

IMPERIAL MODEL	METRIC MODEL	EQUIVALENT BORE DIAMETER mm	(in)
15360 - Size 6	15362 - Size 6	45.5	(1.79)
15370 - Size 7	15372 - Size 7	65	(2.56)
15380 - Size 8	15382 - Size 8	87.4	(3.44)
15390 - Size 9	15392 - Size 9	123	(4.85)

SWITCH OPTIONS
0 - None
7 - Hall Effect Magnet on piston and "T" slot on the body for Series 5360 Hall Switches

15360 - 1 - 0 0 0 2

DESIGN NO.

OPTIONS

OPTIONS
0 - None
LIGHT SPRING FORCE
3 - Spring Close
4 - Spring Open
HEAVY SPRING FORCE
5 - Spring Close
6 - Spring Open

SEALS
1 - Buna-N (Standard)
2 - Fluoro-Elastomer

SERIES 5360 MINIATURE HALL EFFECT SWITCHES

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

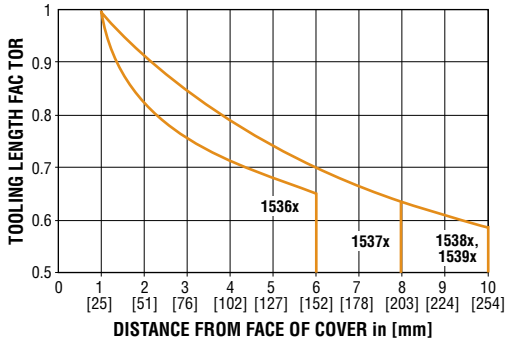
NOTES:
1) See Switches and Sensors section for switch information.
2) Switches must be ordered separately.

UNIQUE GRIPPERS ARE AVAILABLE.
SEE PAGES 4-139 TO 4-164.

SPECIFICATIONS	SERIES 5300 PARALLEL
OPERATING PRESSURE	
STANDARD UNIT	25 psi min to 150 psi max [1.7 bar min to 10 bar max] air
LIGHT SPRING ASSIST UNIT	40 psi min to 150 psi max [2.8 bar min to 10 bar max] air
HEAVY SPRING ASSIST UNIT	65 psi min to 150 psi max [4.5 bar min to 10 bar max] air
OPERATING TEMPERATURE	-20° to +180°F [-28° to +82°C]
RATED LIFE	5 million cycles minimum with standard seals (including spring assist units)
GRIP REPEATABILITY	Within ±0.002 in [±0.05 mm] of original centered position
LUBRICATION	Factory lubricated for rated life
MAINTENANCE	Field repairable

GRIPPER NO.	DISPLACEMENT		GRIP FORCE FACTOR G_F EXTERNAL GRIP		GRIP FORCE FACTOR G_F INTERNAL GRIP		SPRING GRIP FORCE S_F LIGHT SPRING		SPRING GRIP FORCE S_F HEAVY SPRING	
	in^3	cm^3	IMPERIAL	METRIC	IMPERIAL	METRIC	lb	N	lb	N
1536x	.73	12.0	1.47	95.0	1.60	109.0	27.0	121.0	38.5	172.2
1537x	2.58	42.3	3.00	194.0	3.27	211.0	50.0	223.0	85.0	377.6
1538x	6.09	99.8	5.61	362.0	5.90	381.0	88.0	391.0	145.0	647.0
1539x	16.82	275.6	11.26	726.0	11.75	758.0	159.0	706.0	343.0	1527.0

TOOLING LENGTH FACTOR

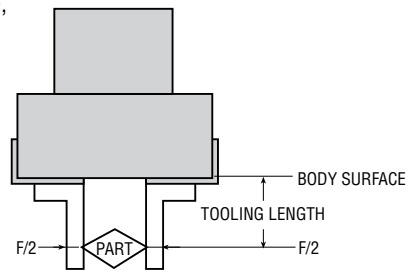


GRIPPER NO.	GRIPPER WEIGHT STANDARD lb	STANDARD kg	SPRING ASSIST LIGHT lb	LIGHT kg	SPRING ASSIST HEAVY lb	HEAVY kg
1536x	3.1	1.41	3.2	1.43	3.2	1.44
1537x	7.0	3.18	7.2	3.24	7.2	3.24
1538x	14.0	6.35	14.4	6.53	14.6	6.64
1539x	37.0	16.78	38.7	17.57	39.1	17.73

SIZING AND APPLICATION ASSISTANCE
See PHD Product Sizing Catalog for specific and complete sizing information. Online sizing assistance is available at:
www.phdinc.com/apps/sizing

TOOLING LENGTH FACTOR

Jaw tooling should be designed so that the grip point is as close to the cover surface as possible. As the grip point is moved away from the cover surface, the applied moment causes jaw friction to increase, resulting in reduced effective grip force. The Grip Force Factor (G_F) values given in the table are for zero tooling length (cover surface).



F = TOTAL GRIP FORCE

GRIP FORCE CALCULATION EQUATIONS:

IMPERIAL:

TOTAL GRIP FORCE [lb] = (Pressure [psi] x G_F) x Tooling Length Factor

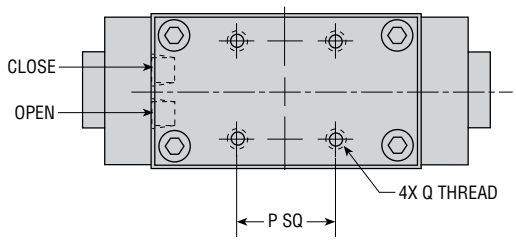
TOTAL GRIP FORCE WITH SPRINGS [lb] = ((Pressure [psi] x G_F) ± S_F [lb]) x Tooling Length Factor

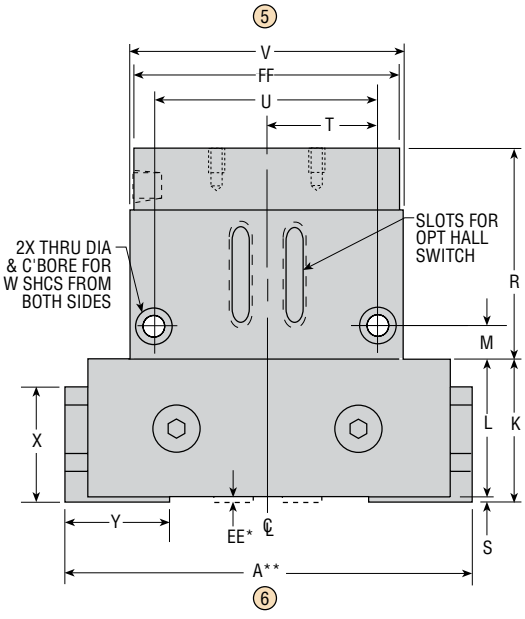
METRIC:

TOTAL GRIP FORCE [N] = (Pressure [bar] x G_F) x Tooling Length Factor

TOTAL GRIP FORCE WITH SPRINGS [N] = ((Pressure [bar] x G_F) ± S_F [N]) x Tooling Length Factor

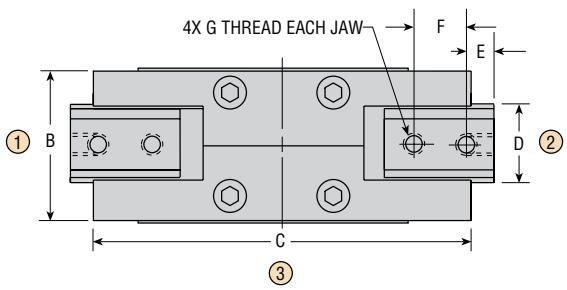
DIMENSIONS: SERIES 5300 PARALLEL OVAL GRIPPER



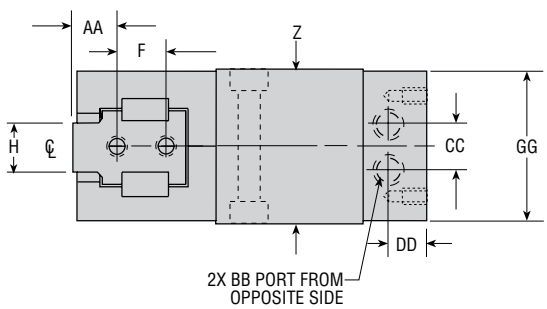


LETTER DIM.	MODEL NUMBER 15360 in	15362 mm	15370 in	15372 mm	15380 in	15382 mm	15390 in	15392 mm
NOMINAL JAW TRAVEL	.62	15.8	1.00	25.4	1.31	33.3	1.80	45.8
A CLOSED**	4.16	105.6	5.71	145.0	7.22	183.4	9.98	253.5
A OPEN**	4.72	119.9	6.65	168.9	8.47	215.1	11.72	296.9
B	1.875	47.6	2.250	57.2	3.000	76.2	4.000	101.6
C	4.000	101.6	5.500	139.7	7.000	177.8	9.500	241.3
D	.960	24.4	1.130	28.7	1.440	36.6	2.190	55.6
E	.270	6.9	.420	10.7	.430	10.9	.460	11.7
F	.625	15.9	.750	19.1	1.000	25.4	1.500	38.1
G	1/4-20 x .31 DP	M6 x 1 x 8.0 DP	5/16-18 x .38 DP	M8 x 1.25 x 9.5 DP	3/8-16 x .44 DP	M10 x 1.5 x 11.0 DP	1/2-13 x .56 DP	M12 x 1.75 x 14.0 DP
H	.625	15.9	.750	19.1	1.000	25.4	1.500	38.1
K	1.604	40.7	2.161	54.9	2.827	71.8	3.811	96.8
L	1.540	39.1	2.100	53.3	2.740	69.6	3.680	93.5
M	.437	11.1	.500	12.7	.500	12.7	.500	12.7
P	1.250	31.8	1.500	38.1	1.750	44.05	2.750	69.9
Q	10-24 x .38 DP	M5 x 0.8 x 9.7 DP	1/4-20 x .38 DP	M6 x 1 x 9.7 DP	5/16-18 x .44 DP	M8 x 1.25 x 11.2 DP	3/8-16 x .56 DP	M10 x 1.5 x 14.2 DP
R	2.625	66.7	3.187	80.9	3.625	92.1	4.750	120.7
S	.062	1.6	.062	1.6	.087	2.2	.131	3.3
T	1.156	29.4	1.687	42.8	2.375	60.3	3.250	82.6
U	2.312	58.7	3.375	85.7	4.750	120.7	6.500	165.1
V	2.843	72.2	4.031	102.4	5.531	140.5	7.531	191.3
W	1/4	M6	5/16	M8	3/8	M10	1/2	M12
X	1.260	32.0	1.726	43.8	2.200	55.9	3.000	76.2
Y	1.170	29.7	1.600	40.6	1.860	47.2	2.420	61.5
Z	1.781	45.2	2.281	57.9	2.781	70.6	4.031	102.4
AA	.437	11.1	.680	17.3	.880	22.4	1.050	26.7
BB	10-32	M5 x 0.8	1/8 NPT	1/8 BSP	1/8 NPT	1/8 BSP	1/4 NPT	1/4 BSP
CC	.562	14.3	.750	19.1	.937	23.8	1.625	41.3
DD	.440	11.2	.500	12.7	.593	15.1	.760	19.3
EE	.04	1.0	0	0	.035	1.0	.05	1.0
FF	2.810	71.4	4.000	101.6	5.500	139.7	7.500	190.5
GG	1.75	44.5	2.25	57.2	2.75	69.9	3.96	100.5

NOTES:
1) NUMBERS IN [ ] ARE FOR METRIC UNITS AND ARE IN mm
2) *EE DIMENSION IS TO BUSHING BLOCK MTG. SCREWS.
3) **A CLOSED REFLECTS THE LARGEST POSSIBLE CLOSED DIMENSION. A OPEN REFLECTS THE SMALLEST POSSIBLE OPEN DIMENSION.
4) CIRCLED NUMBERS INDICATE PORT POSITIONS.



GRIPPER JAWS: SHOWN AT MID-STROKE



OPTION: SERIES 5300 PARALLEL OVAL GRIPPER

7 HALL EFFECT MAGNET

Equips piston with magnet and "T" slot on body for Series 5360 Switches.

SERIES 5360 MINIATURE HALL EFFECT SWITCHES

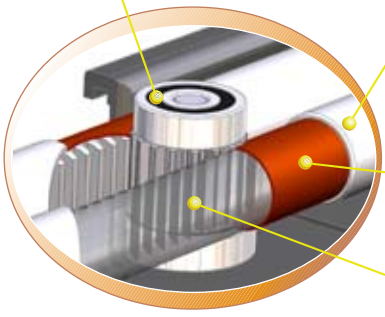
PART NO.	DESCRIPTION
53603-1-02	NPN (Sink) 4.5-24 VDC, 2 meter Cable
53604-1-02	PNP (Source) 4.5-24 VDC, 2 meter Cable
53623-1	NPN (Sink) 4.5-24 VDC, Quick Connect
53624-1	PNP (Source) 4.5-24 VDC, Quick Connect

NOTES:
1) See Switches and Sensors section for switch information.
2) Switches must be ordered separately.

All dimensions are reference only unless specifically toleranced.

GRR

NARROW WIDTH AND LONG TRAVEL

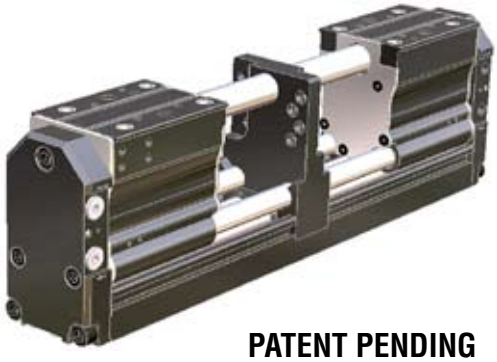


ball bearings support pinion for smooth operation and long life

stainless tubing encloses rack to protect from contamination and to maintain lubrication

NEW! **TC fluoropolymer** composite bushings provide wear resistance

rack and pinion synchronizer minimizes backlash



PATENT PENDING

GRR WITH NEW FEATURES

one piece case hardened ground jaw guides provide high precision and durability NEW!

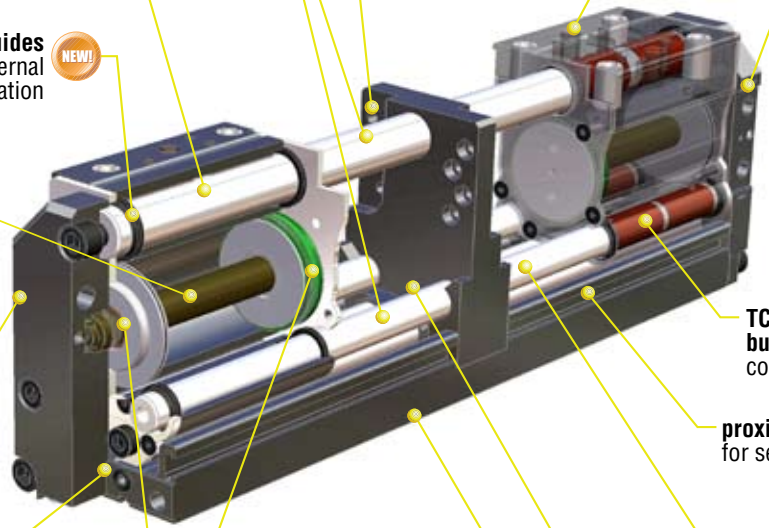
optional Rodlok® holds jaw position if air pressure is lost

coated steel inserts offer superior strength corrosion resistant mounting threads

internal lubrication is provided for extended life without maintenance

open and close port symbols simplify installation

shaft wipers on jaw guides protect bearings from external contamination NEW!



hardcoated aluminum piston rod for wear resistance NEW!

now available in **150, 200, 250 & 350 mm total jaw travels** NEW!

TC fluoropolymer composite bushings provide long life, are contamination and impact resistant

proximity switches available for sensing jaw position

keyed base and end plates ensure alignment NEW!

corrosion resistant option for increased protection

jaw position sensor available for continuous jaw position feedback NEW!

pressure energized seals for low breakaway. Seals available in Fluoro-Elastomer NEW!

rack and pinion synchronizer on model GRR12 (see details above)

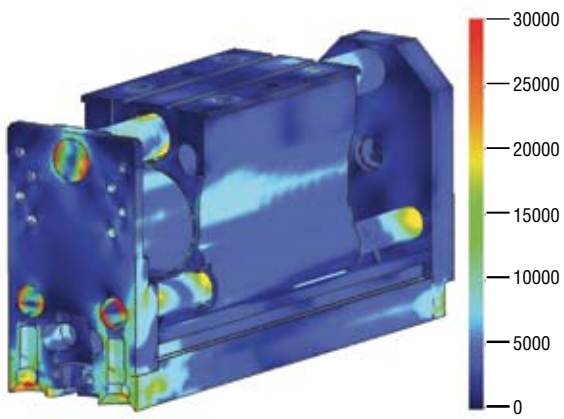
GUARDIAN®

GUARDIAN®

Design Enhancements

- 75% Higher moment capacity
- 55% Higher grip force
- 25% Higher speed
- 10% Lower weight
- Additional accessories
- Continuous feedback jaw position sensor
- Extensive engineering analysis and testing assure performance

STRESS ANALYSIS PLOT [psi]



(HALF MODEL SHOWN)

Major Benefits

- Narrow width and a wide range of available jaw travels.
- Compact design provides high grip force and large moment capacities with low overall weight.
- Rugged build withstands high impact and shock loads.
- Double acting for both internal and external gripping.
- Unique dual air-passage piston rod design promotes rapid bore pressurization for short cycle times.
- Three large diameter jaw guides spanning the length of the gripper provide stable jaw travel, long allowable tooling length, and high moment capacities.
- TC fluoropolymer composite guide shaft bushings provide long life and smooth jaw travel in demanding industrial environments.
- Synchronizer is enclosed, protecting the mechanism from debris.
- Non-synchronized and independently controlled jaws allow flexibility to support diverse applications.
- Optional Rodlok® locks the jaws in a stationary position in the event air pressure is lost.
- Optional analog output sensor continuously monitors entire jaw travel. Gripper is “sensor ready” allowing the sensor to be factory installed or easily installed in the field.
- Proximity switches are available for discrete indication of jaw position.

Industry Uses

- Material handing of rolls, barrels, pallets, and containers
- Movement of large sand and investment castings
- Small engine block manufacture
- Automotive, aeronautical, and agricultural wheel rim manufacture
- Clamping and fixturing during assembly operations
- Gaging and sorting of large parts and assemblies
- Centering and registration of heavy parts
- Incorporation into space-restricted processing and manufacturing equipment

TO ORDER SPECIFY:
Product Line, Series, Type, Synchronization, Jaw, Design No., Size, Total Jaw Travel, and Options required.

OPTIONS (OMIT IF NOT REQUIRED)
PORT OPTIONS
L9 - NPT Ports (metric units only)
UNIT OPTIONS
H47* - Rodlok® (See Note 2)
V1 - Fluoro-Elastomer Seals except for Rodlok® mechanism
Z1 - Corrosion resistant coating on exposed parts except for Rodlok® mechanism and Rodlok® rod
SENSOR OPTIONS
SPP99** - Rotary jaw position sensor pre-installed (see Note 3 for compatibility)

OPTIONS (OMIT IF NOT REQUIRED)
JAW TRAVEL LIMITING OPTIONS GRR02, GRR12 & GRR22
ANxxx - Jaw travel limitation on open, both jaws
ATxxx - Jaw travel limitation on closed, both jaws
GRR02 & GRR22 ONLY
APxxx - Jaw travel limitation on open, Jaw A only
AQxxx - Jaw travel limitation on open, Jaw B only
ARxxx - Jaw travel limitation on closed, Jaw A only
AUxxx - Jaw travel limitation on closed, Jaw B only

SERIES Regular Duty

SYNCHRONIZATION
0- Non-synchronized
1- Synchronized
2- Non-synchronized independently powered jaws

DESIGN NO. (See Note 1)
2 - Imperial
6 - Metric

G	R	R	1	2	-	6	-	63	x	200	-	Z1 - H47

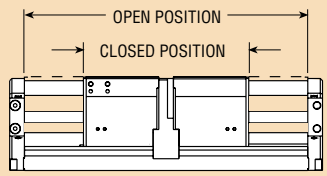
PRODUCT LINE G - Gripper

TYPE Long Travel, High Capacity, Parallel Gripper

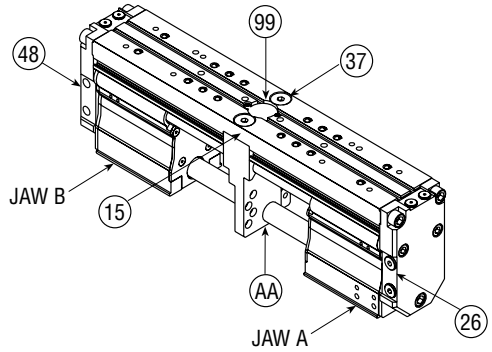
JAW Style 2

BORE SIZE

MINIMUM TOTAL JAW TRAVEL
150 = 150 mm (5.906 in)
200 = 200 mm (7.874 in)
250 = 250 mm (9.843 in)
350 = 350 mm (13.780 in)



Total Jaw Travel = (Open position - Closed Position)



NOTES:
1) Design number indicates imperial or metric mounting holes and ports. Dowel pin holes are metric regardless of design number.
2) *Standard unit is Rodlok® ready.
3) **Standard unit is SPP99 ready. Only available on GRR1. See SPP99 option data for temperature and fluid compatibility.

JAW POSITION SENSOR KIT

STANDARD	CORROSION RESISTANT
74209-31	74209-32

Kit includes 1 jaw position sensor, 2 mounting screws, 1 seal and 1 coupling.

THREADED INDUCTIVE PROXIMITY SWITCH MOUNTING BRACKET KITS

8mm SWITCH	CORROSION RESISTANT 8mm SWITCH	12mm SWITCH	CORROSION RESISTANT 12mm SWITCH
74992-31	74992-32	74993-31	74993-32

Kit includes 1 proximity switch mounting bracket, 1 mounting nut, and 1 mounting screw.

8mm THREADED INDUCTIVE PROXIMITY SWITCHES

PART NUMBER	DESCRIPTION
51422-005-02	NPN (Sink) 5-30 VDC, 2 meter cable
51422-006-02	PNP (Source) 5-30 VDC, 2 meter cable

THREADED INDUCTIVE PROXIMITY SWITCH TARGET KITS

STANDARD	CORROSION RESISTANT
74994-31	74994-32

Kit includes 1 proximity switch target and 2 target mounting screws.

12mm THREADED INDUCTIVE PROXIMITY SWITCHES

PART NUMBER	DESCRIPTION
15561-001	NPN (Sink) 10-30 VDC, 3 meter cable
15561-002	PNP (Source) 10-30 VDC, 3 meter cable
15561-003	20-250 VAC, 3 meter cable

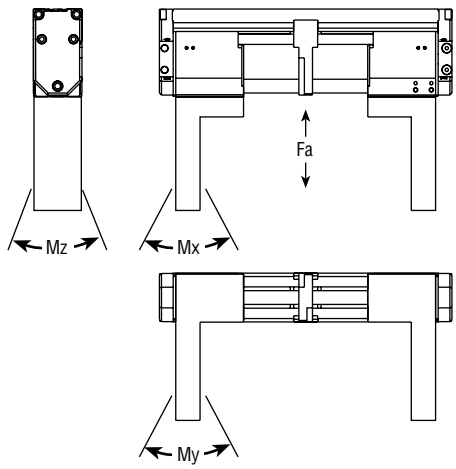
UNIQUE GRIPPERS ARE AVAILABLE. SEE PAGES 4-139 TO 4-164.

SPECIFICATIONS	SERIES GRR
OPERATING PRESSURE STANDARD UNIT	30 psi min to 120 psi [2 to 8 bar] max air
OPERATING TEMPERATURE	-20° to +180°F [-28° to +82°C] Higher temperature service available. Consult PHD.
RATED LIFE	5 million cycles minimum with standard seals
GRIP REPEATABILITY	Within ±0.002 in [±0.05 mm] of original centered position
CYCLE TIME	See table below
LUBRICATION	Factory lubricated for rated life
MAINTENANCE	Field repairable

MODEL NUMBER	MINIMUM TOTAL JAW TRAVEL		GRIPPER WEIGHT		CLOSE OR OPEN TIME 87psi [6 bar]	ONE DIRECTION DISPLACEMENT		GRIP FORCE FACTOR G_F GRIP FORCE VARIES WITH TOOLING LENGTH			
								EXTERNAL GRIP		INTERNAL GRIP	
	in	mm	lb	kg	sec	in^3	cm^3	IMPERIAL	METRIC	IMPERIAL	METRIC
GRRx2-x-63 x 150	5.91	150	28.0	12.7	0.28	28.8	472	8.09	522	7.27	469
GRRx2-x-63 x 200	7.87	200	33.0	15.0	0.36	38.4	629				
GRRx2-x-63 x 250	9.84	250	39.2	17.8	0.42	48.0	787				
GRRx2-x-63 x 350	13.8	350	49.0	22.2	0.57	67.0	1098				

MAXIMUM ALLOWABLE FORCES AND MOMENTS

MODEL NUMBER	Fa		Mx		My		Mz	
	lb	N	in-lb	Nm	in-lb	Nm	in-lb	Nm
GRRx2-x-63 x 150	3500	15570	8000	880	6500	715	6500	715
GRRx2-x-63 x 200	3500	15570	9000	990	7500	825	7500	825
GRRx2-x-63 x 250	3500	15570	9000	990	7500	825	7500	825
GRRx2-x-63 x 350	3500	15570	9000	990	7500	825	7500	825



Fa: Total for both jaws.
Mx: Allowable moment per jaw, measured from jaw mounting surface.
My: Allowable moment per jaw, measured from geometric center of jaw.
Mz: Allowable moment per jaw, measured from jaw mounting surface.

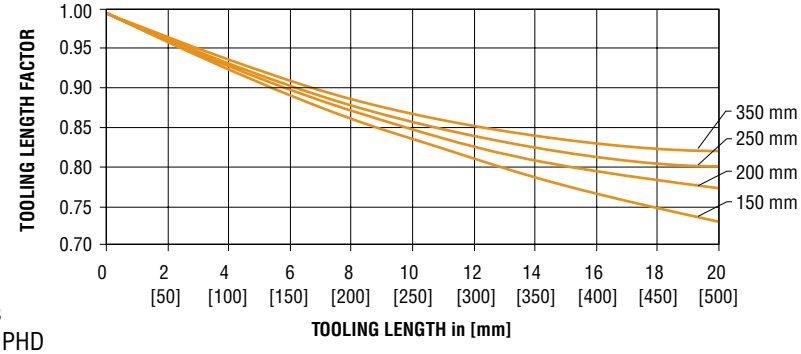
When calculating the value for Fa, include weight of tooling, part weight, acceleration, and external forces. When calculating values for Mx, My, and Mz, include the grip force per jaw, part weight, external forces, and acceleration as applicable.

NOTE: Moment values assume the use of all threaded mounting holes.

TOOLING LENGTH FACTOR

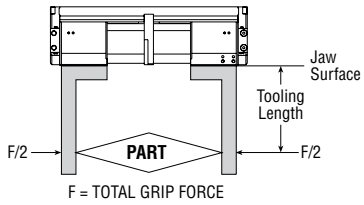
Jaw tooling should be designed so that the grip point is as close to the jaw surface as possible. As the grip point is moved away from the jaw surface, the applied moment causes jaw friction to increase, resulting in reduced effective grip force. The grip force factor (G_F) values given in the table above are for zero tooling length (jaw surface).

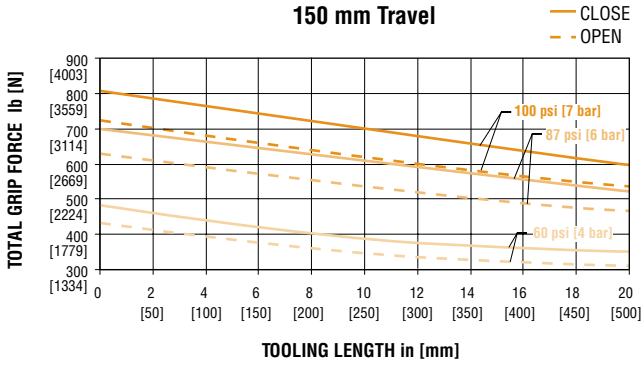
The maximum load that grippers can handle will vary based on: size of the part being picked up, shape of the part, texture of the part, speed at which the part is transferred, working pressure, shape of the fingers, etc. PHD recommends that the fingers of jaws be tooled or machined to conform to the shape of the part being gripped.

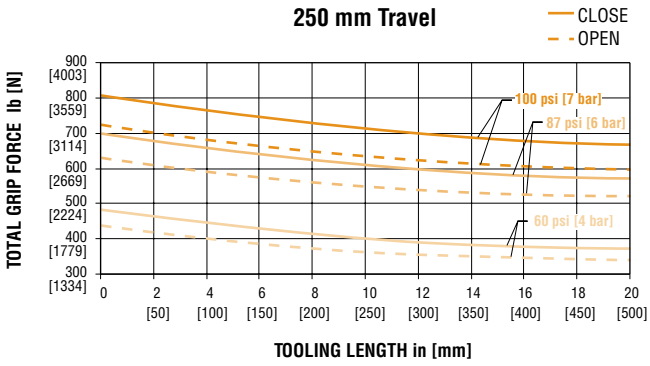


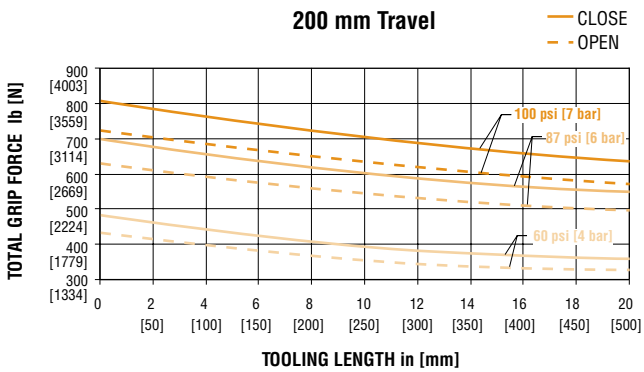
GRIP FORCE

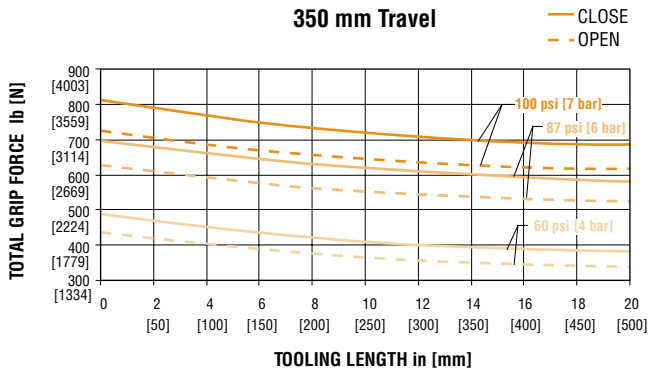
Total gripping force relative to tooling length is shown below at the stated actuating pressure. Grip force per jaw equals the total grip force divided by two. The graphs also indicate the maximum tooling length for each gripper size.











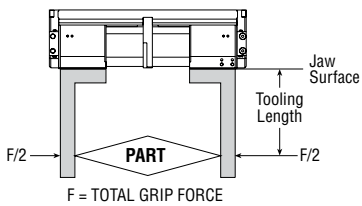
GRIP FORCE CALCULATION EQUATIONS:

IMPERIAL:

TOTAL GRIP FORCE [lb] = (Pressure [psi] x G_F) x Tooling Length Factor

METRIC:

TOTAL GRIP FORCE [N] = (Pressure [bar] x G_F) x Tooling Length Factor



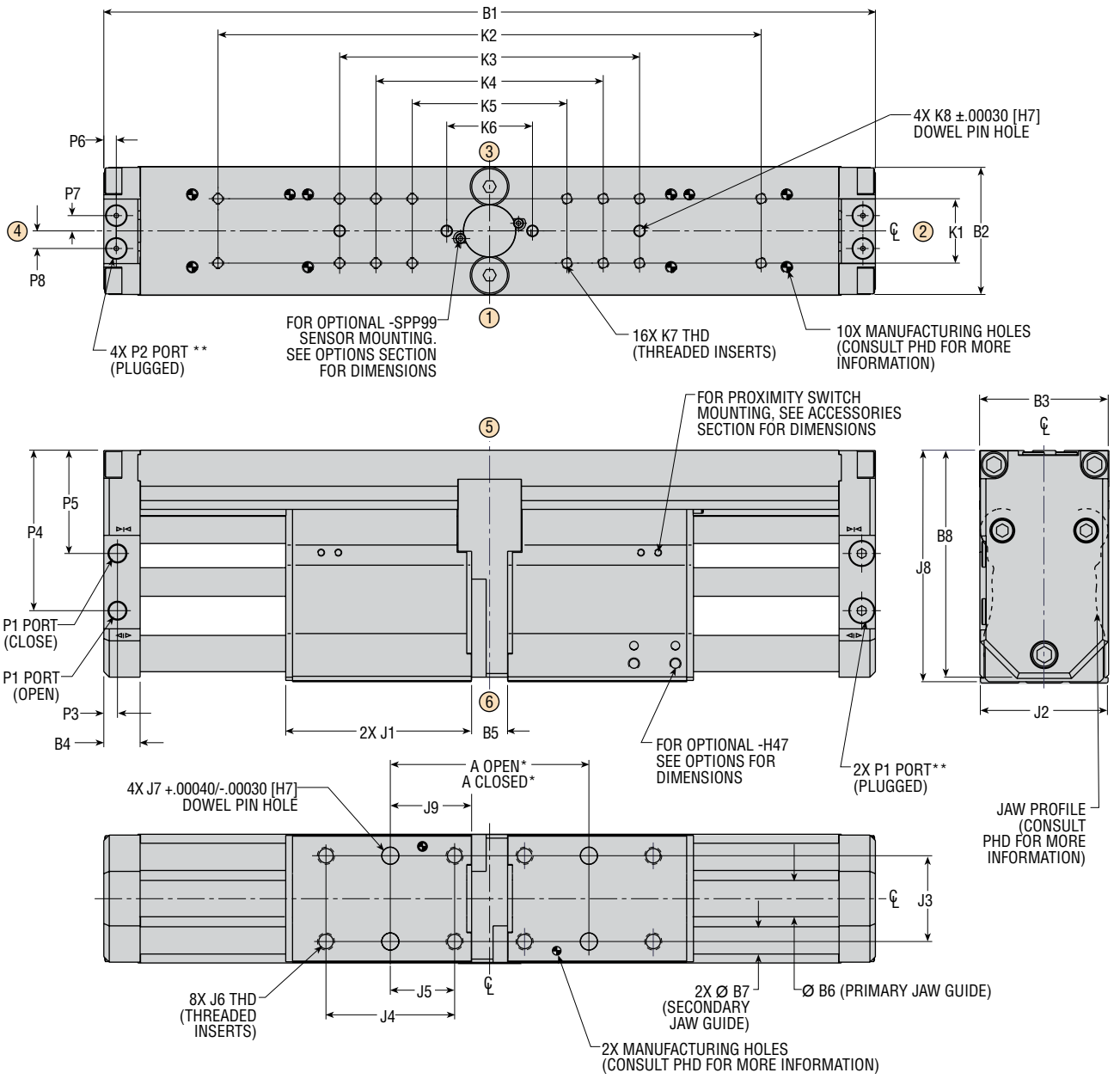
GRIP FORCE CALCULATION EXAMPLE:

Gripper: Series GRR Size 63 x 200
Common Parameters:
Operating Pressure = 87 psi [6 bar]
Tooling Length = 10 in [254 mm]

1. **Determine Grip Force Factor G_F =** 8.09 [522] (from table on page 4-90)
2. **Determine Tooling Length Factor =** 0.84 [0.84] (from Tooling Length Factor graph)
3. **Total Grip Force Calculations:**

For Standard Unit: GRR12-2-63 x 200 [GRR12-6-63 x 200]

Total Grip Force = 87 psi x 8.09 x 0.84 = 591 lb [6 bar x 522 x 0.84 = 2630 N]



NOTES:

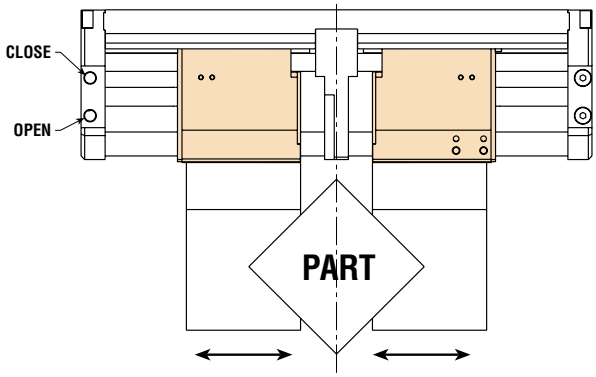
1) DESIGNATED ℄ IS CENTERLINE OF UNIT.
2) METRIC INFORMATION SHOWN IN [ ] OR SHOWN IN COLUMNS DESIGNATED mm.
3) CIRCLED NUMBERS INDICATE POSITION.
4) *A OPEN REFLECTS THE SMALLEST POSSIBLE OPEN DIMENSION.
   A CLOSED REFLECTS THE LARGEST POSSIBLE CLOSED DIMENSION.
5) **PLUGGED PORTS P1 & P2, CAN BE USED FOR GRIPPER ACTUATION.

LETTER DIM	MODEL NUMBER							
	GRRx2-x-63 X 150		GRRx2-x-63 X 200		GRRx2-x-63 X 250		GRRx2-x-63 X 350	
	in	mm	in	mm	in	mm	in	mm
MIN. TRAVEL PER JAW	2.953	75.0	3.937	100.0	4.921	125.0	6.890	175.0
A CLOSED*	4.724	120.0	5.504	139.8	5.504	139.8	12.992	330.0
A OPEN*	10.630	270.0	13.379	339.8	15.347	389.8	26.772	680.0
B1	17.314	439.8	21.251	539.8	26.016	660.8	33.890	860.8
B2	3.500	88.9	3.500	88.9	3.500	88.9	3.500	88.9
B3	3.543	90.0	3.543	90.0	3.543	90.0	3.543	90.0
B4	1.000	25.4	1.000	25.4	1.000	25.4	1.000	25.4
B5	.990	25.1	.990	25.1	.990	25.1	.990	25.1
B6	1.000	25.4	1.000	25.4	1.000	25.4	1.000	25.4
B7	.750	19.1	.750	19.1	.750	19.1	.750	19.1
B8	6.250	158.8	6.250	158.8	6.250	158.8	6.250	158.8
J1	4.136	105.1	5.120	130.0	6.518	165.6	8.487	215.6
J2	3.500	88.9	3.500	88.9	3.500	88.9	3.500	88.9
J3	2.362	60.0	2.362	60.0	2.362	60.0	2.362	60.0
J4	2.598	66.0	3.544	90.0	3.544	90.0	3.544	90.0
J5	1.2990	33.0	1.7720	45.0	1.7720	45.0	1.7720	45.0
J6	1/2-13 x 1.00 DP	M12 x 1.75 x 25.0 DP	1/2-13 x 1.00 DP	M12 x 1.75 x 25.0 DP	1/2-13 x 1.00 DP	M12 x 1.75 x 25.0 DP	1/2-13 x 1.00 DP	M12 x 1.75 x 25.0 DP
J7	.47275 x .625 DP	12.0 x 15.9 DP	.47275 x .625 DP	12.0 x 15.9 DP	.47275 x .625 DP	12.0 x 15.9 DP	.47275 x .625 DP	12.0 x 15.9 DP
J8	6.375	161.9	6.375	161.9	6.375	161.9	6.375	161.9
J9	1.850	47.0	2.240	56.9	2.240	56.9	5.984	152.0
K1	1.773	45.0	1.773	45.0	1.773	45.0	1.773	45.0
K2	12.598	320.0	14.960	380.0	14.960	380.0	23.228	590.0
K3	8.260	209.8	8.260	209.8	8.260	209.8	8.260	209.8
K4	6.260	159.0	6.260	159.0	6.260	159.0	6.260	159.0
K5	4.260	108.2	4.260	108.2	4.260	108.2	4.260	108.2
K6	2.3620	60.0	2.3620	60.0	2.3620	60.0	2.3620	60.0
K7	3/8-16 x .750 DP	M8 x 1.25 x 19.0 DP	3/8-16 x .750 DP	M8 x 1.25 x 19.0 DP	3/8-16 x .750 DP	M8 x 1.25 x 19.0 DP	3/8-16 x .750 DP	M8 x 1.25 x 19.0 DP
K8	.31525 x .750 DP	8.0 x 19.0 DP	.31525 x .750 DP	8.0 x 19.0 DP	.31525 x .750 DP	8.0 x 19.0 DP	.31525 x .750 DP	8.0 x 19.0 DP
P1	1/4 NPT	1/4 BSPP	1/4 NPT	1/4 BSPP	1/4 NPT	1/4 BSPP	1/4 NPT	1/4 BSPP
P2	1/8 NPT	1/8 BSPP	1/8 NPT	1/8 BSPP	1/8 NPT	1/8 BSPP	1/8 NPT	1/8 BSPP
P3	.375	9.5	.375	9.5	.375	9.5	.375	9.5
P4	4.50	114.3	4.50	114.3	4.50	114.3	4.50	114.3
P5	3.250	82.6	3.250	82.6	3.250	82.6	3.250	82.6
P6	.344	8.7	.344	8.7	.344	8.7	.344	8.7
P7	.413	10.5	.413	10.5	.413	10.5	.413	10.5
P8	.591	15.0	.591	15.0	.591	15.0	.591	15.0

All dimensions are reference only unless specifically toleranced.

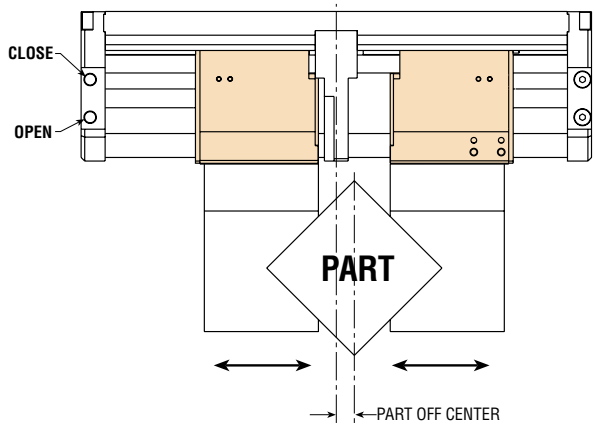
GRR12 SYNCHRONIZED

This model synchronizes the jaws for use with parts that must be centered. Jaws are pressurized by a single set of ports.



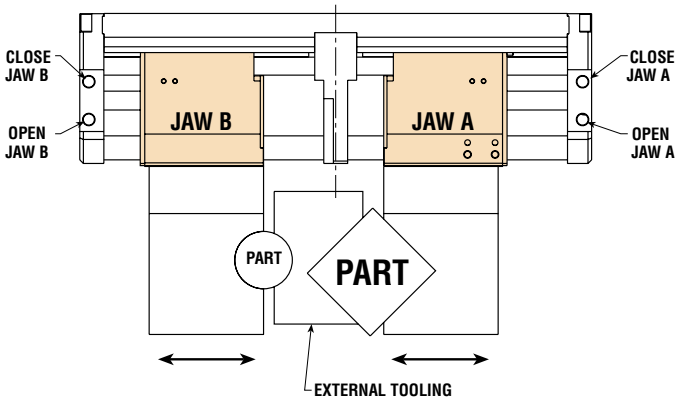
GRR02 NON-SYNCHRONIZED

This model allows each jaw to move independently while being pressurized by a single set of ports. This feature allows the gripping of off center parts.



GRR22 NON-SYNCHRONIZED AND INDEPENDENTLY POWERED JAWS

This model adds the ability to independently power each jaw. The jaws are not synchronized and may be cycled at differing rates or pressures.



Z1 CORROSION RESISTANT

This option provides a corrosion resistant coating on all ferrous parts for use in applications where the standard parts may corrode.

NOTE: Rodlok® and Rodlok rod, part of -H47 option, are not corrosion resistant.

V1 FLUORO-ELASTOMER SEALS

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

NOTE: Rodlok, part of -H47 option does not include -V1 components. Consult PHD for fluid compatibility with -SPP99 option. Consult PHD for high temperature use.

L9 METRIC UNIT WITH IMPERIAL (NPT) PORTS

TRAVEL LIMITING STOPS

These options provide corrosion resistant jaw travel stop tubes for use in limiting jaw travel on open or close. The travel limiting stop tubes provide a repeatable positive stop.

Model GRR12 requires identical stops for both jaws while traveling in the same direction. Synchronized units may only use the ANxxx and ATxxx options. Non-synchronized models (GRR02 & GRR22) may use the APxxx, ARxxx, AUxxx, or AQxxx in any combination for limiting the travel of either jaw independently.

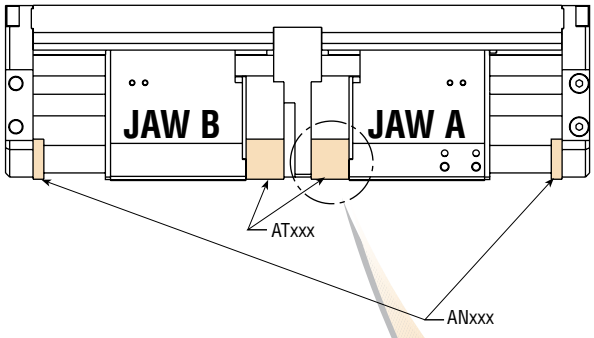
Non-synchronized units may also be ordered with ANxxx or ATxxx options.

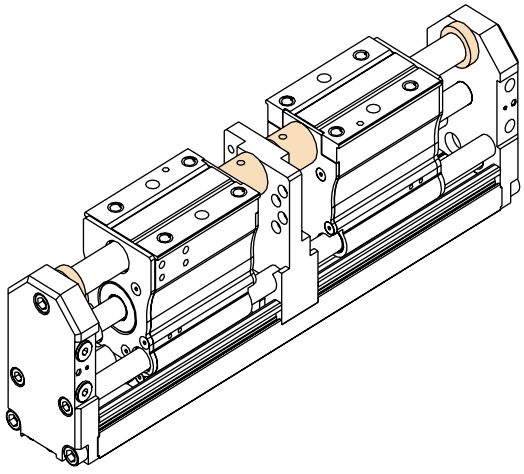
Travel limiting tubes are available in lengths from 3.0 to 99.9 mm in .1 mm increments.

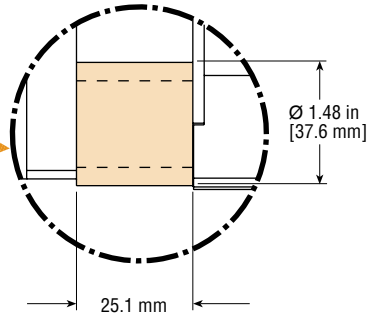
For adjustable jaw travel, see travel adjustment collars on page 4-105.

ANxxx **ATxxx**

AVAILABLE ON GRR02, GRR12, & GRR22

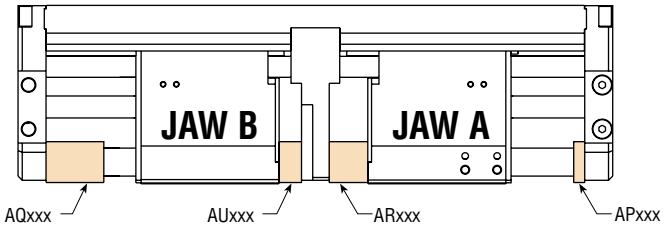






APxxx **ARxxx** **AUxxx** **AQxxx**

AVAILABLE ON GRR02 & GRR22 MODELS ONLY



EXAMPLE:
-ATxxx stop with 25.1 mm length = -AT251

NOTE: Options' xxx are in .1 mm increments with implied decimal point one place from right, and must be 3 digits long with values ranging between 03.0 and 99.9 mm.

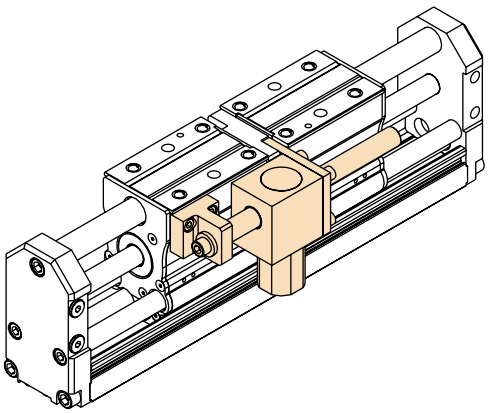
H47 RODLOK®

PHD's Rodlok® is ideal for locking the jaws while in a static/stationary position. When the pressure is removed from the port of the Rodlok®, the mechanism will grip on the external guide shaft and prevent the jaws from moving. The loads are held indefinitely without power. Rodlok® performance is application and environment sensitive. Cleanliness of shaft or Rodlok® will also affect performance.

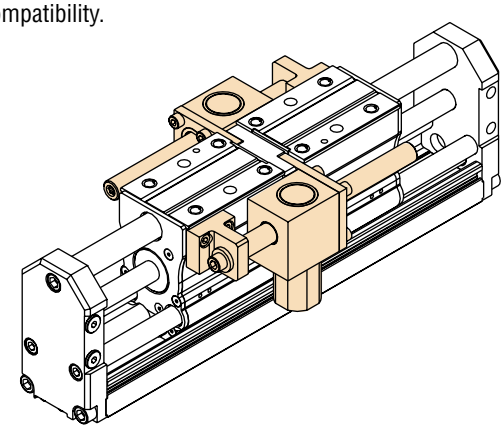
THE RODLOK® IS NOT DESIGNED TO BE USED AS A PERSONNEL SAFETY DEVICE.

Option -H47 provides the Rodlok® pre-assembled to the gripper. The port of the Rodlok device will be in position 5.

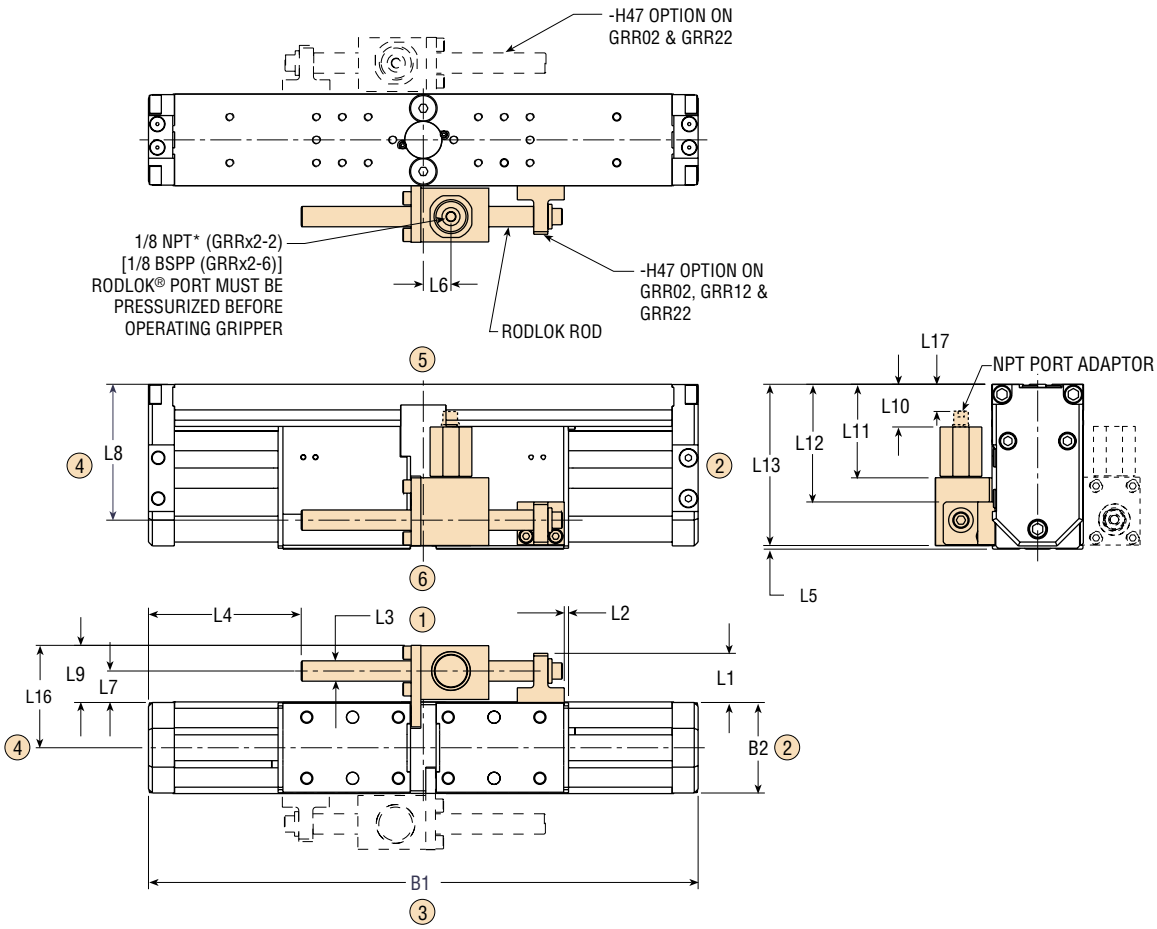
Option -H47 may be purchased with the -Z1 (corrosion resistant) option and -V1 (fluid compatibility) option. However the Rodlok® and Rodlok® rod DO NOT PROVIDE corrosion resistance or fluid compatibility.



GRR12 WITH -H47 OPTION



GRR02 & GRR22 WITH -H47 OPTION



All dimensions are reference only unless specifically toleranced.

LETTER DIM	MODEL NUMBER							
	GRRx2-x-63 X 150		GRRx2-x-63 X 200		GRRx2-x-63 X 250		GRRx2-x-63 X 350	
	in	mm	in	mm	in	mm	in	mm
B1	17.314	439.8	21.251	539.8	26.016	660.8	33.890	860.8
B2	3.500	88.9	3.500	88.9	3.500	88.9	3.500	88.9
L1	1.900	48.3	1.900	48.3	1.900	48.3	1.900	48.3
L2	.165	4.2	.165	4.2	1.630	41.4	3.370	85.6
L3	.787	20.0	.787	20.0	.787	20.0	.787	20.0
L4	4.920	125.0	5.900	149.9	7.280	184.9	9.250	235.0
L5	.141	3.6	.141	3.6	.141	3.6	.141	3.6
L6	1.070	27.2	1.070	27.2	1.070	27.2	1.070	27.2
L7	1.217	30.9	1.217	30.9	1.217	30.9	1.217	30.9
L8	5.254	133.5	5.254	133.5	5.254	133.5	5.254	133.5
L9	2.209	56.1	2.209	56.1	2.209	56.1	2.209	56.1
L10	1.150	41.9	1.150	41.9	1.150	41.9	1.150	41.9
L11	3.618	91.9	3.618	91.9	3.618	91.9	3.618	91.9
L12	4.550	115.6	4.550	115.6	4.550	115.6	4.550	115.6
L13	6.234	158.3	6.234	158.3	6.234	158.3	6.234	158.3
L14	3.95 lb	1.79 kg	4.22 lb	1.91 kg	4.35 lb	1.97 kg	4.65 lb	2.11 kg
L15	7.90 lb	3.58 kg	8.44 lb	3.83 kg	8.70 lb	3.95 kg	9.30 lb	4.22 kg
L16	3.960	100.6	3.960	100.6	3.960	100.6	3.960	100.6
L17	1.06	27.1	1.06	27.1	1.06	27.1	1.06	27.1

L14 = WEIGHT ADDER FOR GRR12
L15 = WEIGHT ADDER FOR GRR02 & GRR22

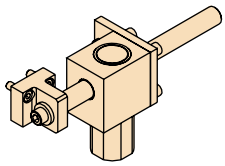
NOTES:

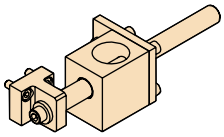
1) LOCKING FORCE INDICATED IS THE ACTUAL LOCKING FORCE WITH A DRY, CLEAN ROD AND DOES NOT INCLUDE ANY SAFETY FACTOR. IT IS POSSIBLE TO OVERRIDE THE RODLOK® WITH VERY HIGH FORCE APPLIED TO THE GRIPPER. STATIC LOCKING FORCE MAY BE INCREASED ON SYNCHRONIZED UNITS, GRR12, WITH THE ADDITION OF A SECOND RODLOK®. SEE KITS BELOW.
2) CIRCLED NUMBERS INDICATE POSITION.
3) *1/8" NPT PORT IS AN ADAPTOR INCLUDED WITH IMPERIAL UNITS.

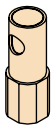
SIZE	STATIC LOCKING FORCE (see Note 1)	
	lb	N
63	495	2200

ACCESSORIES - RODLOK®

The Series GRR is -H47 ready as standard. The following items may be added to the Design 2 [6] GRR or may be used as replacement parts. Note that the kits below are for one jaw only.







COMPLETE RODLOK® KIT (PER JAW)

Full unit description - H9110

Kit includes Rodlok® and Rodlok adaptor for a single (1) jaw.

RODLOK® SEAL KIT (PER JAW)

Full unit description - H9115

Kit includes seals and wear rings for a single (1) jaw.

RODLOK® ADAPTOR KIT (PER JAW)

Full unit description - H9105

Kit includes Rodlok® adaptor for a single (1) jaw. Does not include Rodlok.

RODLOK® KIT (PER JAW)

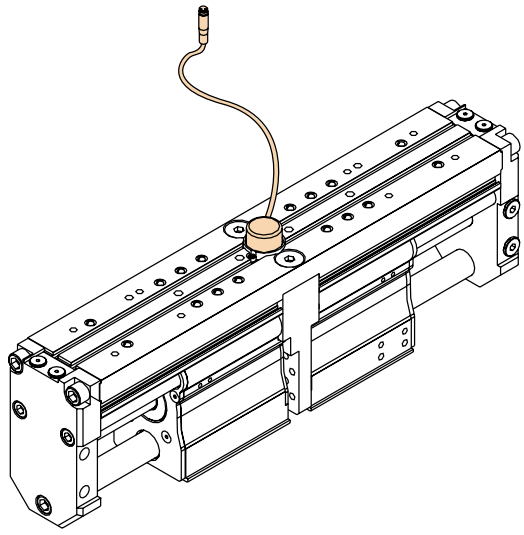
Full unit description - H9100

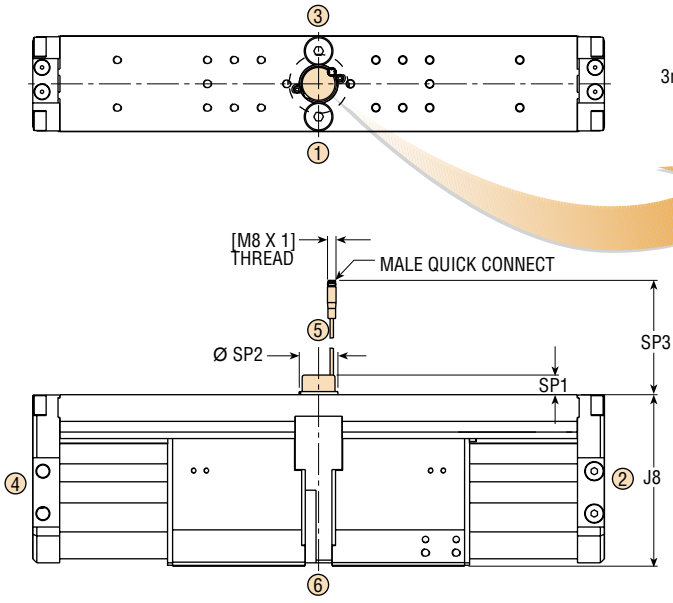
Kit includes Rodlok® for a single (1) jaw. Does not include Rodlok imperial port adaptor.

SPP99 JAW POSITION SENSOR

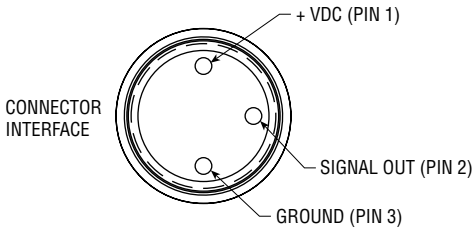
PHD's Jaw Position Sensor provides an easy to use, economical, fully integrated solution to continuously monitor the grip position of the jaws. The sensor mounts directly to the gripper making field installation or replacement quick and easy. The 3-pin quick-connect connector provides a 0-10 volt analog output compatible with standard analog control modules.

Consult PHD for use with -V1 option.





LETTER DIM	MODEL NUMBER GRRx2-x-63 in	mm
J8	6.375	161.9
SP1	.748	19.0
SP2	1.437	36.5
SP3	10.000	254



RESOLUTION

Resolution of sensor installed into gripper is 0.001 inch [0.025 mm] in conjunction with an analog control module having 15 bits or greater input resolution.

REPEATABILITY

Maximum variation of reported grip dimension when repeatedly gripping the same object is ±0.002 in [±0.05 mm].

ENVIRONMENTAL

Temperature Limits: -20 to 180°F [-28 to 82°C]
IP67 compliant when installed in gripper.

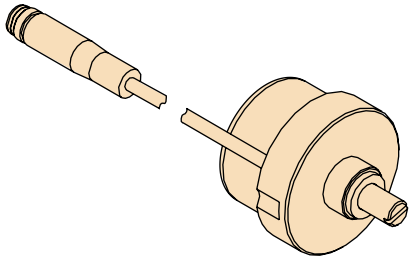
ELECTRICAL

Supply Voltage: 15-30 VDC, reverse polarity protected
Output Voltage: 0-10 VDC, short-circuit protected
Output Constant: 663 ± 1mV/inch [26.10 ± 0.04 mV/mm] of grip change
Output Voltage Offset: <10mV typical
Output Linearity: ± 0.3%

All dimensions are reference only unless specifically toleranced.

ACCESSORIES - JAW POSITION SENSOR

Series GRR is supplied -SPP99 ready. Kit below provides the same jaw position sensor and mounting hardware supplied pre-assembled with the -SPP99 option. See option details for further information.



JAW POSITION SENSOR KIT

STANDARD	CORROSION RESISTANT
74209-31	74209-32

Kit includes 1 jaw position sensor, 2 mounting screws, 1 seal, and 1 coupling.

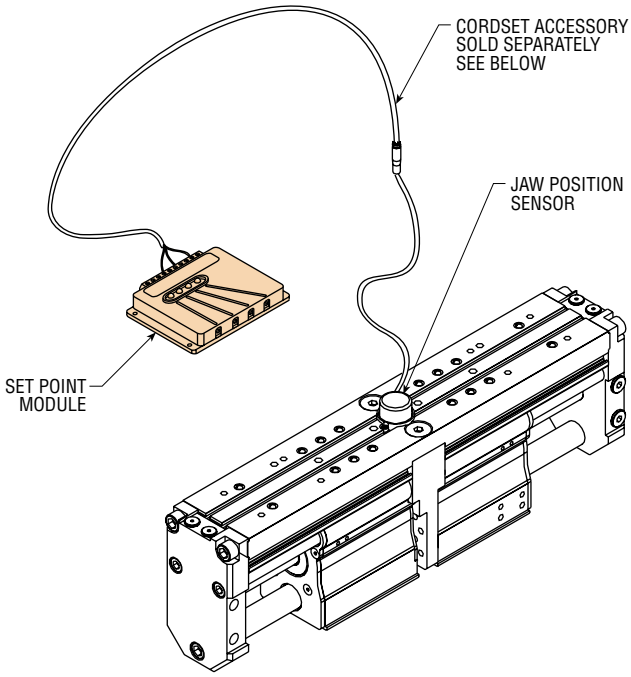
ACCESSORIES - SET POINT MODULE

Set Point Module converts analog output from sensor into discrete on-off outputs. Module provides four independently adjustable set points throughout jaw travel. Available with NPN (sink) or PNP (source) outputs.

SET POINT MODULE

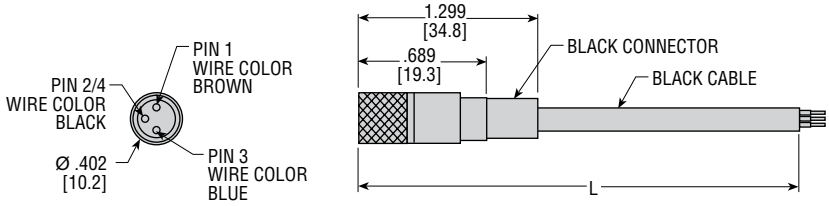
PART NO.	DESCRIPTION
9800-01-0300	4.5-24 VDC, Sink Type Output
9800-01-0400	4.5-24 VDC, Source Type Output

See Switches and Sensors section in main catalog for more information.



ACCESSORIES - CORDSET

Provides a cordset with female quick connect and additional cable. Perfect for use with the Set Point Module.

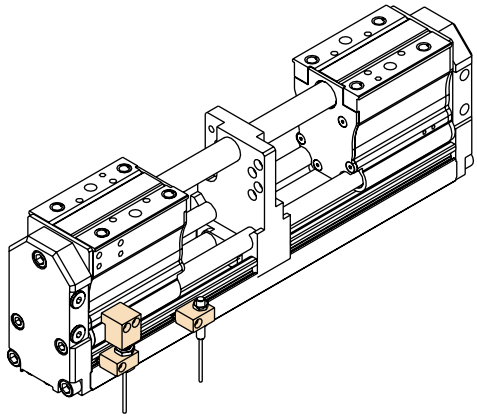


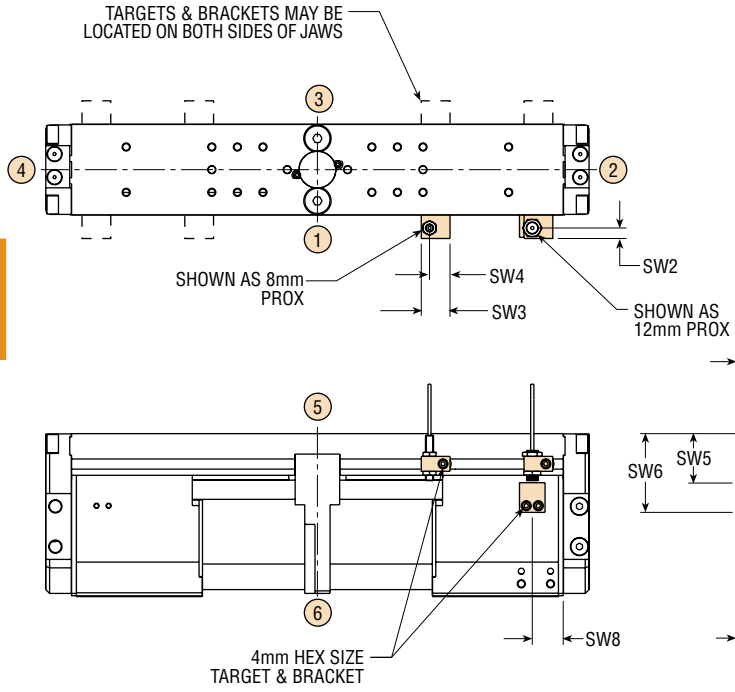
MODEL NO.	LETTER DIM. L
63549-02	78.74 [2 m]
63549-05	196.85 [5 m]

PROXIMITY SWITCHES - EXTERNAL

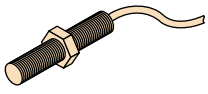
This accessory provides for the external mounting of 8 or 12 mm threaded round metal sensing inductive proximity switches. Multiple switches may be mounted using multiple brackets. Proximity switches, targets, and mounting brackets are ordered separately. See the Switches and Sensors section of catalog for complete switch specifications.

NOTE: Target and bracket kits do not interchange with Series 1 [5] GRR Grippers.



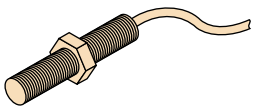


DIM LETTER	GRRx2-x-63 in	mm
B3	3.544	90.0
SW1	.920	23.4
SW2	.410	10.4
SW3	1.125	28.6
SW4	.852	21.6
SW5	1.920	48.8
SW6	3.080	78.2
SW7	.900	22.9
SW8	1.211	30.8



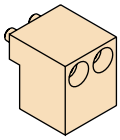
8mm THREADED INDUCTIVE PROXIMITY SWITCHES

PART NUMBER	DESCRIPTION
51422-005-02	NPN (Sink) 5-30 VDC, 2 meter cable
51422-006-02	PNP (Source) 5-30 VDC, 2 meter cable



12mm THREADED INDUCTIVE PROXIMITY SWITCHES

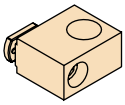
PART NUMBER	DESCRIPTION
15561-001	NPN (Sink) 10-30 VDC, 3 meter cable
15561-002	PNP (Source) 10-30 VDC, 3 meter cable
15561-003	20-250 VAC, 3 meter cable



THREADED INDUCTIVE PROXIMITY SWITCH TARGET KITS

STANDARD	CORROSION RESISTANT
74994-31	74994-32

Kit includes 1 proximity switch target and 2 target mounting screws.



THREADED INDUCTIVE PROXIMITY SWITCH MOUNTING BRACKET KITS

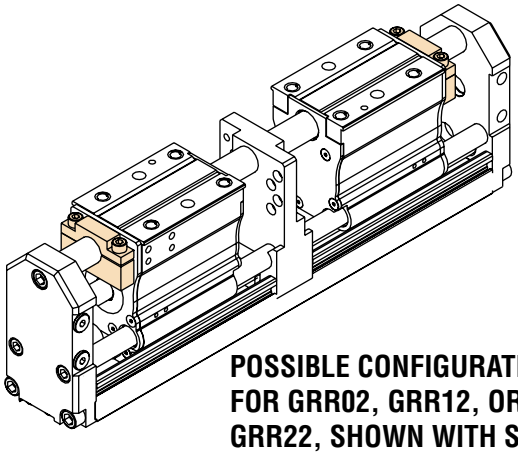
8mm SWITCH	CORROSION RESISTANT 8mm SWITCH	12mm SWITCH	CORROSION RESISTANT 12mm SWITCH
74992-31	74992-32	74993-31	74993-32

Kit includes 1 proximity switch mounting bracket, 1 mounting nut, and 1 mounting screw.

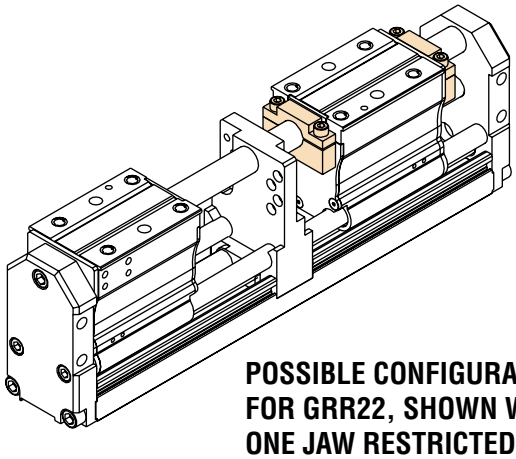
All dimensions are reference only unless specifically toleranced.

TRAVEL ADJUSTMENT COLLARS

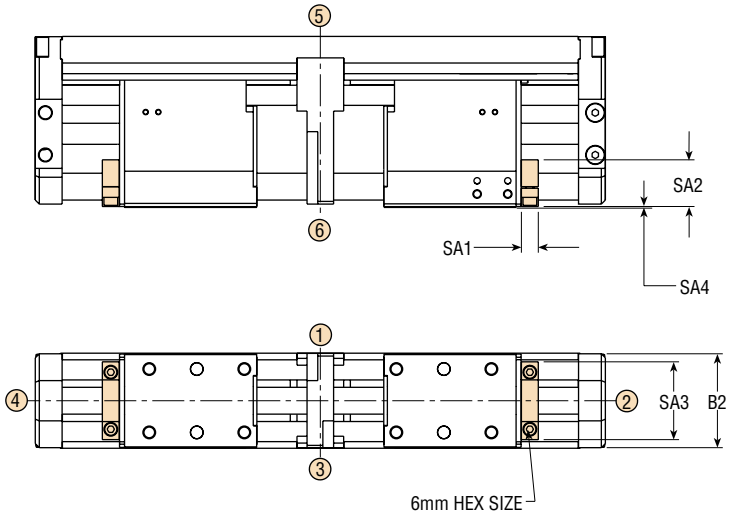
This accessory provides travel adjustment stop collars for use in limiting jaw travel on open or close. The travel adjustment stop collars provide infinite adjustment. Synchronized model (GRR12) requires travel adjustment collars to be identically located for both jaws, in the same direction of travel. Non-synchronized models (GRR02 & GRR22) do not require identical stop locations for each jaw. For non-adjustable jaw travel limiting, see options ANxxx, ATxxx, APxxx, ARxxxx, AUxxx, and AQxxx on page 4-99.



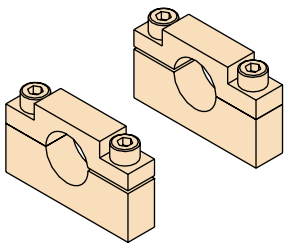
POSSIBLE CONFIGURATION FOR GRR02, GRR12, OR GRR22, SHOWN WITH STROKE LIMITED ON OPEN



POSSIBLE CONFIGURATION FOR GRR22, SHOWN WITH ONE JAW RESTRICTED



DIM LETTER	GRRx2-x-63 in	mm
B2	3.500	88.9
SA1	.630	16.0
SA2	1.740	44.2
SA3	2.900	73.7
SA4	.035	.9



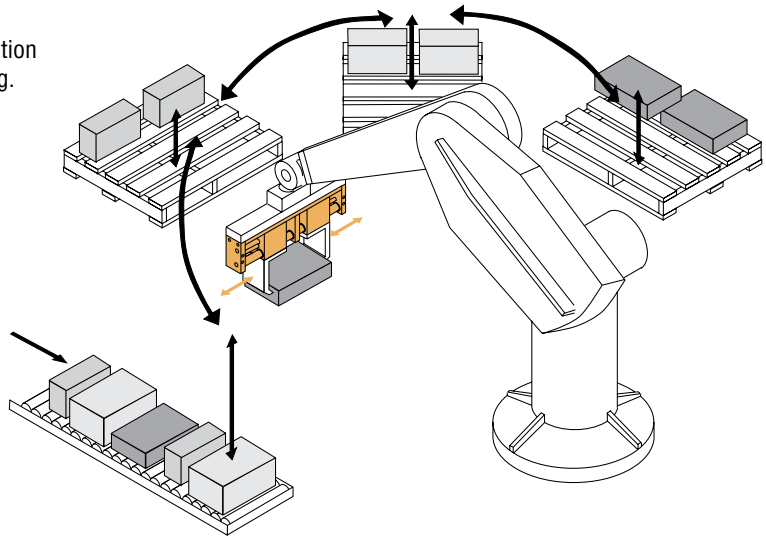
STROKE ADJUSTMENT COLLAR KITS

STANDARD	CORROSION RESISTANT
74211-01	74211-02

Kit includes 2 stroke adjustment collars and 4 mounting screws.

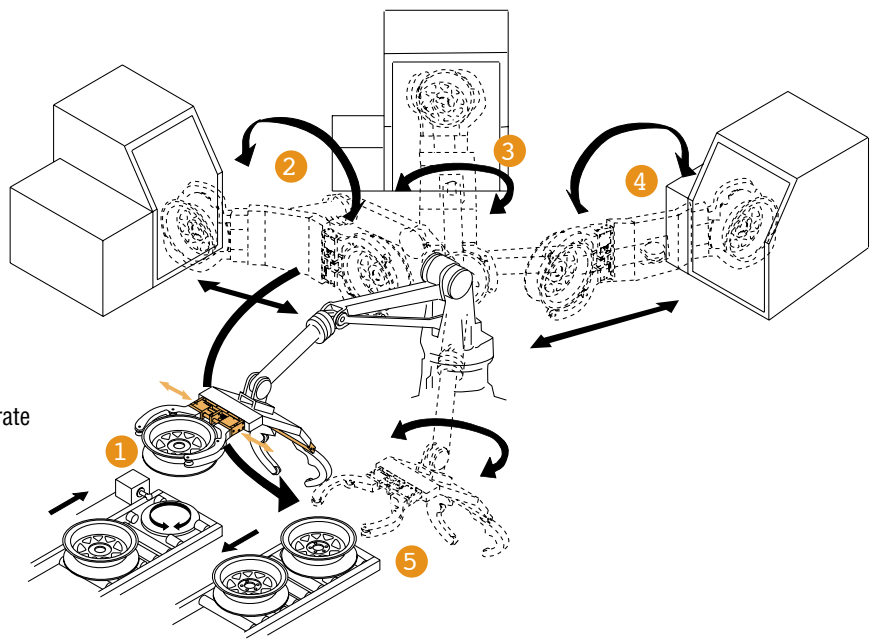
GRIPPER FOR LONG TRAVEL, HIGH FORCE CAPABILITY

The Series GRR Gripper is designed for long stroke, high force applications. The synchronized parallel jaw motion automatically centers items for operations such as sorting. The long stroke compensates for items of varying size or position.



GRIPPER FOR HIGH FORCE AND HIGH JAW LOADS

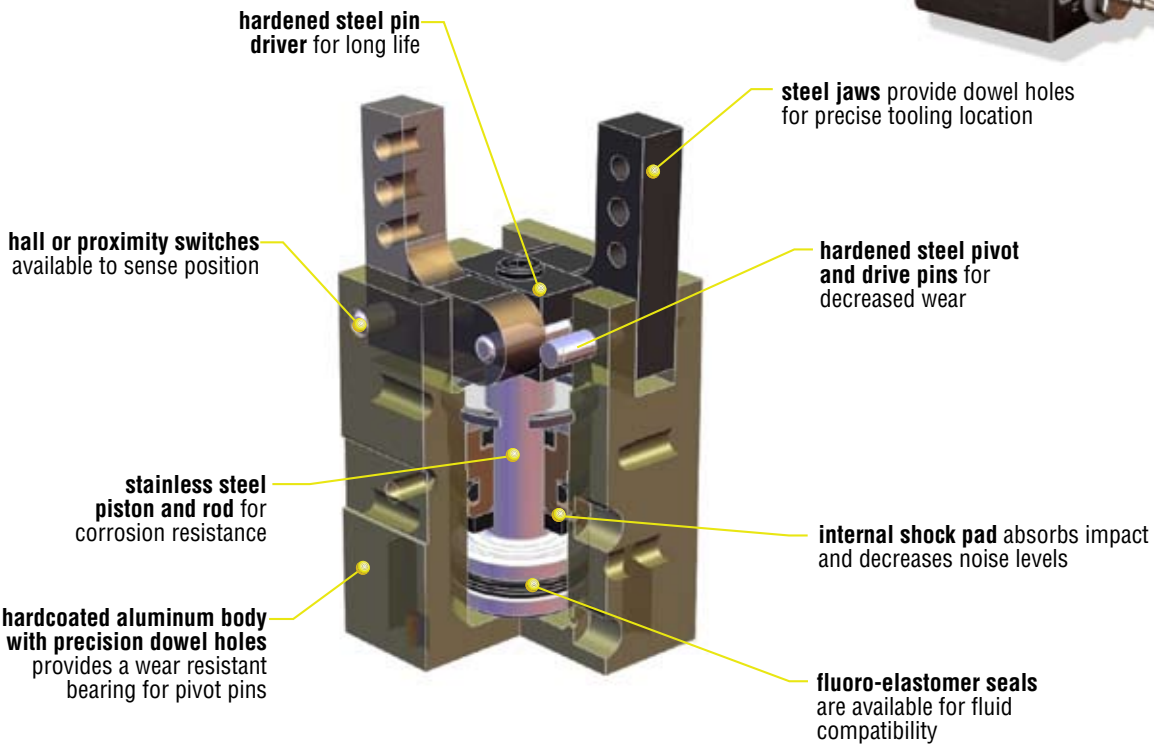
The Series GRR Gripper is designed to withstand external forces when moving heavy parts quickly. The parallel design provides for automatic centering of parts, while the long jaw travel makes it flexible for a wide variety of applications. In this application, two Series GRR Grippers are mounted on a fixture attached to a robot. The robot will transfer rims from an in-feed conveyor station to and from three separate machining processes. Then the finished rim is placed on a conveyor, taking it from the machining area.



8400 angular

COMPACT SIZE WITH ONE DAY DELIVERY

gripper shown with finger blank kit



Major Benefits

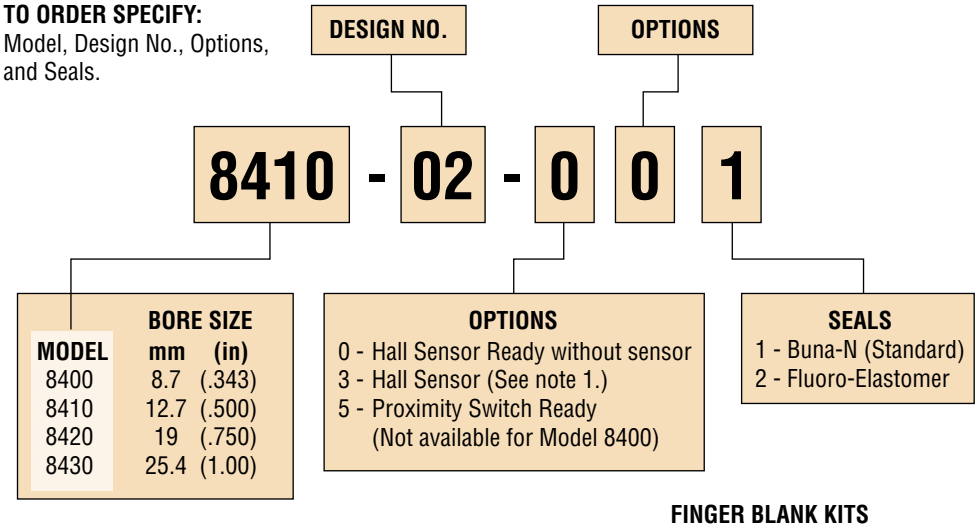
- Compact size
- Rugged body and jaw design
- Four sizes available
- Hardened steel pivot mechanism
- Close tolerance jaw mechanism minimizes jaw play
- Three mounting surfaces as standard
- Blank fingers available for customizing jaw tooling
- 1 day shipping
- 5 million cycles minimum rated life with standard seals

Industry Uses

- Assembly machine builders
- Light bulb manufacturing
- Batteries
- Medical
- Bearing manufacturing
- Semiconductor

ORDERING DATA: SERIES 8400 ANGULAR GRIPPERS

TO ORDER SPECIFY:
Model, Design No., Options, and Seals.



PROXIMITY SWITCHES

PART NO.	DESCRIPTION
18430-001-02	4 mm Round Current Sinking (NPN)
18430-002-02	4 mm Round Current Sourcing (PNP)

PROXIMITY SWITCH KIT

TO FIT:	KIT NO.
8410	19813
8420	19814
8430	19631

FINGER BLANK KITS

TO FIT:	ALUMINUM	DELRIN AF
8400	8573	8574
8410	8575	8576
8420	8577	8578
8430	18613	18614

HALL SENSOR KITS

GRIPPER	SENSOR KIT NUMBER
8400	10906-12
8410	10907-12
8420	10908-12
8430	18686-04

NOTES:
1) Sensor must be used with a PHD Set Point Module which is ordered separately. See Switches and Sensors section for information and ordering data.
2) Proximity Switches, Bracket Kits, and Finger Blanks must be ordered separately. See option pages.

SET POINT MODULES

PART NO.	DESCRIPTION
9800-01-0300	4.5-24 VDC, Sink Type Output
9800-01-0400	4.5-24 VDC, Source Type Output

See Switches and Sensors section for information.

UNIQUE GRIPPERS ARE AVAILABLE.
SEE PAGES 4-139 TO 4-164.

SPECIFICATIONS	SERIES 8400 ANGULAR
OPERATING PRESSURE STANDARD UNIT	40 psi min to 150 psi max [2.8 bar min to 10 bar max] air
OPERATING TEMPERATURE	-20° to +180°F [-28° to +82°C]
RATED LIFE	5 million cycles minimum with standard seals
GRIP BACKLASH	Within 1° per jaw
LUBRICATION	Factory lubricated for rated life
MAINTENANCE	Field repairable

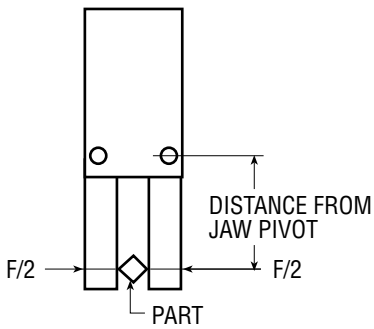
GRIPPER NO.	DISPLACEMENT in^3	GRIPPER WEIGHT lb	GRIP FORCE FACTOR G_F EXTERNAL GRIP	GRIP FORCE FACTOR G_F INTERNAL GRIP
8400	.007	.06	.027	.032
8410	.018	.16	.068	.092
8420	.055	.43	.25	.306
8430	.150	1.17	.576	.774

NOTE: Maximum load that grippers can handle will vary based on size of part being picked up, shape of part, texture of part, speed at which part is transferred, working pressure, shape of finger pads, etc. PHD recommends that the fingers or jaws be tooled or machined to conform to the shape of the part being gripped.

GRIP FORCE CALCULATION EQUATION:

$$\text{TOTAL GRIP FORCE [lb]} = \frac{\text{(Pressure [psi] x } G_F\text{)}}{\text{Distance from Jaw Pivot (in)}}$$

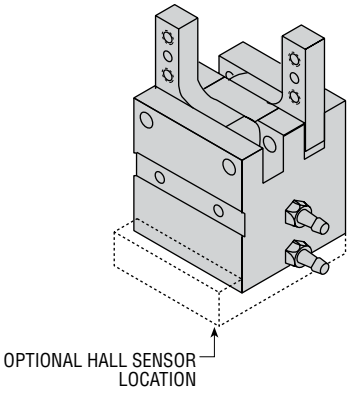
NOTE: Gripping force is defined as the maximum value at which the jaws will not move from their gripping position. The above figures are based on calculations and will vary slightly due to friction. Gripping force is proportional to input pressure.

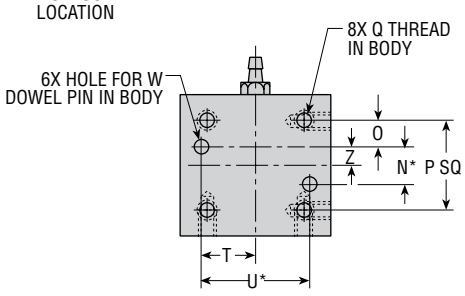


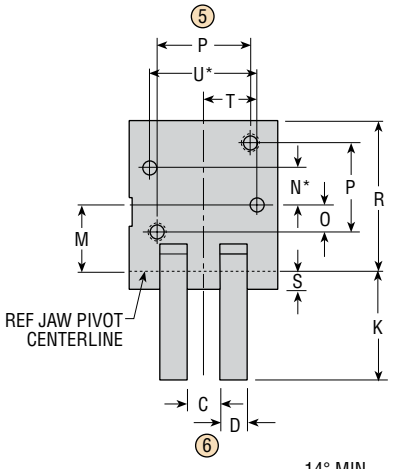
F = TOTAL GRIP FORCE

SIZING AND APPLICATION ASSISTANCE
See PHD Product Sizing Catalog for specific and complete sizing information.
Online sizing assistance is available at: ***www.phdinc.com/apps/sizing***

DIMENSIONS: SERIES 8400 ANGULAR GRIPPERS

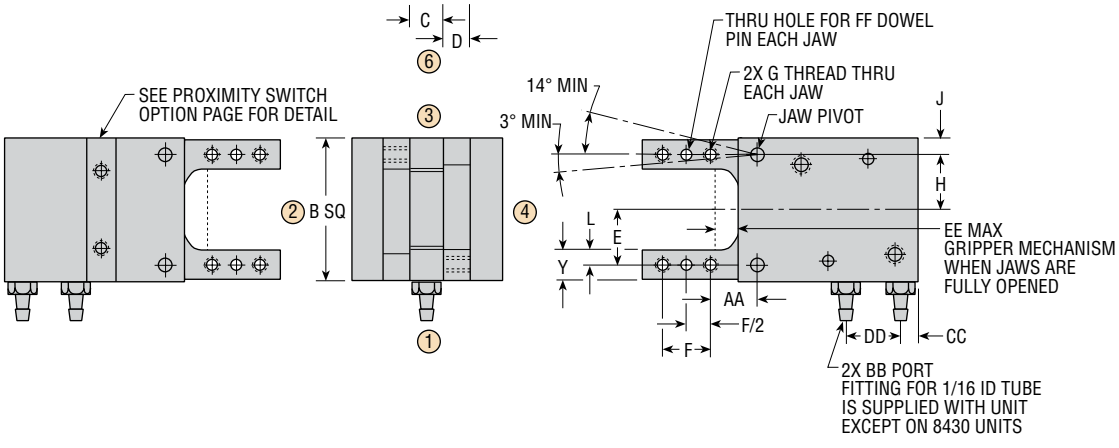






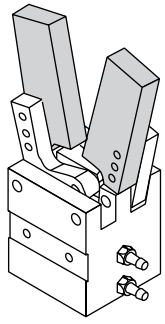
LETTER DIM	MODEL NUMBER			
	8400	8410	8420	8430
B	.700	.900	1.400	1.938
C	.196	.255	.316	.490
D	.125	.187	.250	.315
E	.250	.340	.540	.750
F	.230	.312	.440	.625
G	3-48	4-40	6-32	8-32
H	.270	.340	.540	.750
J	.080	.110	.160	.219
K	.570	.735	1.070	1.415
L	.098	.110	.150	.217
M	.400	.480	.650	.869
N*	.1870	.2500	.3750	.7000
O	.156	.175	.250	.275
P	.500	.600	.875	1.250
Q	4-40 x .156 DP	6-32x .187 DP	8-32 x .281 DP	10-24 x .375 DP
R	.966	1.219	1.480	2.054
S	.094	.156	.180	.256
T	.250	.343	.500	.688
U*	.5000	.6875	1.0000	1.3750
W	1/16	3/32	1/8	5/32
Y	.196	.220	.300	.433
Z	.093	.125	.187	.350
AA	.220	.290	.440	.562
BB	3-56	10-32	10-32	1/8 NPT
CC	.120	.145	.160	.364
DD	.300	.410	.500	.720
EE	.100	.140	.220	.360
FF	1/16	3/32	1/8	1/8

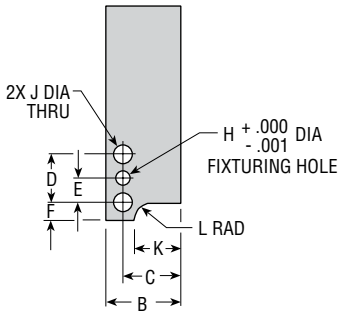
NOTES:
1) *TOLERANCE IS ±.0008
2) **GRIPPER JAWS:** SHOWN AT PARALLEL POSITION
3) JAW MOVEMENT SHOWS MINIMUM AMOUNT OF JAW ROTATION. JAWS MAY OPEN 3° OR CLOSE 5° BEYOND STATED MINIMUM ROTATION.
4) CIRCLED NUMBERS INDICATE POSITION

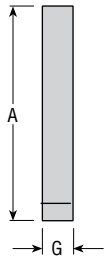


All dimensions are reference only unless specifically toleranced.

FINGER BLANK KITS







LETTER DIM	MODEL NUMBER			
	8400	8410	8420	8430
A	1.000	1.500	2.000	2.500
B	.340	.440	.690	.939
C	.240	.330	.530	.739
D	.230	.312	.440	.625
E	.115	.156	.220	.313
F	.095	.110	.170	.200
G	.187	.250	.312	.500
H	.0620	.0937	.1245	.1240
J	.109	.129	.162	.180
K	.180	.250	.420	.520
L	.094	.094	.156	.234

FINGER BLANK KITS: CONTAIN 2 FINGER BLANKS, 4 MTG SCREWS, & 2 DOWEL PINS
FINGERS MAY ALSO BE MOUNTED FACING OUTWARD

FINGER MATERIAL	FINGER BLANK KIT NO			
ALUMINUM	8573	8575	8577	18613
DELRIN AF	8574	8576	8578	18614

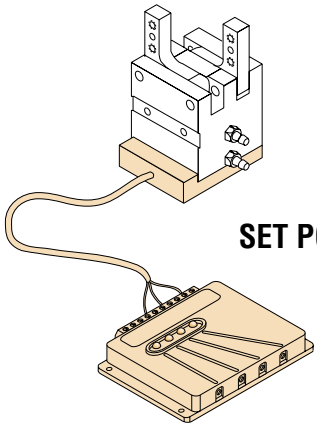
3 SENSOR/TRANSDUCER

PHD offers a solid-state sensor transducer option -3 for use with a Set Point Module for sensing four or more positions throughout the jaw travel. The Set Point Module is ordered separately and allows independent adjustment of each sensing position and is available for 4.5 to 24 VDC NPN or PNP.

SET POINT MODULES

PART NO.	DESCRIPTION
9800-01-0300	4.5-24 VDC, Sink Type Output
9800-01-0400	4.5-24 VDC, Source Type Output

See Switches and Sensors section for information.



SET POINT MODULE

5 PROXIMITY SWITCH READY

Provides unit ready for installation of kits for proximity switch mounting.

PROXIMITY SWITCHES

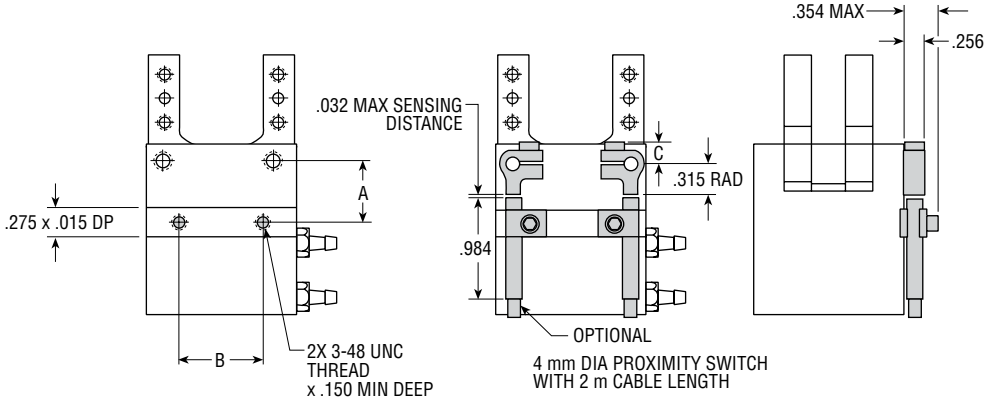
PART NO.	DESCRIPTION
18430-001-02	4 mm ROUND CURRENT SINKING (NPN)
18430-002-02	4 mm ROUND CURRENT SOURCING (PNP)

SEE SWITCHES AND SENSORS SECTION FOR DETAILS.

GRIPPER	KIT	LETTER DIMENSION		
		A	B	C
8410	19813	.594	.374	.223
8420	19814	.594	.770	.223
8430	19631	.594	1.190	.286

EACH PROXIMITY SWITCH KIT CONTAINS THE FOLLOWING ITEMS:
- 1 TARGET WITH SCREW
- 1 SWITCH BRACKET WITH SCREW

PROXIMITY SWITCHES ARE ORDERED SEPARATELY.

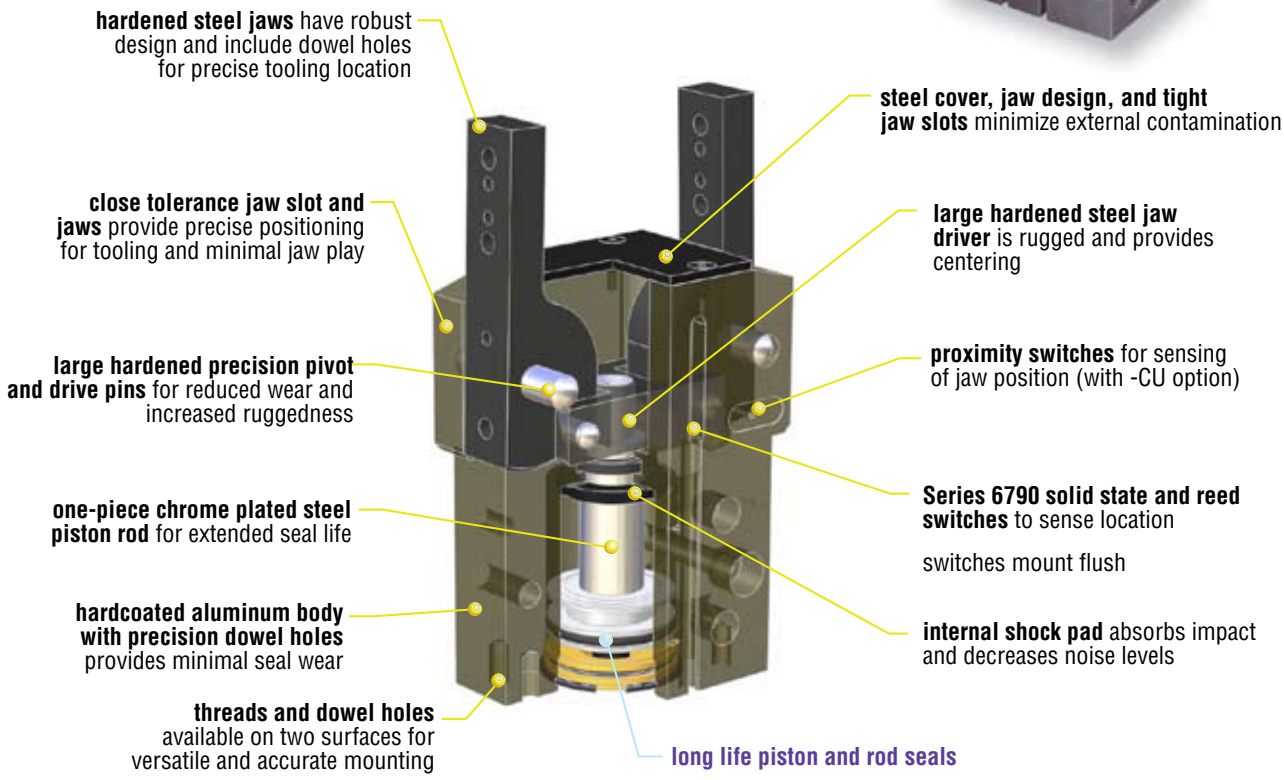


SLOT DETAIL FOR SWITCH BRACKET

All dimensions are reference only unless specifically toleranced.

GRB

LONG LIFE COMPACT ANGULAR GRIPPER SHIPS IN 1-2 DAYS



Major Benefits

- Jaws rotate completely clear of work area eliminating an otherwise required axis of travel
- Three standard jaw rotations available: 60°, 90°, and 180°
- One piece body minimizes jaw play
- Internal speed restriction removes the need for external speed controls in standard applications
- All units incorporate twin switch slots for flush switch mounting
- Two mounting surfaces
- Six sizes available
- 1-2 day shipping
- 5 million cycles minimum rated life

Industry Uses

- Assembly machine builders
- Light bulb manufacturing
- Batteries
- Medical
- Bearing manufacturing
- Semiconductor
- Optical
- Golf equipment
- Material handling
- Robotics

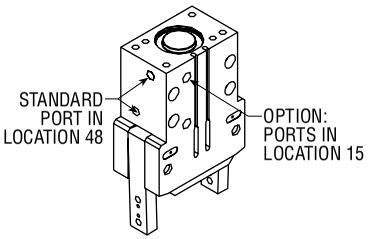
TO ORDER SPECIFY:
Product, Series, Type, Jaw Variation, Jaw, Design No., Bore Size, Total Jaw Rotation, and Options required.

SERIES
R - Regular Duty

JAW VARIATION
1 - Non-locking

DESIGN NO.
(See Note)
2 - Imperial
6 - Metric

OPTIONS
(OMIT IF NOT REQUIRED)
PORTING OPTION
UB15 - Port option in location 15
SWITCH OPTIONS
CU - Proximity switch ready
M - Magnet for Series 6790 Switches



G	R	B	1	1	-	2	-	12	x	180	-	UB15-M

PRODUCT
G - Gripper

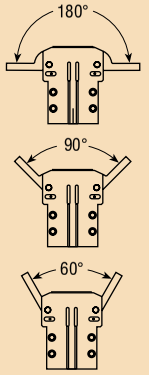
TYPE
B - 180° Angular

JAW
1 - Style 1

BORE SIZE

Diameter mm	(in)
12	(.472)
16	(.630)
20	(.787)
32	(1.260)
40	(1.575)
50	(1.969)

TOTAL JAW ROTATION (DEGREES)
180 (Standard)
90
60



NOTE: Design number indicates imperial or metric mounting holes, dowel pin holes, and ports.

4 mm ROUND INDUCTIVE PROXIMITY SWITCHES

PART NUMBER	DESCRIPTION
18430-001-02	NPN (Sink) 10-30 VDC, 2 meter cable
18430-002-02	PNP (Source) 10-30 VDC, 2 meter cable

SERIES 6790 SOLID STATE & REED SWITCHES

PART NUMBER	DESCRIPTION
67923-1	NPN (Sink) Solid State, 4.5-30 VDC, Quick Connect
67903-1-02	NPN (Sink) Solid State, 4.5-30 VDC, 2 Meter Cable
67903-1-05	NPN (Sink) Solid State, 4.5-30 VDC, 5 Meter Cable
67924-1	PNP (Source) Solid State, 4.5-30 VDC, Quick Connect
67904-1-02	PNP (Source) Solid State, 4.5-30 VDC, 2 Meter Cable
67904-1-05	PNP (Source) Solid State, 4.5-30 VDC, 5 Meter Cable
67922-1	PNP (Source) or NPN (Sink) DC Reed, 4.5-30 VDC, Quick Connect
67902-1-02	PNP (Source) or NPN (Sink) DC Reed, 4.5-30 VDC, 2 Meter Cable
67902-1-05	PNP (Source) or NPN (Sink) DC Reed, 4.5-30 VDC, 5 Meter Cable
67929-2	AC Reed, Current Limited, Quick Connect

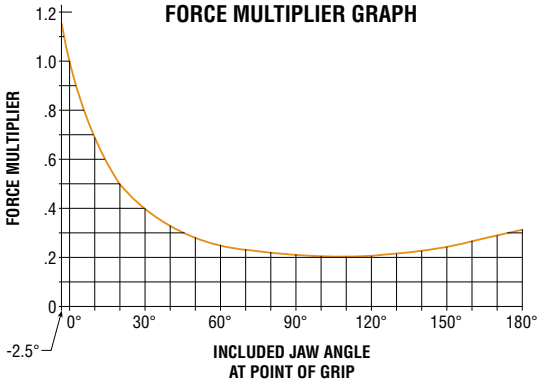
Refer to option pages for switch kit information.

UNIQUE GRIPPERS ARE AVAILABLE.
SEE PAGES 4-139 TO 4-164.

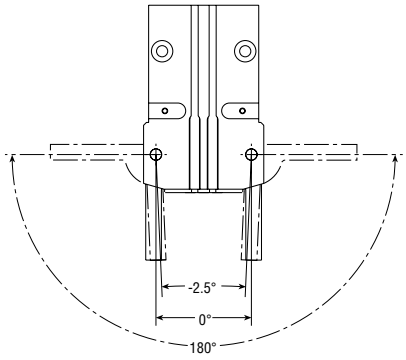
SPECIFICATIONS	SERIES GRB
OPERATING PRESSURE	
STANDARD UNIT	30 psi min to 100 psi max [2 bar min to 7 bar max] air
OPERATING TEMPERATURE	-20° to +180°F [-28° to +82°C]
RATED LIFE	5 million cycles minimum with standard seals
CYCLE TIME	See table below
LUBRICATION	Factory lubricated for rated life
MAINTENANCE	Field repairable

SIZE	NOMINAL TOTAL JAW ROTATION	GRIP FORCE FACTOR G_F EXTERNAL GRIP IMPERIAL	EXTERNAL GRIP METRIC	INTERNAL GRIP IMPERIAL	INTERNAL GRIP METRIC	GRIPPER WEIGHT lb	GRIPPER WEIGHT kg	CLOSE TIME 87 psi [6 bar] sec	OPEN TIME 87 psi [6 bar] sec	DISPLACEMENT in^3	DISPLACEMENT cm^3
12	180°	0.065	106	0.083	136	0.28	0.13	0.12	0.07	0.09	1.4
16	180°	0.18	299	0.21	346	0.55	0.25	0.25	0.13	0.21	3.5
20	180°	0.61	994	0.75	1221	0.98	0.45	0.26	0.13	0.38	6.2
32	180°	1.9	3170	2.4	3951	2.2	0.98	0.41	0.19	1.33	22
40	180°	3.7	6089	4.3	7049	4.3	2.0	0.55	0.30	2.84	47
50	180°	12	19964	14	22864	11.5	5.2	0.56	0.32	7.00	115

FORCE MULTIPLIER GRAPH



NOTES:
1) The force multiplier is a function of the jaw position at point of grip.
2) Force multiplier with the jaws parallel (0°) is 1.



GRIP FORCE CALCULATION EQUATIONS:

IMPERIAL:

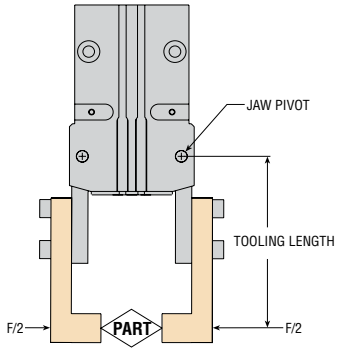
$$\frac{\text{PRESSURE (psi)} \times G_F}{\text{DISTANCE FROM JAW PIVOT (in)}} \times \text{FORCE MULTIPLIER} = \text{TOTAL GRIP FORCE (lb)}$$

METRIC:

$$\frac{\text{PRESSURE [bar]} \times G_F}{\text{DISTANCE FROM JAW PIVOT [mm]}} \times \text{FORCE MULTIPLIER} = \text{TOTAL GRIP FORCE [N]}$$

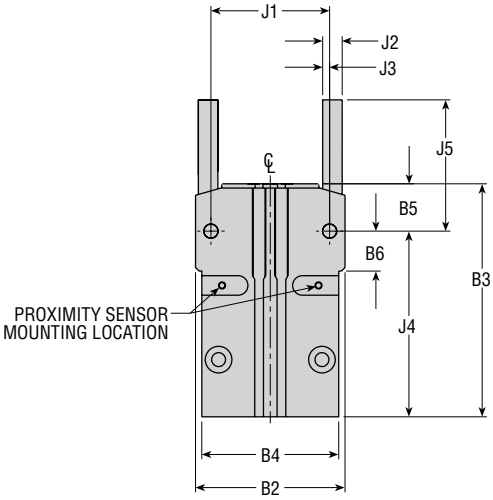
For complete sizing information including jaw tooling and inertia, see online sizing guide or sizing catalog.

SIZING AND APPLICATION ASSISTANCE
See PHD Product Sizing Catalog for specific and complete sizing information.
Online sizing assistance is available at: ***www.phdinc.com/apps/sizing***

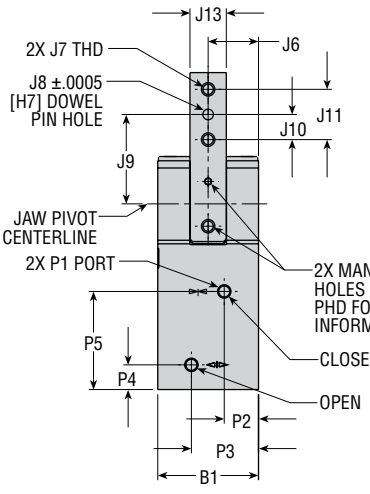


F = Total Grip Force

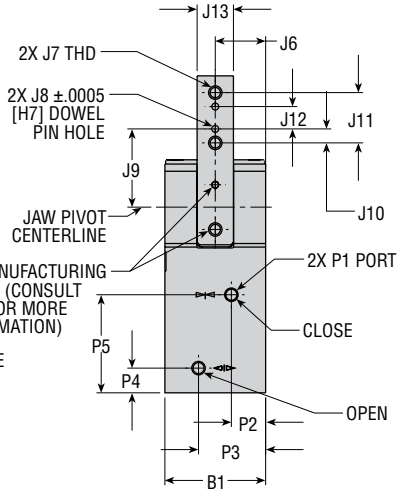
SIZE 12, 16, 20, & 32

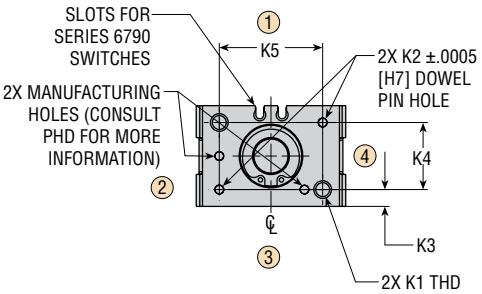


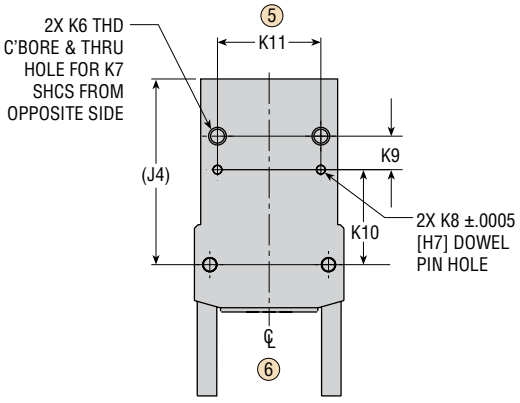
SIZE 12 & 16



SIZE 20 & 32





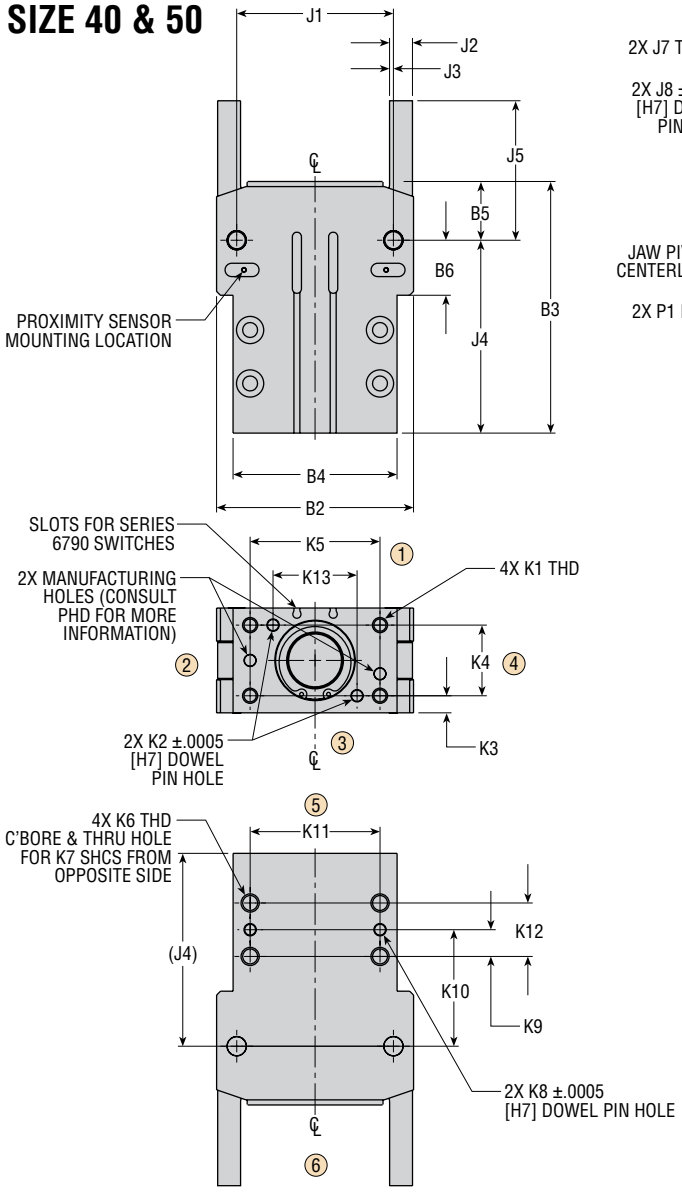


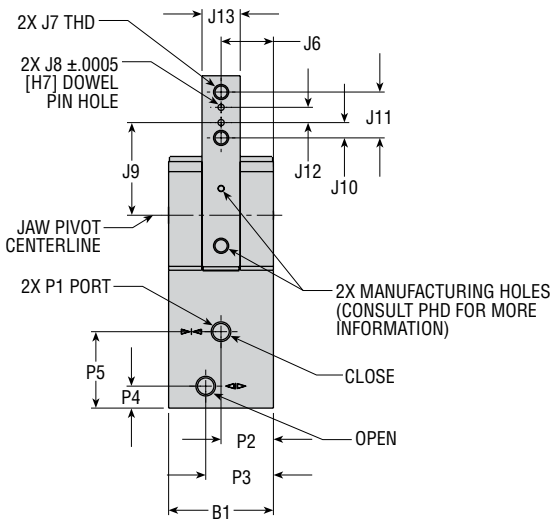
NOTES:
1) DESIGNATED ℄ IS CENTERLINE OF UNIT
2) METRIC INFORMATION SHOWN IN [ ] OR SHOWN IN COLUMNS DESIGNATED mm
3) CIRCLED NUMBERS INDICATE POSITIONS

LETTER	SIZE							
	12		16		20		32	
DIM	in	mm	in	mm	in	mm	in	mm
B1	.966	24.5	1.142	29.0	1.422	36.1	1.635	41.5
B2	1.420	36.1	1.810	46.0	2.107	53.5	3.070	78.0
B3	2.197	55.8	2.709	68.8	3.286	83.5	4.210	106.9
B4	1.102	28.0	1.654	42.0	1.930	49.0	2.600	66.0
B5	.444	11.3	.562	14.3	.668	17.0	.923	23.4
B6	.386	9.8	.523	13.3	.564	14.3	.869	22.1
J1	1.063	27.0	1.417	36.0	1.673	42.5	2.400	61.0
J2	.196	5.0	.216	5.5	.275	7.0	.394	10.0
J3	.019	.5	.059	1.5	.098	2.5	.0790	2.0
J4	1.752	44.5	2.146	54.5	2.618	66.5	3.287	83.5
J5	1.142	29.0	1.575	40.0	1.850	47.0	2.402	61.0
J6	.452	11.5	.550	14.0	.710	18.0	.7870	20.0
J7	6-32 THRU	M4 x 0.7 THRU	8-32 THRU	M4 x 0.7 THRU	10-24 THRU	M5 x 0.8 THRU	1/4-20 THRU	M6 x 1.0 THRU
J8	.0971 THRU	2.5 THRU	.0971 THRU	2.5 THRU	.0971 THRU	2.5 THRU	.1283 THRU	3.0 THRU
J9	.8270	21.0	1.0820	27.5	1.1024	28.0	1.5355	39.0
J10	.177	4.5	.256	6.5	.197	5.0	.236	6.0
J11	.354	9.0	.512	13.0	.709	18.0	.787	20.0
J12	—	—	—	—	.315	8.0	.315	8.0
J13	.3150	8.0	.3937	10.0	.5120	13.0	.6500	16.5
K1	8-32 x .296 DP	M4 x 0.7 x 7.5 DP	10-24 x .300 DP	M5 x 0.8 x 7.6 DP	1/4-20 x .375 DP	M6 x 1.0 x 9.5 DP	5/16-18 x .551 DP	M8 x 1.25 x 14.0 DP
K2	.0947 x .187 DP	2.5 x 4.75 DP	.1283 x .200 DP	3.0 x 5.0 DP	.1283 x .200 DP	3.0 x 5.0 DP	.1908 x .354 DP	5.0 x 9.0 DP
K3	.216	5.5	.215	5.5	.239	6.1	.295	7.5
K4	.4724	12.0	.6694	17.0	.9450	24.0	.9844	25.0
K5	.7480	19.0	1.2206	31.0	1.4568	37.0	2.0080	51.0
K6	10-24 x .400 DP	M5 x 0.8 x 10.0 DP	1/4-20 x .500 DP	M6 x 1.0 x 12.7 DP	1/4-20 x .551 DP	M6 x 1.0 x 14.0 DP	5/16-18 x .630 DP	M8 x 1.25 x 16.0 DP
K7	#6	M4	#10	M5	#10	M5	1/4	M6
K8	.0947 x .187 DP	2.5 x 4.75 DP	.1283 x .200 DP	3.0 x 5.0 DP	.1283 x .200 DP	3.0 x 5.0 DP	.1908 x .354 DP	5.0 x 9.0 DP
K9	.256	6.5	.354	9.0	.472	12.0	.591	15.0
K10	.906	23.0	1.123	28.5	1.339	34.0	1.634	41.5
K11	.7480	19.0	1.2206	31.0	1.4568	37.0	2.0080	51.0
P1	10-32	M5 x 0.8	10-32	M5 x 0.8	10-32	M5 x 0.8	1/8 NPT	1/8 BSPP
P2	.433	11.0	.472	12.0	.710	18.0	.728	18.5
P3	.511	13.0	.669	17.0	.946	24.0	.905	23.0
P4	.236	6.0	.256	6.5	.348	8.8	.433	11.0
P5	.886	22.5	1.142	29.0	1.378	35.0	1.673	42.5

All dimensions are reference only unless specifically toleranced.

SIZE 40 & 50



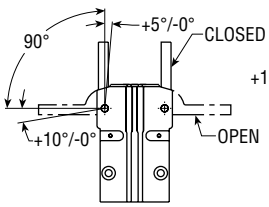


NOTES:
1) DESIGNATED ℄ IS CENTERLINE OF UNIT
2) METRIC INFORMATION SHOWN IN [ ] OR SHOWN IN COLUMNS DESIGNATED mm
3) CIRCLED NUMBERS INDICATE POSITIONS

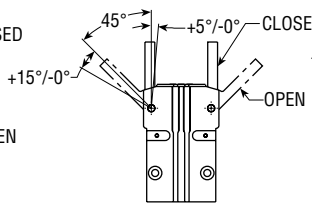
LETTER DIM	SIZE 40 in	40 mm	50 in	50 mm
B1	2.160	54.9	2.560	65.0
B2	4.060	103.1	6.220	158.0
B3	5.188	131.8	7.609	193.3
B4	3.380	85.9	4.880	124.0
B5	1.213	30.8	1.901	48.3
B6	1.134	28.8	1.676	42.6
J1	3.230	82.0	5.040	128.0
J2	.472	12.0	.708	18.0
J3	.079	2.0	.196	5.0
J4	3.975	101.0	5.708	145.0
J5	2.875	73.0	4.133	105.0
J6	1.080	27.4	1.280	32.5
J7	5/16-18 THRU	M8 x 1.25 THRU	3/8-16 THRU	M10 x 1.5 THRU
J8	.1283 THRU	3.0 THRU	.2533 THRU	6.0 THRU
J9	1.9094	48.5	2.9528	75.0
J10	.315	8.0	.394	10.0
J11	.945	24.0	1.181	30.0
J12	.3150	8.0	.3937	10.0
J13	.7875	20.0	.9840	25.0
K1	5/16-18 x .551 DP	M8 x 1.25 x 14.0 DP	3/8-16 x .787 DP	M10 x 1.5 x 20.0 DP
K2	.2533 x .397 DP	6.0 x 10.0 DP	.3158 x .590 DP	8.0 x 15.0 DP
K3	.352	8.9	.434	11.0
K4	1.4567	37.0	1.6930	43.0
K5	2.6772	68.0	4.0160	102.0
K6	3/8-16 x .787 DP	M10 x 1.5 x 20.0 DP	1/2-13 x .984 DP	M12 x 1.75 x 25.0 DP
K7	5/16	M8	3/8	M10
K8	.2533 x .397 DP	6.0 x 10.0 DP	.3158 x .590 DP	8.0 x 15.0 DP
K9	.551	14.0	.729	18.5
K10	2.401	61.0	3.485	88.5
K11	2.6772	68.0	4.0160	102.0
K12	1.102	28.0	1.457	37.0
K13	1.7323	44.0	2.8740	73.0
P1	1/8 NPT	1/8 BSPP	1/8 NPT	1/8 BSPP
P2	1.080	27.4	.414	10.5
P3	1.395	35.4	1.654	42.0
P4	.453	11.5	.551	14.0
P5	1.575	40.0	3.484	88.5

ANGULAR JAW ROTATION TOLERANCE (ALL SIZES)

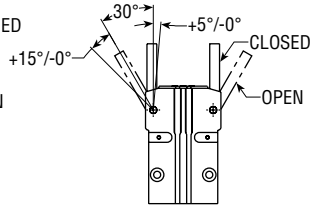
TOTAL JAW ROTATION 180° (90° PER JAW) STANDARD



TOTAL JAW ROTATION 90° (45° PER JAW)

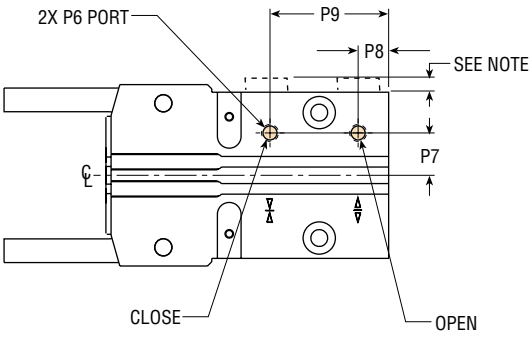


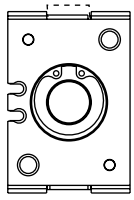
TOTAL JAW ROTATION 60° (30° PER JAW)

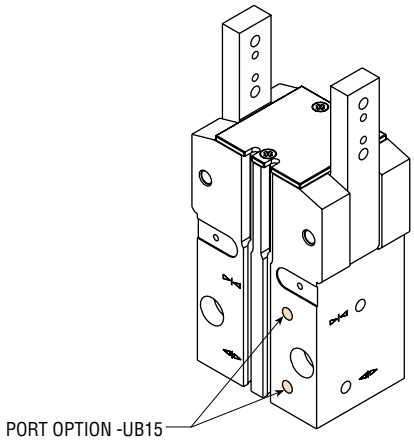


UB15 PORT OPTION IN LOCATION 15

This option provides ports in Location 15. The standard ports are plugged.





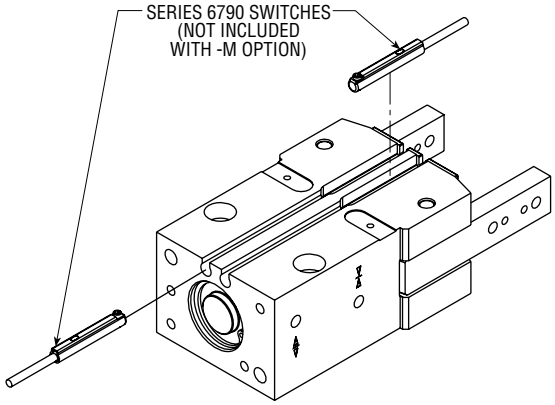


LETTER DIM	SIZE											
	12		16		20		32		40		50	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
P6	10-32	M5 x 0.8	10-32	M5 x 0.8	10-32	M5 x 0.8	1/8 NPT	1/8 BSPP	1/8 NPT	1/8 BSPP	1/8 NPT	1/8 BSPP
P7	.296	7.5	.374	9.5	.492	12.5	.728	18.5	.925	23.5	1.321	33.6
P8	.315	8.0	.256	6.5	.354	9.0	.571	14.5	.453	11.5	.551	14.0
P9	.906	23.0	1.122	28.5	1.378	35.0	1.730	43.9	1.575	40.0	3.484	88.5

NOTE: .098 [2.5 mm] PORT PLUG HEAD FOR SIZE 32, 40, & 50 METRIC UNITS ONLY

M MAGNET FOR PHD SERIES 6790 REED AND SOLID STATE SWITCHES

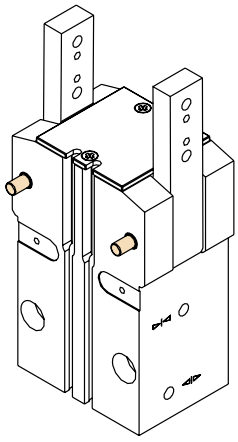
This option equips the unit with a magnetic piston for use with PHD's Series 6790 Reed and Solid State Switches. The switches mount easily into two small grooves located on the front of the gripper body and are locked into place with a set screw. PHD's Series 6790 switches are required in addition to the -M option and are sold separately. See accessories page for switch information.

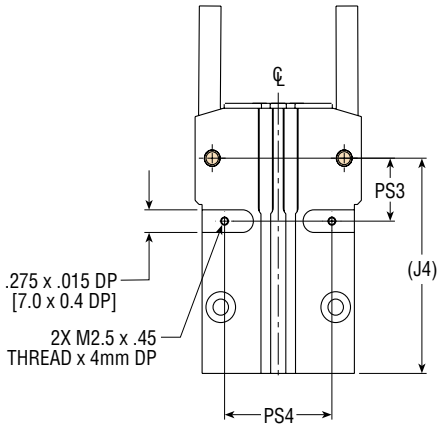


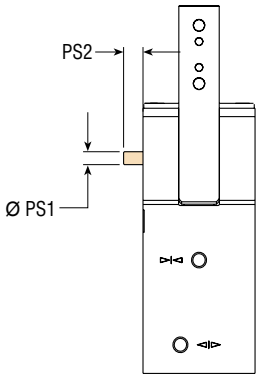
All dimensions are reference only unless specifically toleranced.

CU SENSOR READY

With this option the gripper is assembled with extended jaw pivot pins for use with PHD inductive proximity switch mounting kits. Switches and switch mounting kits are required in addition to the -CU option and are sold separately. See next page for switches and mounting kits.







LETTER DIM	SIZE 12		16		20		32		40		50	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
Ø PS1	.079	2.0	.118	3.0	.157	4.0	.196	5.0	.196	5.0	.196	5.0
PS2	.236	6.0	.236	6.0	.295	7.5	.295	7.5	.295	7.5	.295	7.5
PS3	.523	13.3	.671	17.0	.765	19.4	.612	15.5	.612	15.5	.612	15.5
PS4	.828	21.0	1.060	26.9	1.360	34.5	2.100	53.3	2.930	74.4	4.740	120.4
(J4)	1.752	44.5	2.146	54.5	2.618	66.5	3.287	83.5	3.975	101.0	5.708	145.0

PROXIMITY SWITCHES (-CU OPTION REQUIRED)

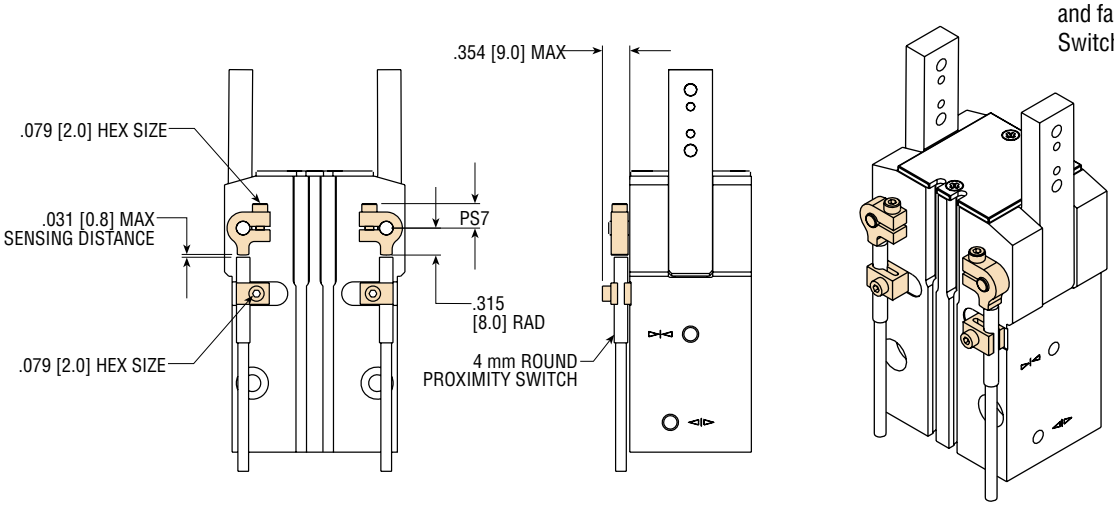
4 mm ROUND INDUCTIVE PROXIMITY SWITCHES

PART NUMBER	DESCRIPTION
18430-001-02	NPN (Sink) 10-30 VDC, 2 meter cable
18430-002-02	PNP (Source) 10-30 VDC, 2 meter cable

PROXIMITY SWITCH MOUNTING KITS

SIZE	KIT NUMBER
12	18074
16	18090
20	18075
32	18091
40	18091
50	18091

Each kit contains 1 target, 1 switch mounting bracket, and fasteners for mounting. Switches sold separately.



LETTER DIM	SIZE											
	12		16		20		32		40		50	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
PS7	.236	6.0	.236	6.0	.295	7.5	.295	7.5	.295	7.5	.295	7.5

All dimensions are reference only unless specifically toleranced.

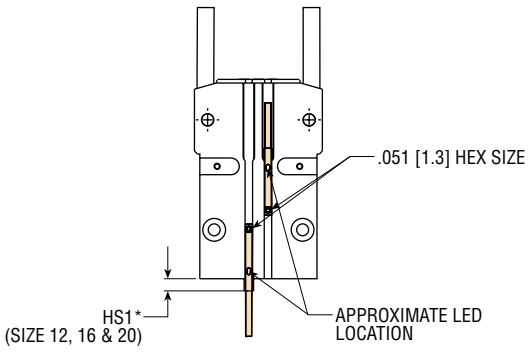
SERIES 6790 SWITCHES (-M OPTION REQUIRED)

See Switches and Sensors section for additional switch information and complete specification.

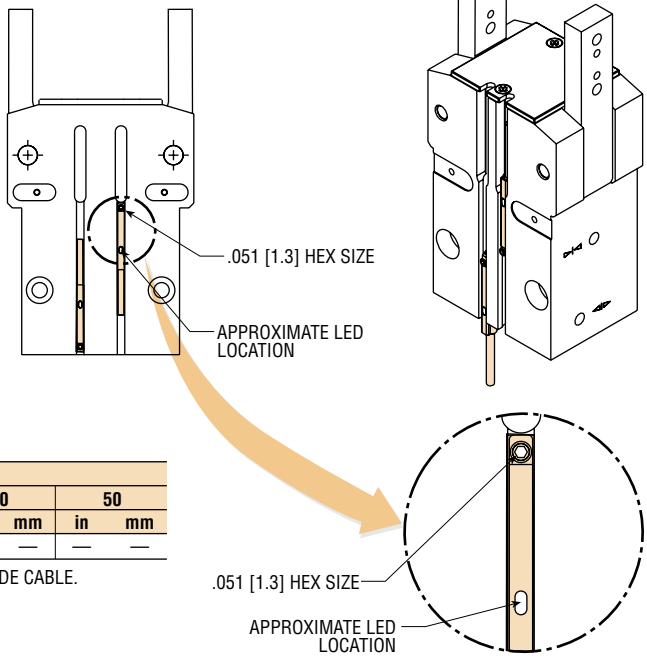
SERIES 6790 SOLID STATE & REED SWITCHES

PART NUMBER	DESCRIPTION
67923-1	NPN (Sink) Solid State, 4.5-30 VDC, Quick Connect
67903-1-02	NPN (Sink) Solid State, 4.5-30 VDC, 2 Meter Cable
67903-1-05	NPN (Sink) Solid State, 4.5-30 VDC, 5 Meter Cable
67924-1	PNP (Source) Solid State, 4.5-30 VDC, Quick Connect
67904-1-02	PNP (Source) Solid State, 4.5-30 VDC, 2 Meter Cable
67904-1-05	PNP (Source) Solid State, 4.5-30 VDC, 5 Meter Cable
67922-1	PNP (Source) or NPN (Sink) DC Reed, 4.5-30 VDC, Quick Connect
67902-1-02	PNP (Source) or NPN (Sink) DC Reed, 4.5-30 VDC, 2 Meter Cable
67902-1-05	PNP (Source) or NPN (Sink) DC Reed, 4.5-30 VDC, 5 Meter Cable
67929-2	AC Reed, Current Limited, Quick Connect

SIZE 12, 16, & 20



SIZE 32, 40, & 50

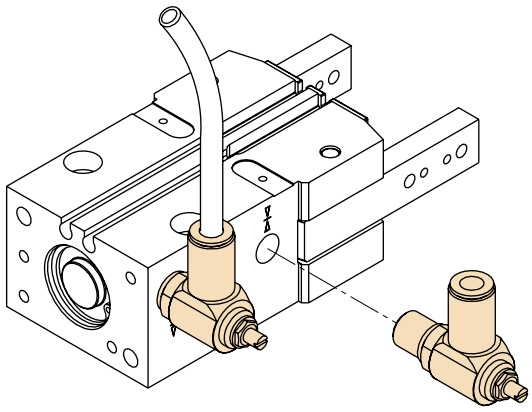


LETTER DIM	SIZE											
	12		16		20		32		40		50	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
HS1*	.350	8.9	.300	7.6	.200	5.1	—	—	—	—	—	—

NOTE: * INDICATES END OF SERIES 6790 SWITCH HOUSING, DOES NOT INCLUDE CABLE.

FLOW CONTROLS

This accessory may be used to control the jaw actuation speed of the gripper. By decreasing the jaw actuation speed, the tooling inertia may be increased.



IMPERIAL FLOW CONTROLS

GRIPPER SIZE	PORT SIZE	TUBE OD	KIT NUMBER
12	10-32 UNC-2B	5/32"	70695-01
16	10-32 UNC-2B	5/32"	70695-01
20	10-32 UNC-2B	5/32"	70695-01
32	1/8 NPT	1/4"	70695-03
40	1/8 NPT	1/4"	70695-03
50	1/8 NPT	1/4"	70695-03

NOTE: EACH KIT CONTAINS 1 FLOW CONTROL

METRIC FLOW CONTROLS

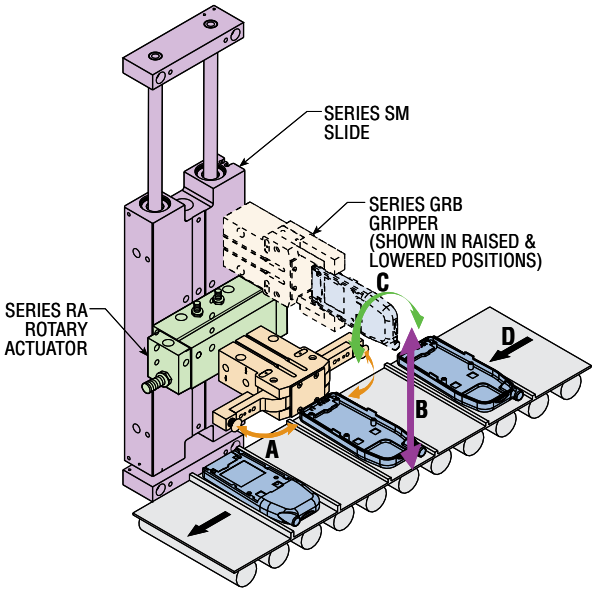
GRIPPER SIZE	PORT SIZE	TUBE OD	KIT NUMBER
12	M5 x 0.8	4.0 mm	70696-01
16	M5 x 0.8	4.0 mm	70696-01
20	M5 x 0.8	4.0 mm	70696-01
32	1/8 BSP	6.0 mm	70696-03
40	1/8 BSP	6.0 mm	70696-03
50	1/8 BSP	6.0 mm	70696-03

NOTE: EACH KIT CONTAINS 1 FLOW CONTROL

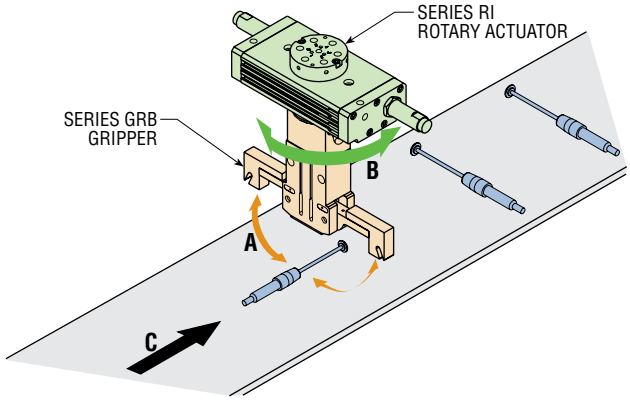
APPLICATIONS & CONCEPTS: SERIES GRB GRIPPERS

The Series GRB 180° Angular Grippers are ideal for applications where the jaws or fingers must rotate completely clear of the work area. In this application, a Series GRB 180° Angular Gripper is used in conjunction with a PHD Series RA Rotary Actuator and a PHD Series SM Slide to grasp, lift, and rotate a part 180°. The Series GRB Gripper's jaws rotate clear of the work area when not in use, eliminating the need for an additional horizontal axis of movement. The use of a typical gripper would require an actuator to move the gripper back out of the way after the part has been rotated. The Series GRB 180° Angular Gripper saves money by eliminating a linear actuator from this application.

This application shows the Series GRB 180° Angular Gripper used in conjunction with a PHD Series RI Rotary Actuator to grasp a part and rotate it 90°. The gripper is able to grasp the object, change its position 90°, and replace the object without the use of a vertical axis. Once the object has been replaced, the Series GRB jaws rotate completely clear of the work area, allowing normal work flow. As in the other example, an axis of motion is eliminated, saving money.



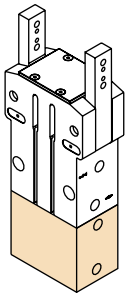
ACTIONS: A- CLOSE, **B**- UP, **C**- ROTATE 180°, **B**- DOWN, **A**- OPEN, **D**- MOVE

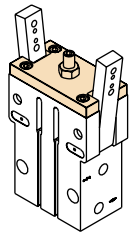


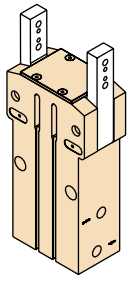
ACTIONS: **A**- CLOSE, **B**- ROTATE 90°, **A**- OPEN, **C**- MOVE

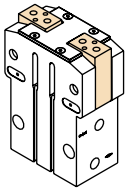
PHD UNLIMITED™ UNIQUE SOLUTIONS

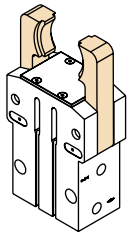
- Smaller or larger bore sizes
- Alternate angles of rotation
- Fluid compatibility
- Alternate port locations
- Alternate mounting locations
- Manifold ports

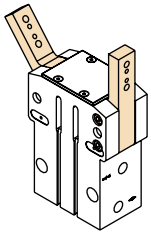

TANDEM


ROTATION ADJUSTMENT


SPRING ASSIST

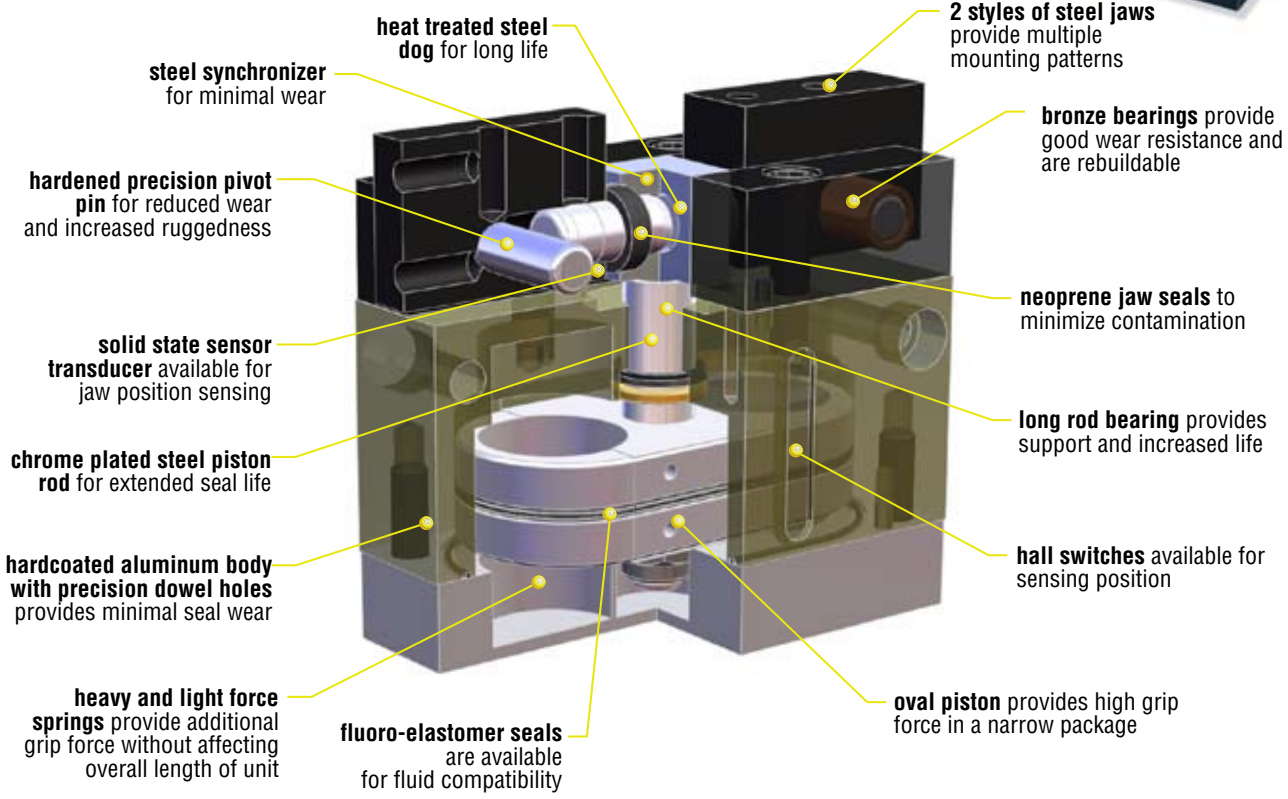

ALTERNATE JAW


ALTERNATE JAW


SINGLE JAW
ROTATION

5300 angular oval piston

COMPACT SIZE, HIGH FORCE WITH TWO JAW STYLES



Major Benefits

- Spring assist on open or close available in different forces
- High grip force to weight ratio
- Hardened steel pivot mechanism
- Close tolerance jaw mechanism minimizes jaw play
- Four sizes available in both imperial and metric versions
- 1-2 day shipping
- 5 million cycles minimum rated life with standard seals (includes spring assist units)

Industry Uses

- Assembly machine builders
- Material handling
- Robotics

TO ORDER SPECIFY:
Model, Design No., Switches, Options, and Seals.

SENSORS & SWITCHES
0 - None
3 - Hall Sensor (See note 1.)
4 - Hall Sensor Ready
7 - Hall Effect Magnet on piston and "T" slot on body for Series 5360 Hall Switches

OPTIONS
0 - None
LIGHT SPRING FORCE
3 - Spring Close
4 - Spring Open
HEAVY SPRING FORCE
5 - Spring Close
6 - Spring Open

15321 - 1 - 3 0 0 2

MODEL JAW STYLE 1	EQUIVALENT BORE DIAMETER mm	(in)
1532x	45.5	(1.79)
1533x	65	(2.56)
1534x	87.4	(3.44)
1535x	123	(4.85)
JAW STYLE 2		
1532x	45.5	(1.79)
1533x	65	(2.56)
1534x	87.4	(3.44)
1535x	123	(4.85)

IMPERIAL MODEL
JAW STYLE 1
15320 - Size 2
15330 - Size 3
15340 - Size 4
15350 - Size 5
JAW STYLE 2
15321 - Size 2
15331 - Size 3
15341 - Size 4
15351 - Size 5

METRIC MODEL
JAW STYLE 1
15322 - Size 2
15332 - Size 3
15342 - Size 4
15352 - Size 5
JAW STYLE 2
15323 - Size 2
15333 - Size 3
15343 - Size 4
15353 - Size 5

DESIGN NO.

OPTIONS

SEALS
1 - Buna-N (Standard)
2 - Fluoro-Elastomer

SERIES 5360 MINIATURE HALL EFFECT SWITCHES

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

See Switches and Sensors section for switch information.

NOTES:
1) Sensor must be used with a PHD Set Point Module which is ordered separately. See Switches and Sensors section for information and ordering data.
2) Proximity Switches, Bracket Kits, and Finger Blanks must be ordered separately.

SET POINT MODULES

PART NO.	DESCRIPTION
9800-01-0300	4.5-24 VDC, Sink Type Output
9800-01-0400	4.5-24 VDC, Source Type Output

See Switches and Sensors section for information.

UNIQUE GRIPPERS ARE AVAILABLE.
SEE PAGES 4-139 TO 4-164.

SPECIFICATIONS	SERIES 5300 ANGULAR
OPERATING PRESSURE	
STANDARD UNIT	25 psi min to 150 psi max [1.7 bar min to 10 bar max] air
LIGHT SPRING ASSIST UNIT	35 psi min to 150 psi max [2.4 bar min to 10 bar max] air
HEAVY SPRING ASSIST UNIT	65 psi min to 150 psi max [4.5 bar min to 10 bar max] air
OPERATING TEMPERATURE	-20° to +180°F [-28° to +82°C]
RATED LIFE	5 million cycles minimum with standard seals
GRIP BACKLASH	Within .2° per jaw
GRIP REPEATABILITY	Within 0.002 in [±0.05 mm] of original centered position
LUBRICATION	Factory lubricated for rated life
MAINTENANCE	Field repairable

GRIPPER NO.	DISPLACEMENT		GRIP FORCE FACTOR G_F				SPRING GRIP FORCE S_F			
			EXTERNAL GRIP		INTERNAL GRIP		LIGHT SPRING		HEAVY SPRING	
	in^3	cm^3	IMPERIAL	METRIC	IMPERIAL	METRIC	lb	N	lb	N
1532x	.59	9.6	1.87	3058.0	2.03	3323.0	34.50	3908.0	49.50	5582.0
1533x	1.78	29.2	5.56	9085.0	6.08	9938.0	93.00	10518.0	157.50	17751.0
1534x	4.29	70.3	14.14	23109.0	14.85	24255.0	221.00	24968.0	366.50	41318.0
1535x	12.66	207.5	41.85	68355.0	43.70	71382.0	590.00	66492.0	1275.00	143796.0

NOTE: Maximum load that grippers can handle will vary based on size of part being picked up, shape of part, texture of part, speed at which part is transferred, working pressure, shape of fingers, etc. PHD recommends that the fingers of jaws be tooled or machined to conform to the shape of the part being gripped.

GRIPPER NO.	GRIPPER WEIGHT					
	STANDARD		SPRING ASSIST			
			LIGHT		HEAVY	
	lb	kg	lb	kg	lb	kg
1532x	2.40	1.08	2.5	1.11	2.5	1.12
1533x	4.87	2.2	5.0	2.28	5.1	2.32
1534x	9.58	4.35	10.0	4.53	10.2	4.63
1535x	27.73	12.57	29.5	13.37	29.8	13.53

GRIP FORCE CALCULATION EQUATIONS:

IMPERIAL:

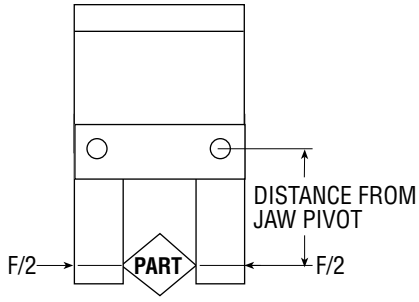
$$\text{TOTAL GRIP FORCE [lb]} = \frac{\text{(Pressure [psi] x } G_F\text{)}}{\text{Distance from jaw pivot (in)}}$$

$$\text{TOTAL GRIP FORCE WITH SPRINGS [lb]} = \frac{\text{((Pressure [psi] x } G_F\text{) } \pm S_F\text{ [lb])}}{\text{Distance from jaw pivot (in)}}$$

METRIC:

$$\text{TOTAL GRIP FORCE [N]} = \frac{\text{(Pressure [bar] x } G_F\text{)}}{\text{Distance from jaw pivot (mm)}}$$

$$\text{TOTAL GRIP FORCE WITH SPRINGS [N]} = \frac{\text{((Pressure [bar] x } G_F\text{) } \pm S_F\text{ [N])}}{\text{Distance from jaw pivot (mm)}}$$

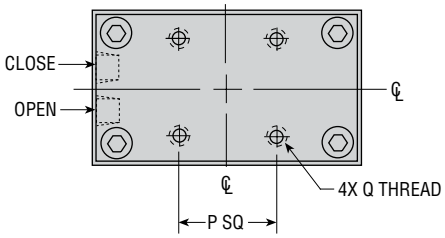


F = Total Grip Force

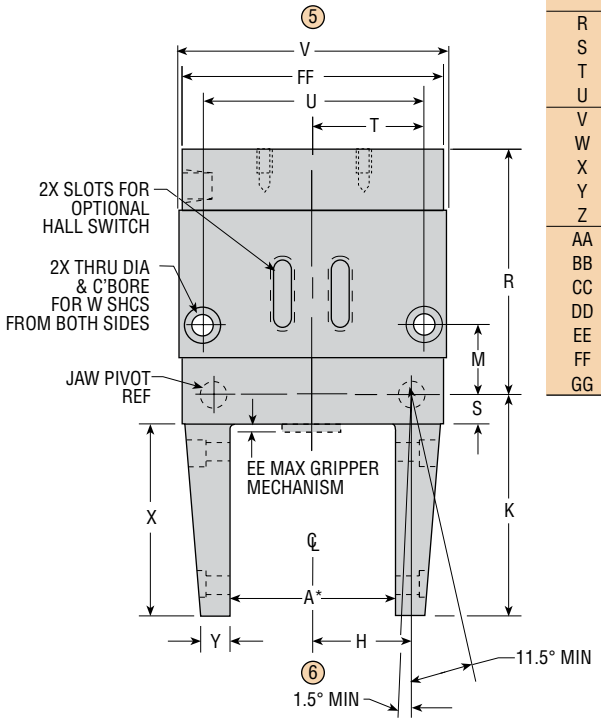
SIZING AND APPLICATION ASSISTANCE

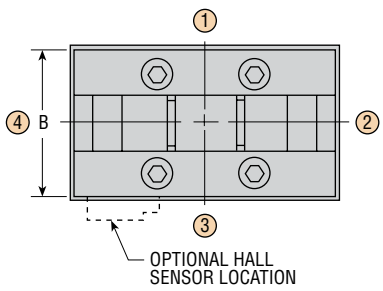
See PHD Product Sizing Catalog for specific and complete sizing information.
Online sizing assistance is available at: ***www.phdinc.com/apps/sizing***

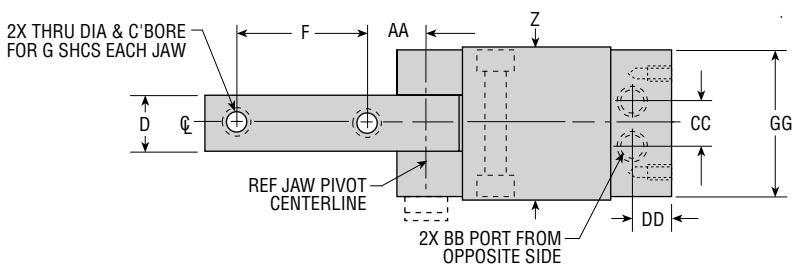
DIMENSIONS: SERIES 5300 ANGULAR OVAL GRIPPER - JAW STYLE 1



LETTER DIM	MODEL NUMBER 15320 in	15322 mm	15330 in	15332 mm	15340 in	15342 mm	15350 in	15352 mm
A*	1.812	46.0	2.500	63.5	3.500	88.9	5.125	130.2
B	1.750	44.5	2.250	57.2	2.750	69.9	4.000	101.6
D	.750	19.1	.875	22.2	1.000	25.4	1.500	38.1
F	1.500	38.1	2.000	50.8	2.750	69.9	3.500	88.9
G	#10	5	1/4	M6	5/16	M8	3/8	M10
H	1.062	27.0	1.500	38.1	2.000	50.8	2.875	73.0
K	2.438	61.9	3.390	86.1	4.587	116.5	5.734	145.6
M	.875	22.2	1.062	27.0	1.187	30.1	1.625	41.3
P	1.250	31.8	1.500	38.1	1.750	44.5	2.750	69.9
Q	10-24 x .38 DP	M5 x 0.8 x 9.7 DP	1/4-20 x .38 DP	M6 x 1 x 9.7 DP	5/16-18 x .44 DP	M8 x 1.25 x 11.2 DP	3/8-16 x .56 DP	M10 x 1.5 x 14.2 DP
R	3.063	77.8	3.749	95.2	4.312	109.5	5.875	149.2
S	.312	7.9	.438	11.1	.562	14.3	.845	21.5
T	1.156	29.4	1.687	42.8	2.375	60.3	3.250	82.6
U	2.312	58.7	3.375	85.7	4.750	120.7	6.500	165.1
V	2.843	72.2	4.031	102.4	5.531	140.5	7.531	191.3
W	1/4	M6	5/16	M8	3/8	M10	1/2	M12
X	2.126	54.0	2.952	75.0	4.025	102.2	4.859	123.4
Y	.285	7.2	.450	11.4	.598	15.2	.688	17.5
Z	1.781	45.2	2.281	57.9	2.781	70.6	4.031	102.4
AA	.688	17.5	.900	22.9	1.312	33.3	1.750	44.5
BB	10-32	M5 x 0.8	1/8 NPT	1/8 BSP	1/8 NPT	1/8 BSP	1/4 NPT	1/4 BSP
CC	.562	14.3	.750	19.1	.937	23.8	1.625	41.3
DD	.440	11.2	.500	12.7	.590	15.1	.760	19.3
EE	.125	3.2	.160	4.1	.200	5.1	.250	6.4
FF	2.810	71.4	4.000	101.6	5.500	139.7	7.500	190.5
GG	1.75	44.5	2.25	57.2	2.75	69.9	3.96	100.5



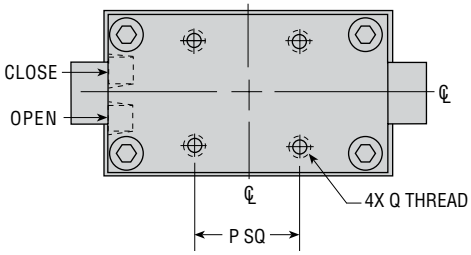


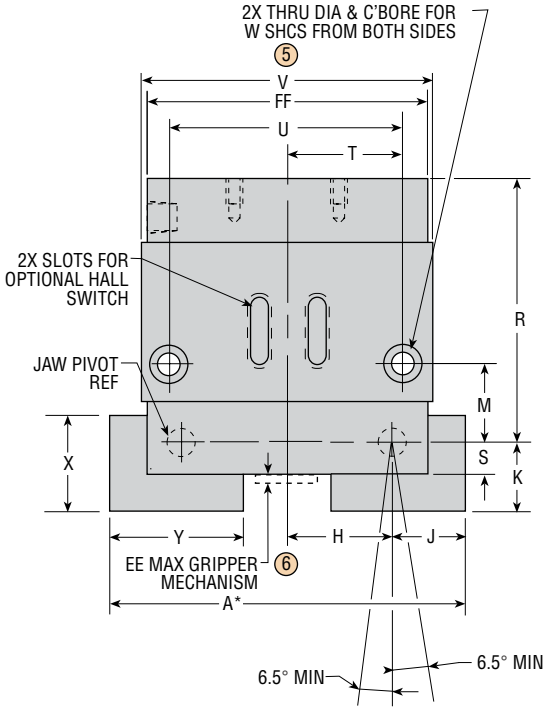


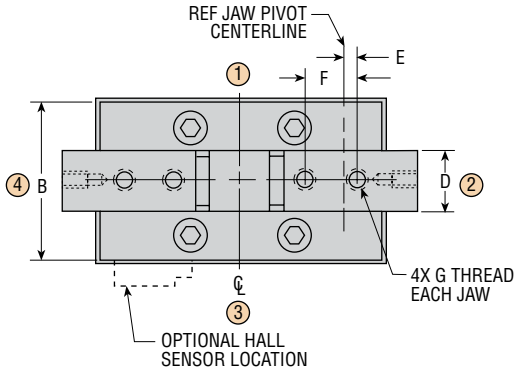
***GRIPPER JAWS:** SHOWN AT PARALLEL POSITION

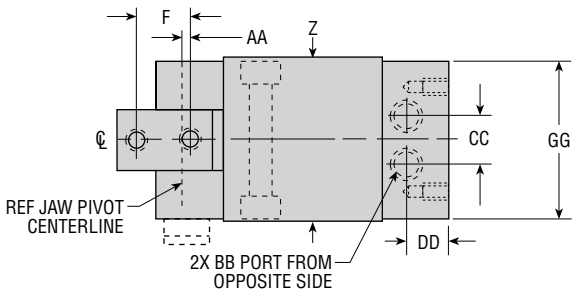
JAW MOVEMENT SHOWS MINIMUM AMOUNT OF JAW ROTATION. JAWS MAY OPEN 3° OR CLOSE 3° BEYOND STATED MINIMUM ROTATION.

All dimensions are reference only unless specifically toleranced.









LETTER DIM	MODEL NUMBER							
	15321 in	15323 mm	15331 in	15333 mm	15341 in	15343 mm	15351 in	15353 mm
A*	3.937	100.0	5.000	127.0	6.236	158.4	8.610	218.7
B	1.750	44.5	2.250	57.2	2.750	69.9	4.000	101.6
D	.750	19.1	.875	22.2	1.000	25.4	1.500	38.1
E	.231	5.9	.187	4.7	.063	1.6	0.00	0.0
F	.625	15.9	.750	19.1	1.000	25.4	1.500	38.1
G	1/4-20 x .38 DP	M6 x 1 x 9.7 DP	5/16-18 x .44 DP	M8 x 1.25 x 11.2 DP	3/8-16 x .56 DP	M10 x 1.5 x 14.2 DP	1/2-13 x .75 DP	M12 x 1.75 x 19.0 DP
H	1.062	27.0	1.500	38.1	2.000	50.8	2.875	73.0
J	.906	23.0	1.000	25.4	1.118	28.4	1.430	36.3
K	.813	20.7	.968	24.6	1.200	30.5	1.680	42.7
M	.875	22.2	1.062	27.0	1.187	30.1	1.625	41.3
P	1.250	31.8	1.500	38.1	1.750	44.5	2.750	69.9
Q	10-24 x .38 DP	M5 x 0.8 x 9.7 DP	1/4-20 x .38 DP	M6 x 1 x 9.7 DP	5/16-18 x .44 DP	M8 x 1.25 x 11.2 DP	3/8-16 x .56 DP	M10 x 1.5 x 14.2 DP
R	3.063	77.8	3.749	95.2	4.312	109.5	5.875	149.2
S	.312	7.9	.438	11.1	.562	14.3	.845	21.5
T	1.156	29.4	1.687	42.8	2.375	60.3	3.250	82.6
U	2.312	58.7	3.375	85.7	4.750	120.7	6.500	165.1
V	2.843	72.2	4.031	102.4	5.531	140.5	7.531	191.3
W	1/4	M6	5/16	M8	3/8	M10	1/2	M12
X	1.125	28.6	1.375	34.9	1.700	43.2	2.430	61.7
Y	1.500	38.1	1.875	47.6	2.430	61.7	3.430	87.1
Z	1.781	45.2	2.281	57.9	2.781	70.6	4.031	102.4
AA	.062	1.6	.095	2.4	.150	3.8	.300	7.6
BB	10-32	M5 x 0.8	1/8 NPT	1/8 BSP	1/8 NPT	1/8 BSP	1/4 NPT	1/4 BSP
CC	.562	14.3	.750	19.1	.937	23.8	1.625	41.3
DD	.440	11.2	.500	12.7	.590	15.1	.760	19.3
EE	.125	3.2	.160	4.1	.200	5.1	.250	6.4
FF	2.810	71.4	4.00	101.6	5.500	139.7	7.500	190.5
GG	1.75	44.5	2.25	57.2	2.75	69.9	3.96	100.5

***GRIPPER JAWS:** SHOWN AT PARALLEL POSITION

JAW MOVEMENT SHOWS MINIMUM AMOUNT OF JAW ROTATION. JAWS MAY OPEN 3° OR CLOSE 3° BEYOND STATED MINIMUM ROTATION.

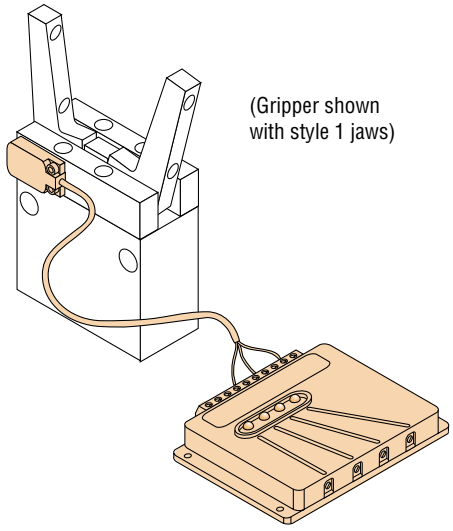
3 4 SENSOR/TRANSDUCER

PHD offers a solid-state sensor transducer option -3 along with a set point module for sensing four or more positions throughout the jaw travel. The set point module allows independent adjustment of each sensing position and is available for 4.5 to 24 VDC NPN or PNP.

SET POINT MODULE

PART NO.	DESCRIPTION
9800-01-0300	4.5-24 VDC, Sink Type Output
9800-01-0400	4.5-24 VDC, Source Type Output

See Switches and Sensors section for information.



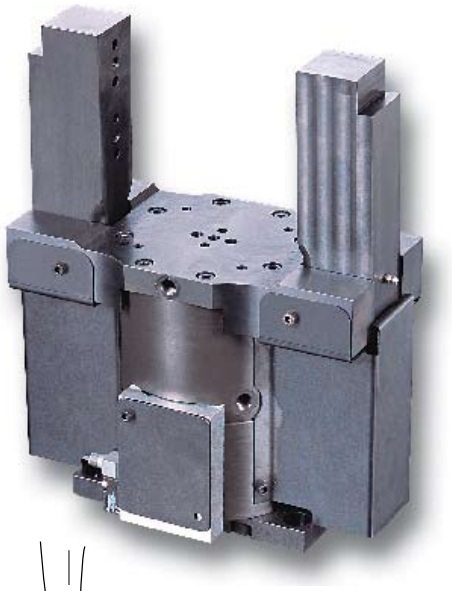
(Gripper shown with style 1 jaws)

7 HALL EFFECT MAGNET

Equips piston with magnets and “T” slot on body for Series 5360 Switches.

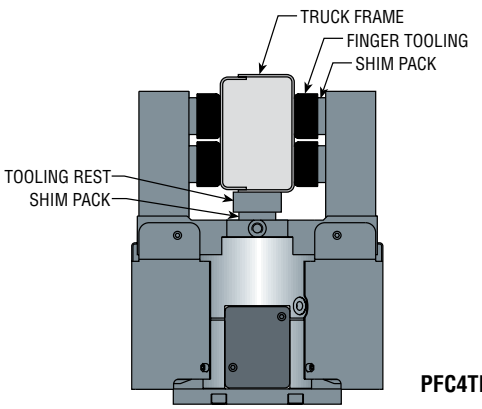
PFC

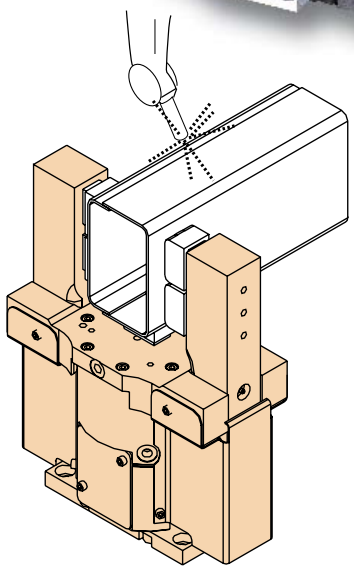
FRAME CLAMP
IDEAL FOR HEAVY PARTS



APPLICATION EXAMPLE

- Wide spacing between jaws allows clamping of part closer to tooling surface.
- Power window of .150 in [3.8 mm] and clamp force of 11250 lb [50040 N] at 3.94 in [100 mm] above tooling surface.
- NAAMS™ standard mounting patterns on “L” style jaws and tooling surface for ease of tooling and fixturing.





PFC4TL-1-16-16 SHOWN

Major Benefits

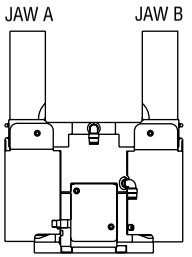
- Rugged cam design provides consistent clamping force throughout a wide power window.
- Constant high clamp force available throughout a wide power window. The PFC4TL is 11250 lb [50040 N] at 3.940 in [100 mm] above tooling surface. The PFC4TW is 7200 lb [32027 N] at 2.187 in [55.6 mm] above tooling surface.
- Wide jaw throat accommodates large parts with simple tooling.
- Tooling surface has dowels and threads to North American Automotive Metric Standards (NAAMS™) NC blocks.
- “L” style jaws have dowels and threads for NAAMS™ mounting and shims.

Industry Uses

- Automotive
- Appliances
- Sheet metal handling

ORDERING DATA: SERIES PFC CLAMPS

TO ORDER SPECIFY:
Size, Mounting, Jaw Style Option, Design No., Jaw Opening (A & B), Fitting Option, Sensing Option, Weld Cover Option if desired.



UNIT SIZE
4 - Medium Duty

JAW STYLE OPTION
L - Long Jaw Style
W - Wide Jaw Style

JAW OPENING - JAW A
16 - 16° Opening

HOUSING OPTION
P - Positional Sensing

SENSING OPTION
S - Standard
R - Reversed

SWITCH HOUSING POSITION
1 - Position 1 (Port Side)
3 - Position 3

CONNECTOR POSITION
1 - Parallel to jaws
9 - Perpendicular to jaws

SWITCH OPTION
N - No Switch
A - 5-pin AC/DC Switch
D - 4-pin DC Switch (P&F)
E - 4-pin DC Switch (Turck)
(See Note 2)

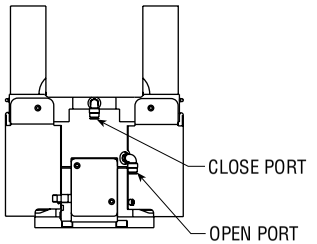
PFC	4	T	L	-	1	-	16	-	16	-	LAA	-	-PS3D9	-	WC1	-	B001

MOUNTING
REAR | T - Rear Mounting Plate

DESIGN NO.
1 - Imperial
5 - Metric

JAW OPENING - JAW B
16 - 16° Opening

PORT FITTINGS
BLANK - No Fitting
LAA - 90° Swivel Elbow, Metal



WELD COVER OPTION
WC1 - Weld Cover (Both Jaws)

BUSHING BLOCK OPTION
B001 - Customer mounting pattern with M10 threads and 10 mm dowel pin holes

NOTES:
1) Metric units have metric ports and mounting.
2) -A switch only available as A1 (example PS3A1).

SPECIFICATIONS

MODEL	UNIT WEIGHT lb	UNIT WEIGHT kg	TOTAL CLAMP FORCE at 87 psi [6 bar] lb	TOTAL CLAMP FORCE at 87 psi [6 bar] N	CLOSE OR OPEN TIME 87 psi [6 bar] second	DISPLACEMENT CLOSE in³	DISPLACEMENT CLOSE cm³	DISPLACEMENT OPEN in³	DISPLACEMENT OPEN cm³	CLAMP FORCE FACTOR (Cf) Imperial	CLAMP FORCE FACTOR (Cf) Metric
PFC4TL-1-16-16	74.6	33.8	11250	50040	0.5	44.2	724.3	43.1	706.3	606.1	992400
PFC4TW-1-16-16	72.4	33.0	7200	32027	0.5	44.2	724.3	43.1	706.3	181.0	296516

SEALS AND FLUIDS

Buna-N and Nitrile seals are standard on Series PFC Clamps. Piston seals are long life Nitrile and rod seals are lip type. Both are compatible with standard paraffin-based lubrication oils used for pneumatic cylinders. For compatibility with other fluids, consult PHD.

TEMPERATURE LIMITS

Seals and clamp mechanism are designed for use in temperatures from –20° to 180°F [–30° to 82°C]. For higher temperatures, consult PHD.

LIFE EXPECTANCY

All units with Buna-N and Nitrile seals have been designed for 5 million cycles with minimal seal wear and minimal backlash.

LUBRICATION

Seals and clamp mechanism are prelubricated at the factory for service under normal operating conditions.

OPTION WEIGHT ADDERS

OPTION	WEIGHT lb	WEIGHT kg
LAA	0.2	0.09
PSxxx	0.9	0.4
WC1	3.0	1.4
B001	—	—

MATERIAL

Clamp body is made of hardcoated aluminum. Jaws and operating mechanism are manufactured from steel.

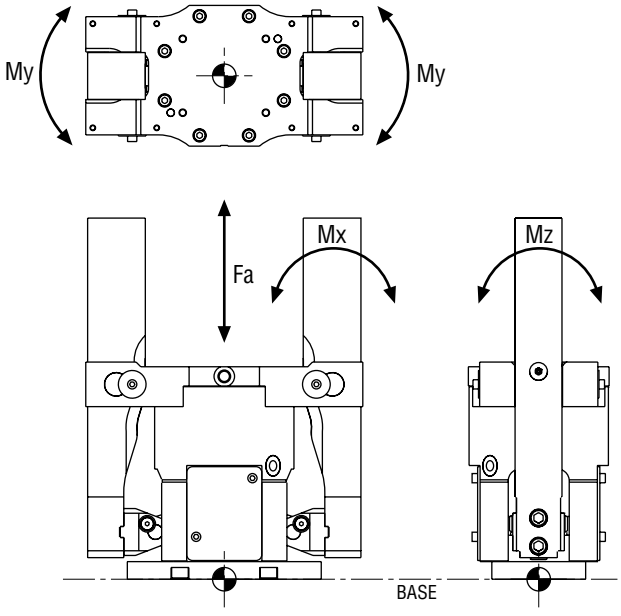
SPECIAL CLAMPS

Clamps for special applications, severe duty, or constructed of special materials are available. Consult PHD.

PFC

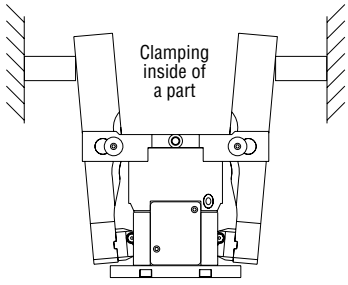
MOMENTS TEST

Take care to limit moment loads on the Series PFC. External loads and moments due to jaw clamp forces should be considered.



APPLICATION CONCERNS

The Series PFC has a robust mechanism designed to clamp the outside of a part. However, it should not be used to clamp the inside of a part, nor be limited externally from opening. The opening of one or both jaws should not be limited with external stops or tooling. Consult factory on internal applications.



MAX. ALLOWABLE FORCES & MOMENTS FOR JAWS

MODEL	Fa lb	Fa N	Mx in-lb	Mx Nm	My in-lb	My Nm	Mz in-lb	Mz Nm
PFC	1000	4448	20000	2261	10000	1130	10000	1130

Fa: Total for both jaws
Mx: Total for both jaws moments from base mounting surface
My: Total for both jaws moments from base mounting surface
Mz: Total for both jaws moments from base mounting surface

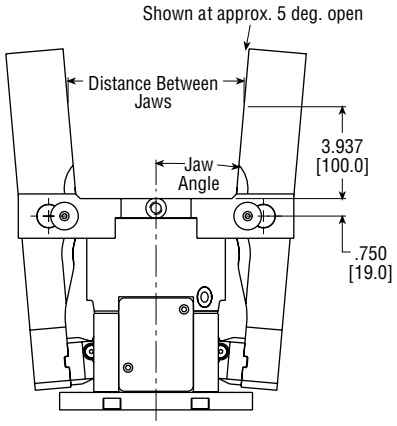
EFFECTIVE CLAMPING RANGE

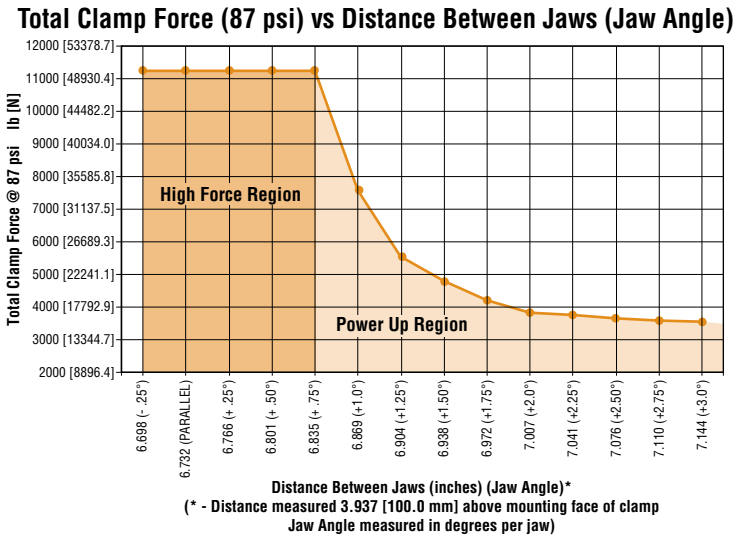
Total clamp force can be determined by multiplying air pressure by the clamp force multiplier (Cf), then dividing by the distance from clamping location to jaw pivot.

To achieve maximum clamp force, custom tooling or spacers must be used to close the jaws in the high force region. Refer to charts for high force region.

"L" LONG JAW STYLE

PFC4TL
High force region Cf (Imperial) = 606.1
High force region Cf (Metric) = 992400



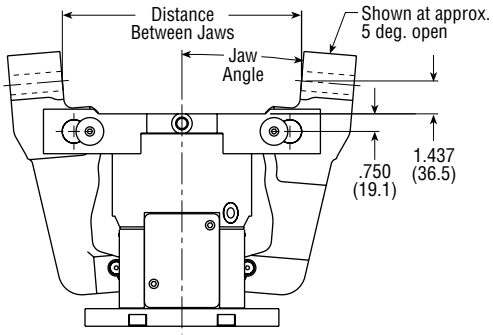


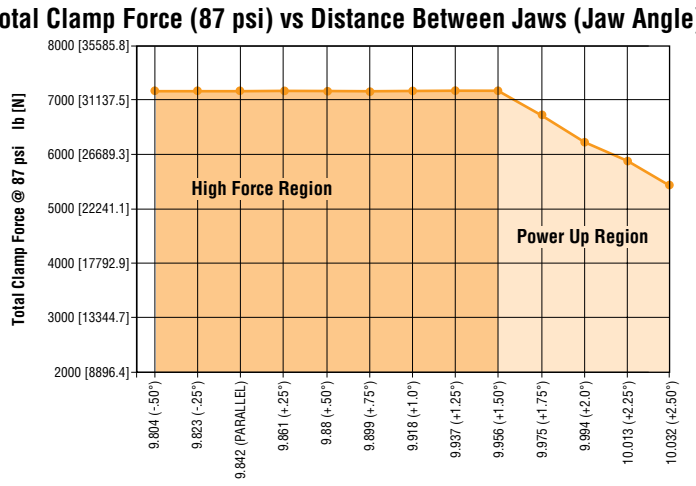
Imperial Example:
Your air line pressure: 87 psi
Clamp force multiplier: 606.1
(Within high force region)
Distance from clamping location to pivot: 4.687 in
(87 x 606.1)/4.687 = 11250 lb

Metric Example:
Your air line pressure: 6 bar
Clamp force multiplier: 992400
(within high force region)
Distance from clamping location to pivot: 119 mm
(6 x 992400)/119 = 50042 N

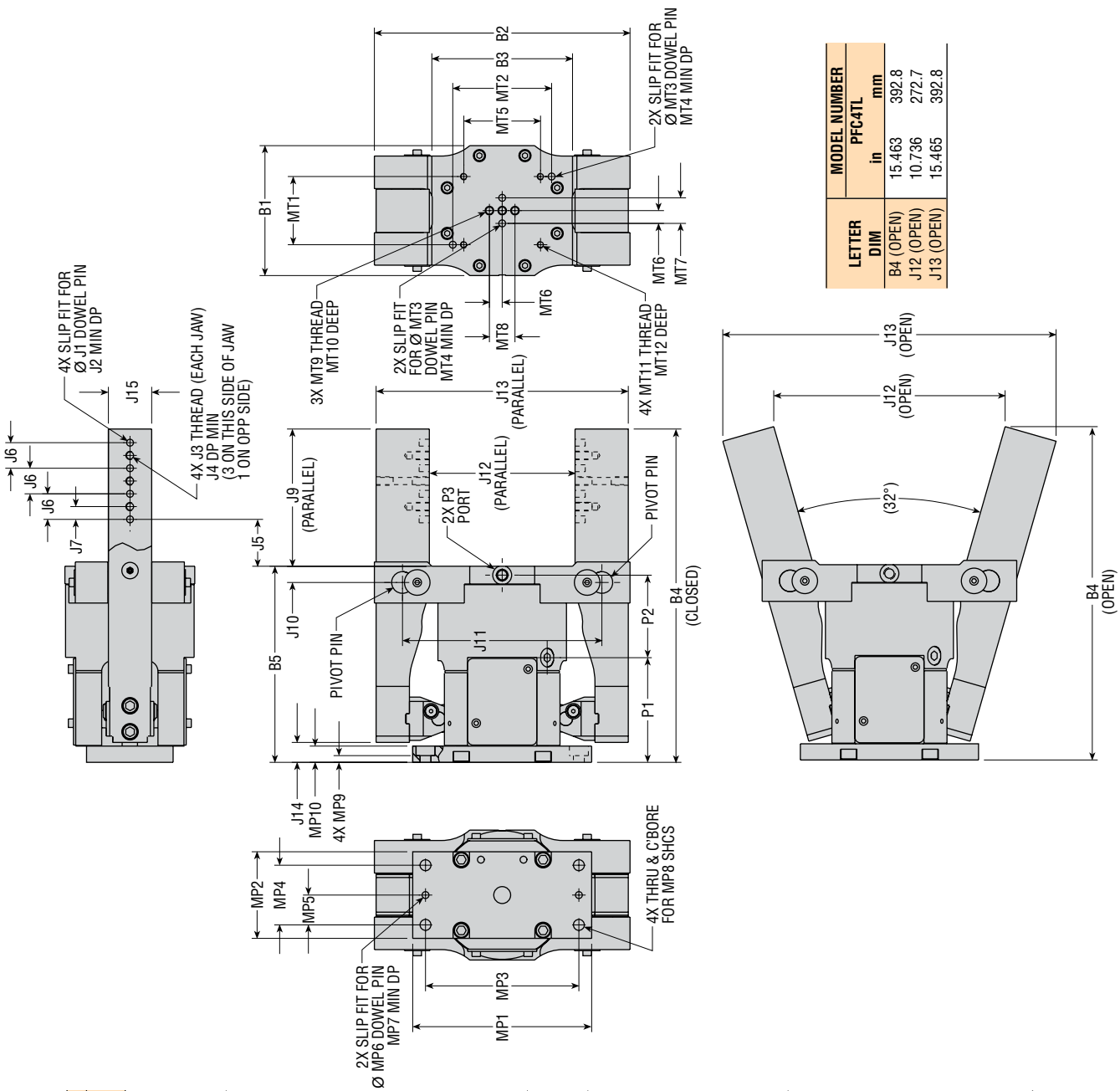
"W" WIDE JAW STYLE

PFC4TW
High force region Cf (Imperial) = 181.0
High force region Cf (Metric) = 296516





DIMENSIONS: SERIES PFC CLAMPS - "L" LONG JAW STYLE

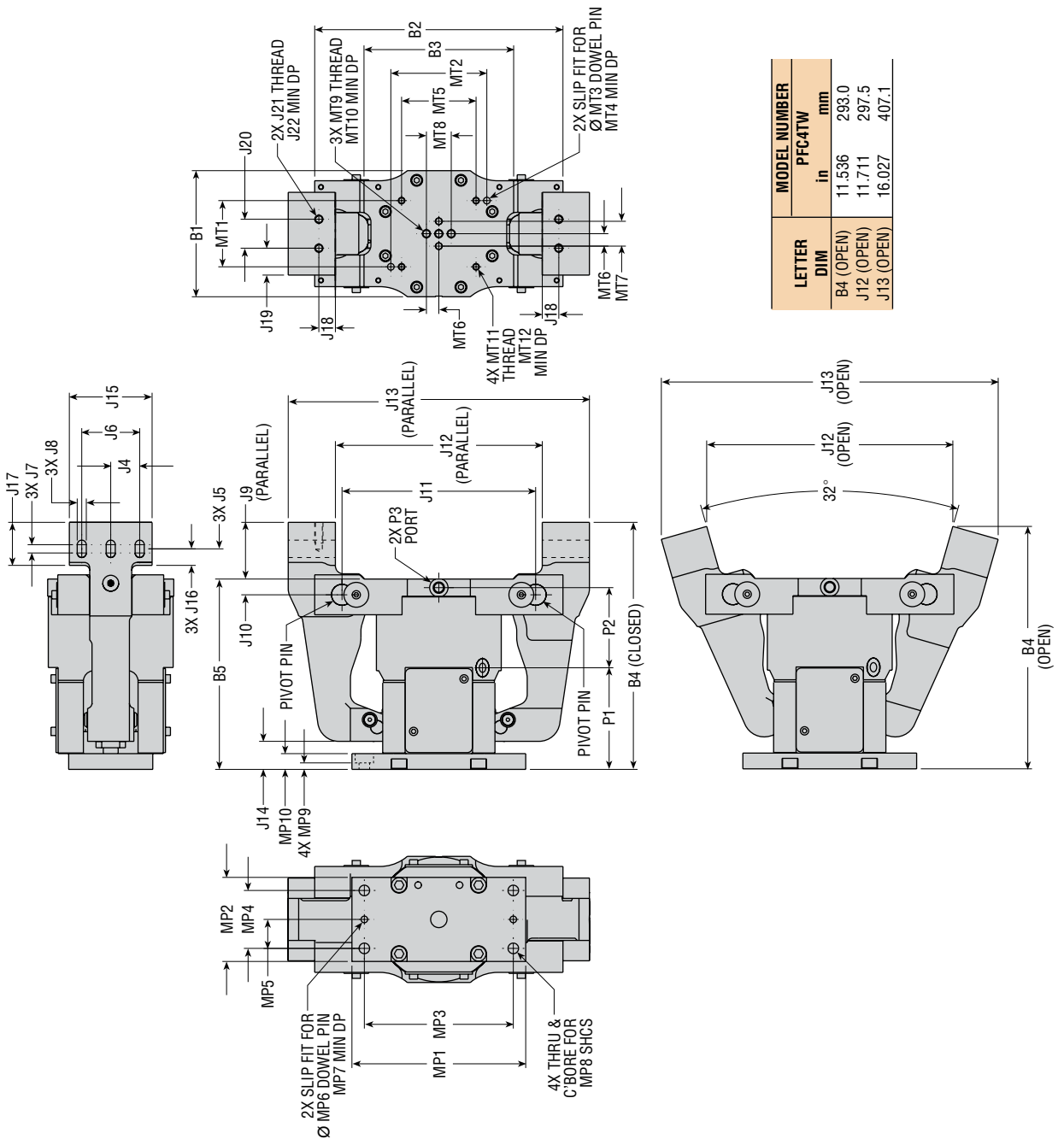


LETTER DIM	MODEL NUMBER PFC4TL in	mm
B4 (OPEN)	15.463	392.8
J12 (OPEN)	10.736	272.7
J13 (OPEN)	15.465	392.8

LETTER DIM	MODEL NUMBER PFC4TL in	mm
B1	6.000	152.4
B2	11.811	300.0
B3	7.120	180.8
B4 (CLOSED)	15.396	391.1
B5	9.058	230.1
J1	.315	8.0
J2	.472	12.0
J3	M10 x 1.5	
J4	.787	20.0
J5	2.165	55.0
J6	1.181	30.0
J7	.591	15.0
J8	1.181	30.0
J9	6.338	161.0
J10	.750	19.1
J11	9.212	234.0
J12 (CLOSED)	6.732	171.0
J13 (CLOSED)	11.652	296.0
J14	.920	23.4
J15	2.000	50.8
P1	4.835	122.8
P2	3.813	96.9
P3	1/4 NPT	1/4 BSPP
MP1	8.268	210.0
MP2	4.000	101.6
MP3	7.087	180.0
MP4	2.756	70.0
MP5	1.378	35.0
MP6	.315	8.0
MP7	.472	12.0
MP8	7/16	M12
MP9	.315	8.0
MP10	.750	19.1
MT1	3.150	80.0
MT2	4.567	116.0
MT3	.315	8.0
MT4	.472	12.0
MT5	3.543	90.0
MT6	.591	15.0
MT7	1.181	30.0
MT8	1.181	30.0
MT9	M10 x 1.5	
MT10	.669	17.0
MT11	M8 x 1.25	
MT12	.669	17.0

All dimensions are reference only unless specifically toleranced.

DIMENSIONS: SERIES PFC CLAMPS - "W" WIDE JAW STYLE



LETTER DIM	MODEL NUMBER PFC4TW in	mm
B4 (OPEN)	11.536	293.0
J12 (OPEN)	11.711	297.5
J13 (OPEN)	16.027	407.1

LETTER DIM	MODEL NUMBER PFC4TW in	mm
B1	6.000	152.4
B2	11.811	300.0
B3	7.120	180.8
B4 (CLOSED)	11.755	298.6
B5	9.058	230.1
J4	1.378	35.0
J5	1.437	36.5
J6	2.756	70.0
J7	.394	10.0
J8	.433	11.0
J9	2.697	68.5
J10	.750	19.1
J11	9.212	234.0
J12 (CLOSED)	9.843	250.0
J13 (CLOSED)	14.331	364.0
J14	1.335	33.9
J15	3.937	100.0
J16	.787	20.0
J17	2.047	52.0
J18	.787	20.0
J19	1.280	32.5
J20	1.378	35.0
J21	M10 x 1.5	
J22	.984	25.0
P1	4.835	122.8
P2	3.813	96.9
P3	1/4 NPT	1/4 BSPP
MP1	8.268	210.0
MP2	4.000	101.6
MP3	7.087	180.0
MP4	2.756	70.0
MP5	1.378	35.0
MP6	.315	8.0
MP7	.472	12.0
MP8	7/16	M12
MP9	.315	8.0
MP10	.750	19.1
MT1	3.150	80.0
MT2	4.567	116.0
MT3	.315	8.0
MT4	.472	12.0
MT5	3.543	90.0
MT6	.591	15.0
MT7	1.181	30.0
MT8	1.181	30.0
MT9	M10 x 1.5	
MT10	.669	17.0
MT11	M8 x 1.25	
MT12	.669	17.0

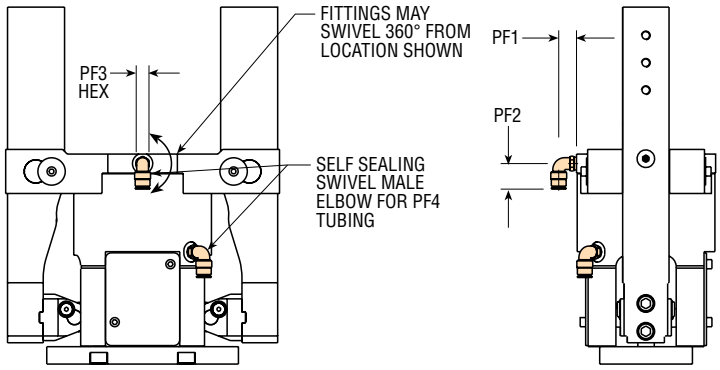
All dimensions are reference only unless specifically toleranced.

LAA PORT FITTINGS

90° swivel elbow (in both ports) for ease of air line hook-up.

LETTER DIMENSION	MODEL NUMBER PFC4xx in	mm
PF1 (MIN)	.767	20.5
PF2	1.102	28.0
PF3	.551	14.0
PF4	3/8	10.0
PART NO.	62178-010	62195-010

NOTE: FITTINGS ARE ORDERED SEPARATELY



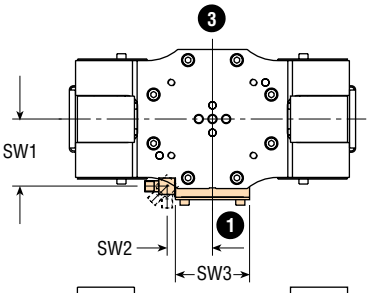
PS(R)xxx POSITION SENSING

This option provides jaw open and jaw closed sensing by affixing an aluminum housing to the side of the clamp body. The adjustable switches sense the position of a target on the drive pin as the clamp opens and closes.

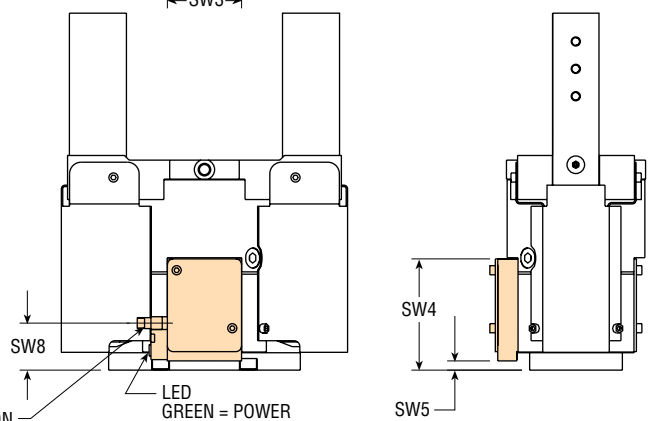
PR positions satellite switch S01 to sense open and S02 to sense close. PS positions satellite switch S02 to sense open and S01 to sense close. See charts below or switch information for satellite switch to quick connect pin to relationships.

For use with the following PHD or customer supplied switches or equivalent:

Ni 2-Q6.5-ADZ32-0.16-FSB 5.4X4/S304 (Turck)
NBN2-F581-160S6-E8-V1 (P&F)
Ni 2-Q6.5-0.16-BDS-2AP6X3-H1141/S34 (Turck)



NOTE:
1) POSITIONAL SENSOR MAY BE LOCATED IN POSITION 1 OR POSITION 3
2) CIRCLED NUMBERS INDICATE POSITION. POSITION 1 IS PORT SIDE



LETTER DIMENSION	MODEL NUMBER PFC4xx in	mm
SW1	2.892	73.5
SW2	1.955	49.7
SW3	3.200	81.3
SW4	4.798	121.9
SW5	.397	10.1
SW6	.236	6.0
SW7	3.480	88.4
SW8	2.028	51.5

KIT DESCRIPTION	KIT NUMBER
NO SWITCH (PSxNx)	73120-01
AC/DC SWITCH (PSxAx)	73120-02
DC SWITCH (P + F) (PSxDx)	73120-03
DC SWITCH (Turck) (PSxEx)	73120-04

KIT INCLUDES: SWITCH HOUSING
TARGET
TARGET DRIVER
DOWEL PINS
MOUNTING SCREWS
SWITCH (WHEN SPECIFIED)

POSITION SENSING OPTION

-P S 3 D 9

HOUSING OPTION
P - Positional Sensing

SENSING OPTION
S - Standard
R - Reversed

SWITCH HOUSING POSITION
1 - Position 1 (Port Side)
3 - Position 3

CONNECTOR POSITION
1 - Parallel to jaws
9 - Perpendicular to jaws

SWITCH OPTION
N - No Switch
A - 5-pin AC/DC Switch
D - 4-pin DC Switch (P&F)
E - 4-pin DC Switch (Turck)

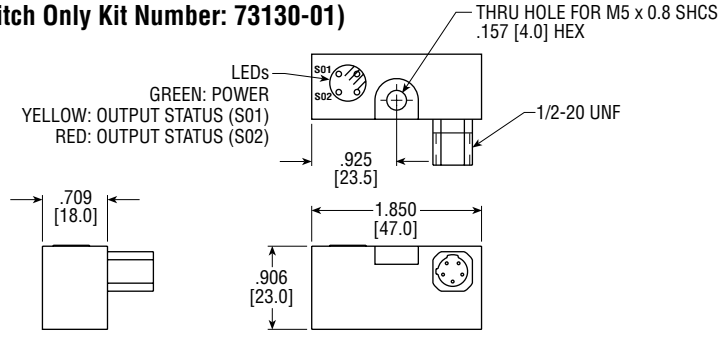
-A switch only available as A1 (example PS3A1)

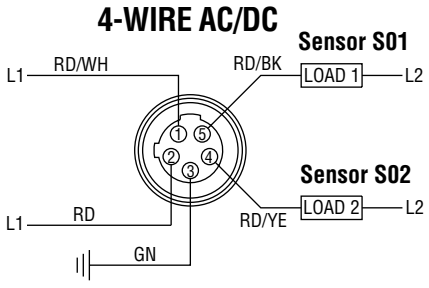
OPTION CODE	SATELLITE OPEN	CLOSE
PSxxx	S02	S01
PRxxx	S01	S02

OPTION CODE	QUICK DISCONNECT PIN NUMBER
PxxA1	S01 = Pin 5 S02 = Pin 4
PxxDx	S01 = Pin 4
PxxEx	S02 = Pin 2

PS(R)xxx POSITION SENSING (continued)

SWITCH OPTION A
(Switch Only Kit Number: 73130-01)

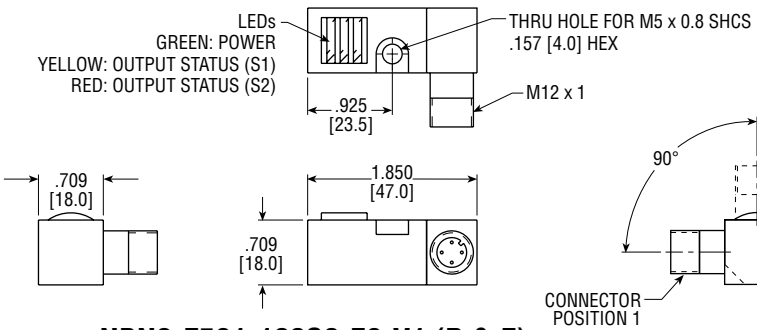


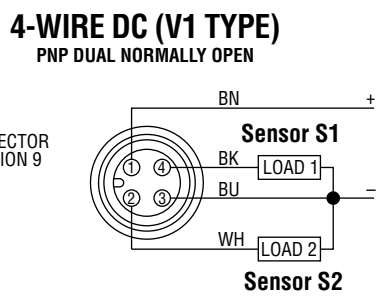


Ni 2-Q6.5-ADZ32-0.16-FSB 5.4X4/S304 (Turck)

PFC

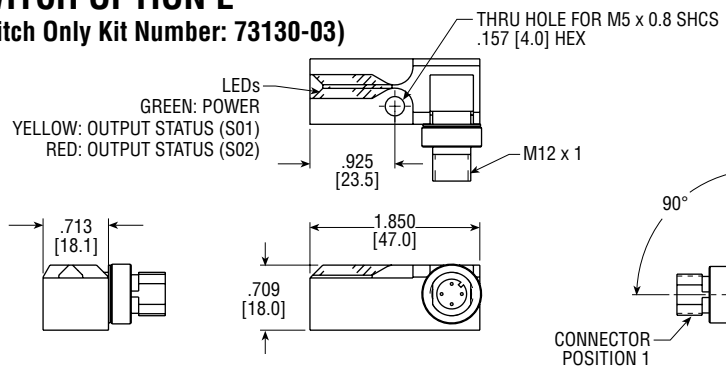
SWITCH OPTION D
(Switch Only Kit Number: 73130-02)

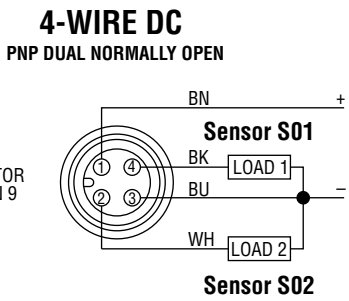




NBN2-F581-160S6-E8-V1 (P & F)

SWITCH OPTION E
(Switch Only Kit Number: 73130-03)





Ni 2-Q6.5-0.16-BDS-2AP6X3-H1141/S34 (Turck)

MATCHING CORDSETS 2 METERS LONG

SWITCH TYPE	PHD PART NUMBER	CORDSET PART NUMBER
A	73317-00-02	KB 5T-2 (Turck)
D	65440-001-02	V1-G-YE2M-PVC (P & F)
E	78039-00-02	RK 4.4T-2 (Turck)

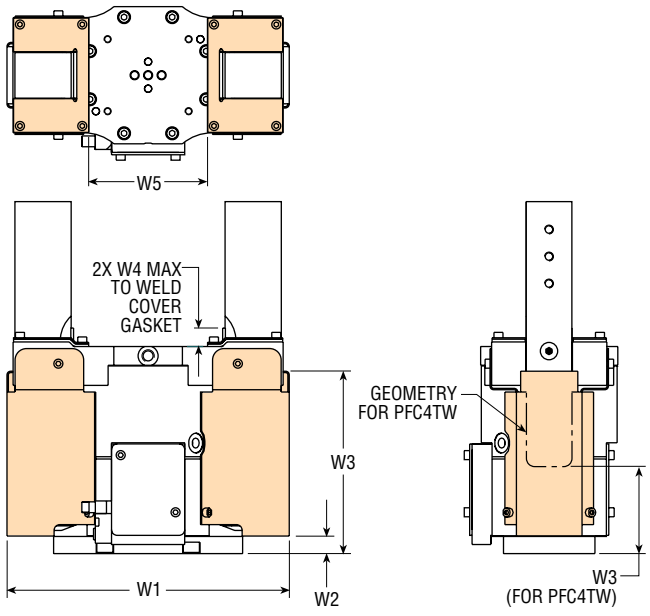
All dimensions are reference only unless specifically toleranced.

WC1 WELD COVER

This option provides plated steel covers around the jaws above and below the mounting surface to enclose the clamp mechanism, protecting it from weld splatter.

LETTER DIMENSION	PFC4TL in	PFC4TL mm	PFC4TW in	PFC4TW mm
W1	12.346	313.6	12.346	313.6
W2	.768	19.5	.768	19.5
W3	7.978	202.6	3.668	93.2
W4 MAX	.906	23.0	.906	23.0
W5	5.120	130.0	5.120	130.0
KIT NUMBER	73121-01		73121-02	

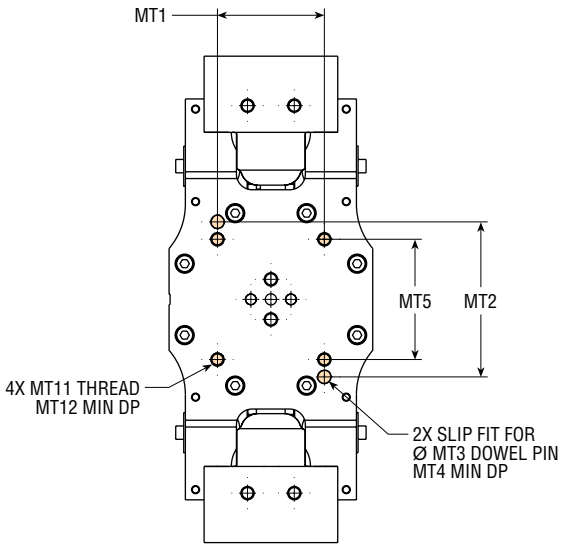
KIT INCLUDES: 2 WELD COVERS
2 WELD COVER PLATES
2 WELD COVER GASKETS
MOUNTING SCREWS



B001 BUSHING BLOCK

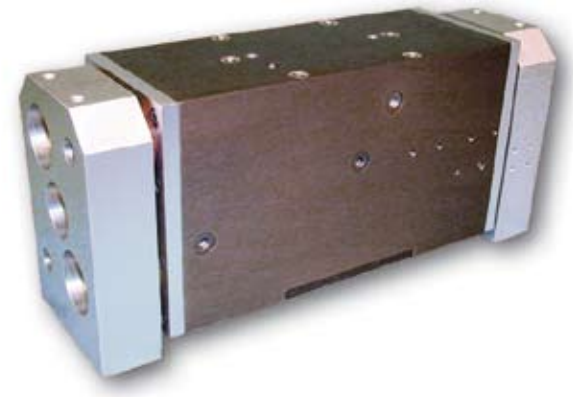
This option provides a customer mounting pattern with M10 threads and 10 mm dowel pin holes.

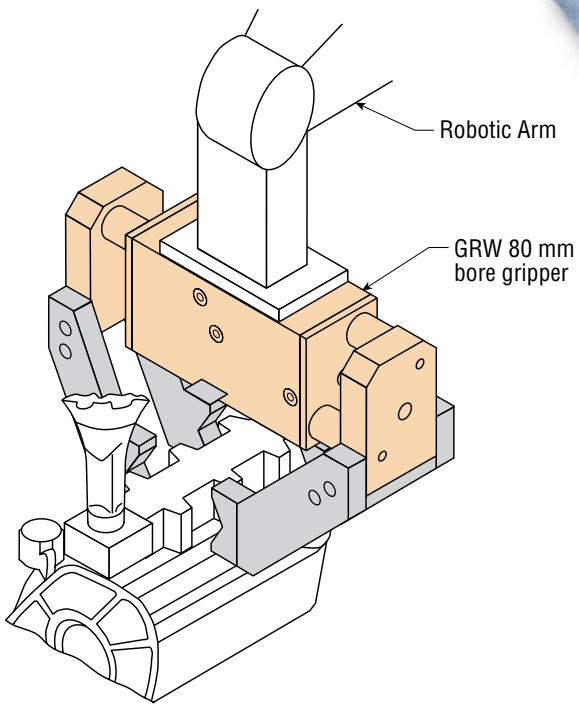
LETTER DIMENSION	PFCxxx in	PFCxxx mm
MT1	3.150	80.0
MT2	4.567	116.0
MT3	.394	10.0
MT4	.591	15.0
MT5	3.543	90.0
MT11	M10 x 1.5	
MT12	.669	17.0



GRW 80 mm Bore Foundry

MODEL# ML301651





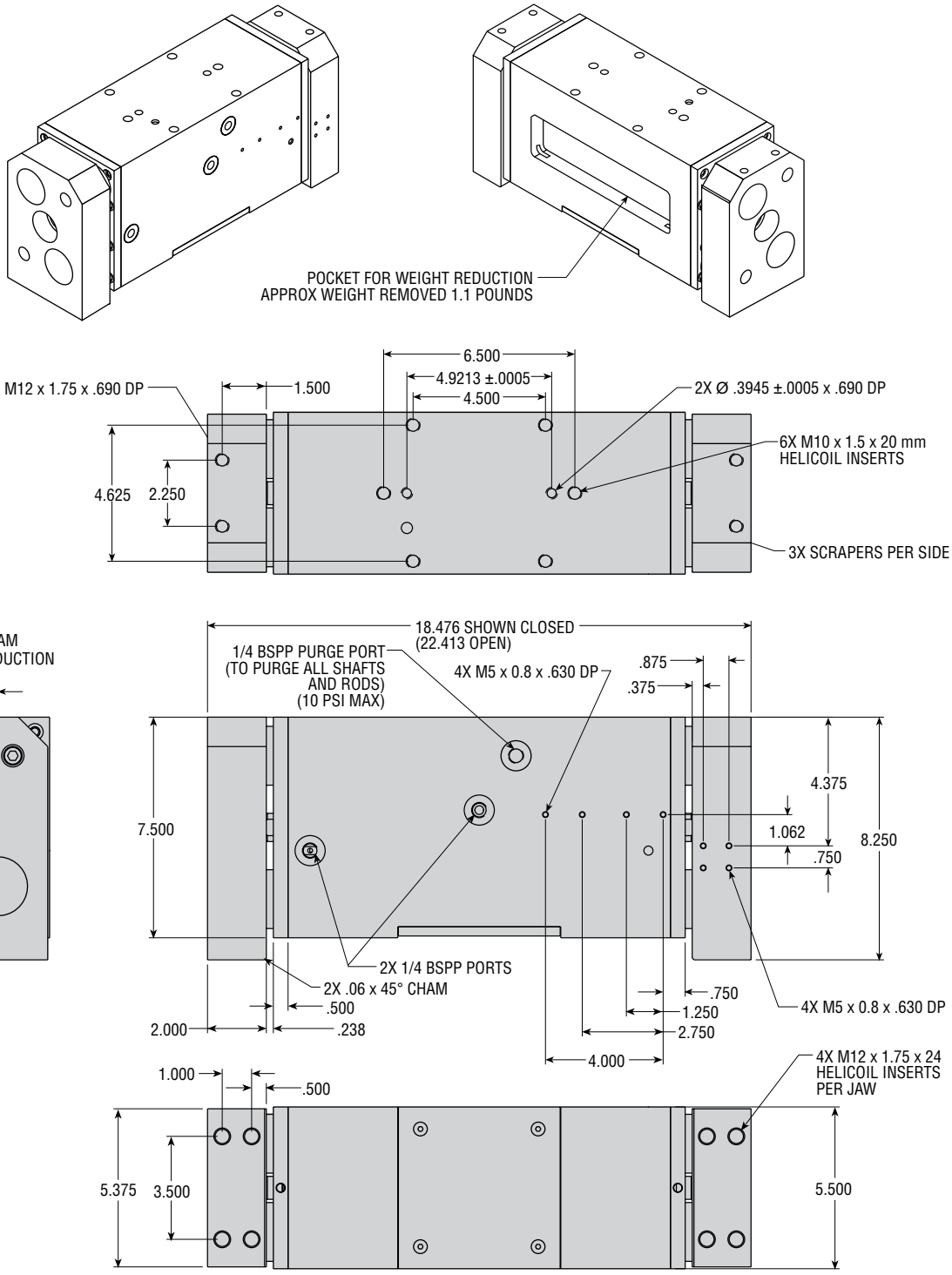
Major Benefits

- Built-in metallic guide and piston rod scrapers protect the gripper from external contaminants.
- Internal spring assist close.
- Incorporates fluoro-elastomer seals for high temperature applications.
- External corrosion resistant parts for high moisture applications.
- Extremely high grip force.
- Built-in purge ports to assist in keeping contaminants out.
- Synchronized parallel jaw travel.
- Consult PHD for delivery.

Industry Uses

- Motor Vehicle/Wheels Parts
- Non-Ferrous Foundries

DIMENSIONS: GRW 80 mm Bore Lost Foam/Foundry - MODEL# ML301651



NOTES:

1) ALL DIMENSIONS ARE FOR REFERENCE ONLY
2) APPROX WEIGHT = 79 POUNDS
3) BORE SIZE = 80 mm
4) TOTAL STROKE = 100 mm
5) METALLIC ROD AND SHAFT SCRAPERS
6) ALL SEALS ARE FLUORO-ELASTOMER
7) ALL EXTERNAL STEEL PARTS ARE ARMOLOY PLATED OR STAINLESS STEEL
8) USING HEAVY DUTY SPRINGS FOR SPRING ASSIST CLOSE
9) SHAFT SIZE = 1-1/4", ROD SIZE = 1 INCH
10) MAX OPERATING TEMP = 400°F

ESTIMATED THEORETICAL GRIP FORCE:
VALUES FOR CLOSED 11.26 POUNDS PER PSI + 300 POUNDS SPRING FORCE
IT TAKES APPROXIMATELY 50-60 PSI TO CYCLE THE UNIT
FULLY OPEN TO OVERCOME SPRINGS

phd Unlimited™ UNIQUE SOLUTIONS

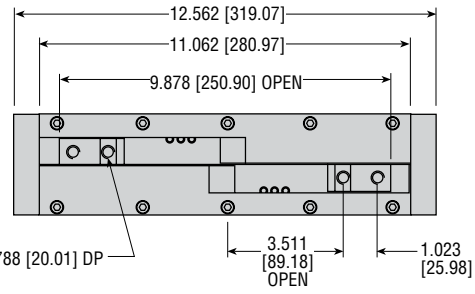
Steel Hydraulic
MODEL# ML221538

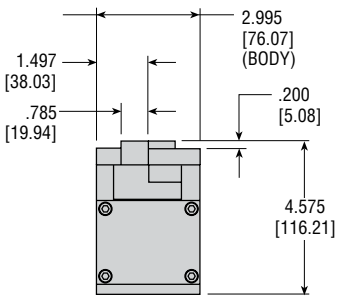
Major Benefits

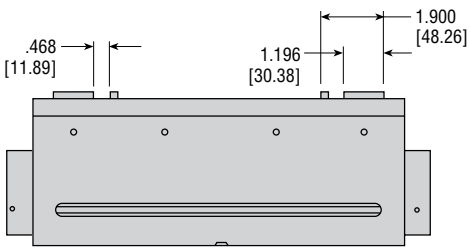
- Hydraulically driven
- Manifold ported for simplified plumbing
- Long jaw travel in a compact package
- Simple construction allows the gripper to be repaired in the field for extended life and value.
- Steel body and jaw covers with corrosion resistant plating extend life in harsh environments
- Consult PHD for delivery

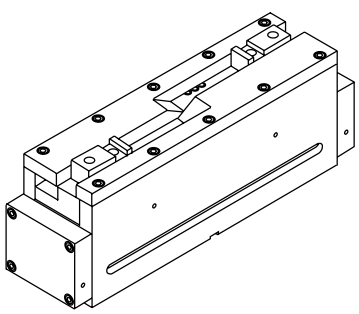
Industry Uses

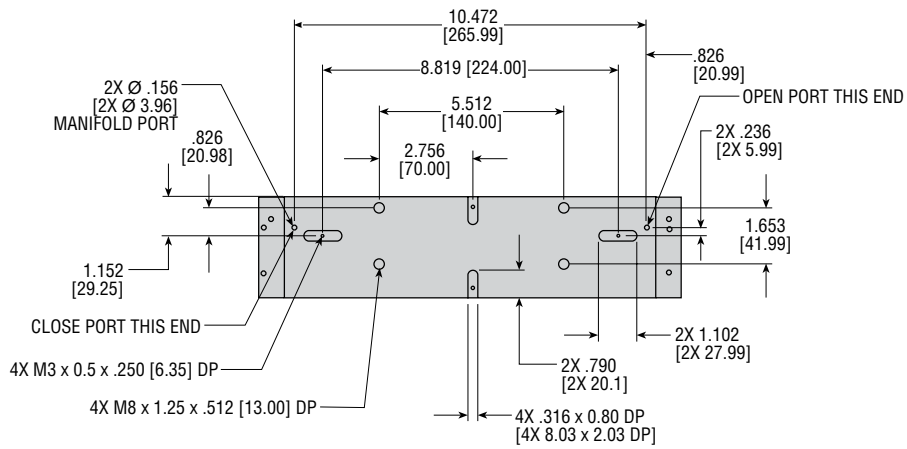
- Transmission and powertrain parts transfer
- Forging applications







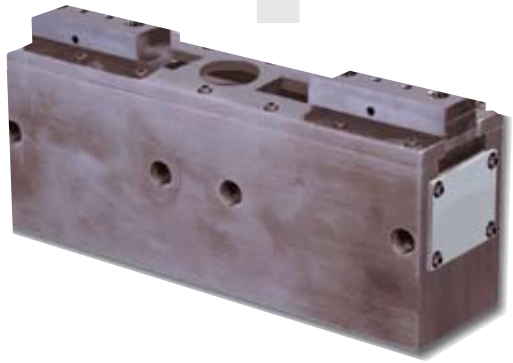




NOTES:
1) ALL DIMENSIONS ARE REFERENCE ONLY UNLESS SPECIFICALLY TOLERANCED
2) NUMBERS IN [ ] ARE IN mm.

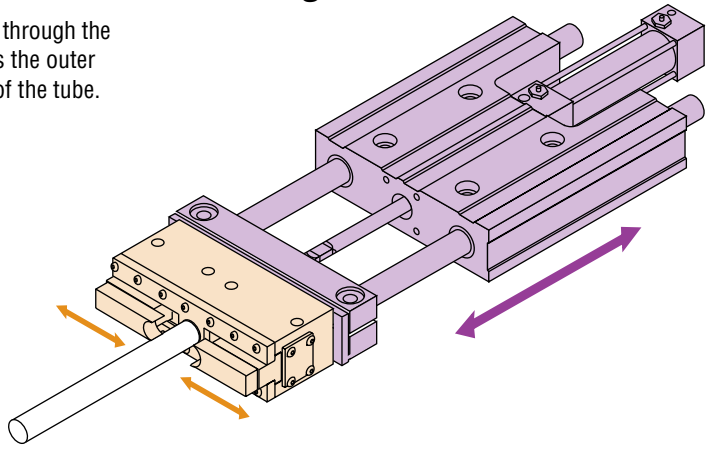
Parallel with Through Hole

MODEL# ML300016



Gripper For Finishing Operation On Tubing

The gripper is designed to allow a tube to be extended through the body. When the gripper closes, the jaw tooling grasps the outer tube. As the slide retracts the gripper skives the end of the tube.



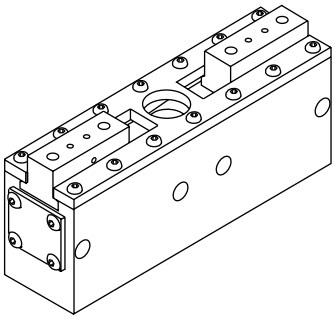
Major Benefits

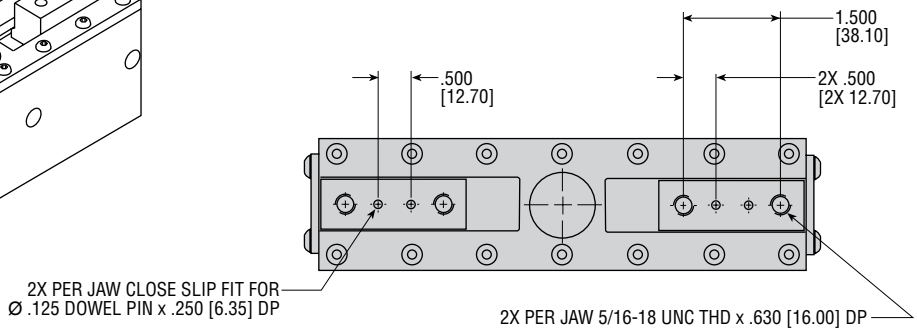
- Through hole allows material to be drawn through body between jaw tooling
- Long jaw travel
- Independent jaw movement
- Rugged jaw and body construction can withstand high impact and shock loads
- Consult PHD for delivery

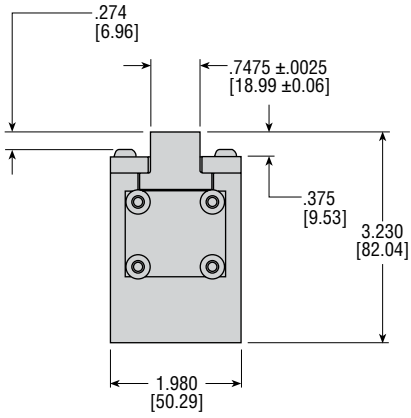
Industry Uses

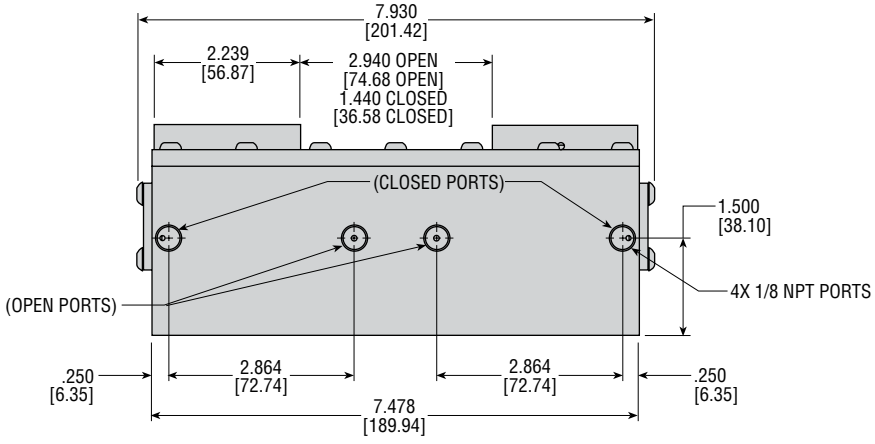
- Assembly machine building
- Injection molded plastics

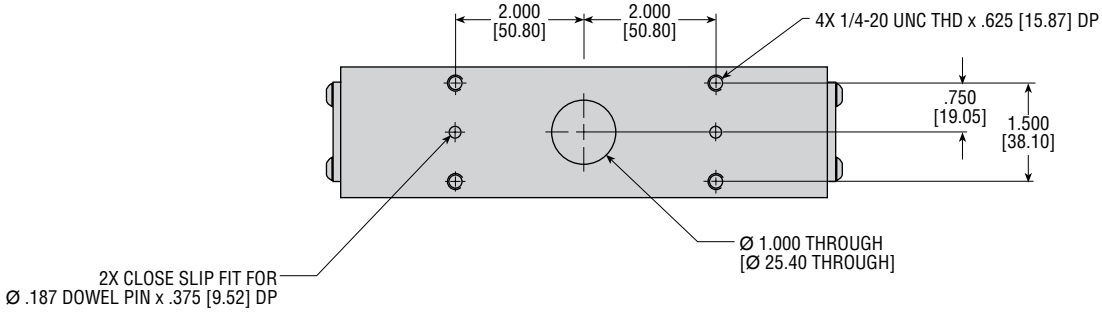
DIMENSIONS: Parallel with Through Hole - MODEL# ML300016









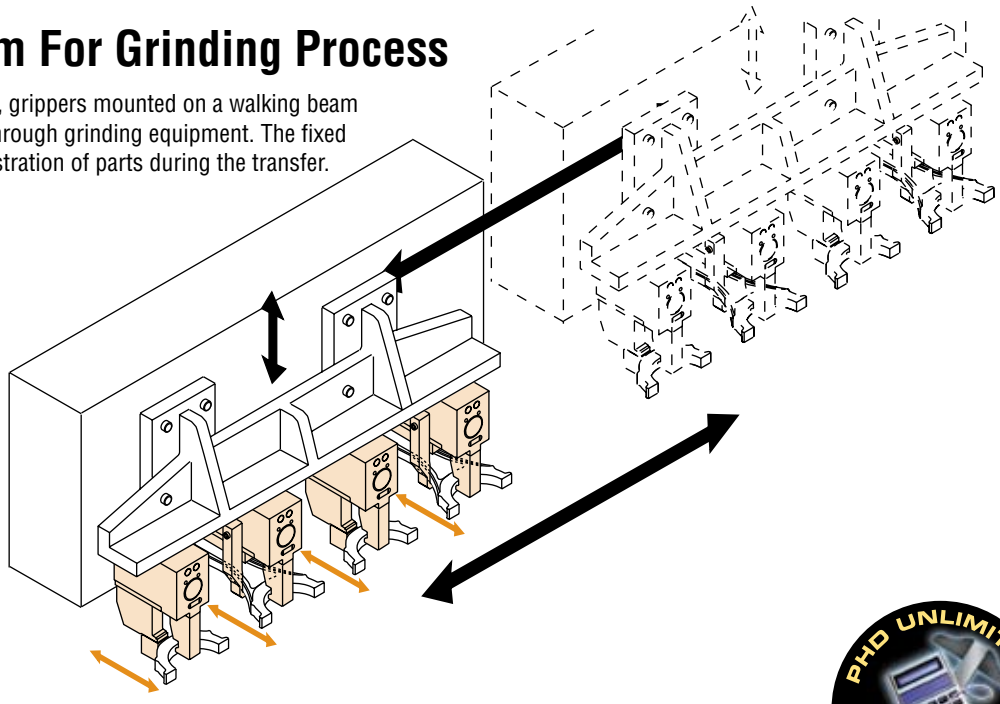


NOTES:
1) ALL DIMENSIONS ARE REFERENCE ONLY UNLESS SPECIFICALLY TOLERANCED
2) NUMBERS IN [ ] ARE IN mm.

Mono Jaw Gripper
MODEL# ML219177

Walking Beam For Grinding Process

In this application example, grippers mounted on a walking beam transfer connecting rods through grinding equipment. The fixed jaw provides accurate registration of parts during the transfer.



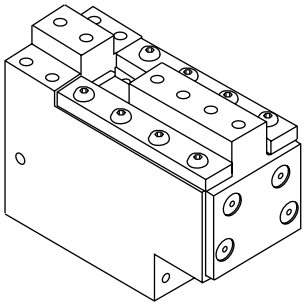
Major Benefits

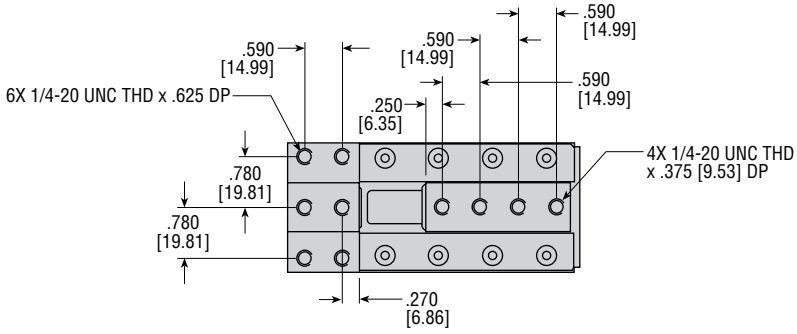
- Long jaw travel
- Spring assist closed
- One fixed jaw to maintain accurate registration on gripped parts
- Simple construction allows the gripper to be easily repaired in the field for extended life and value
- Consult PHD for delivery

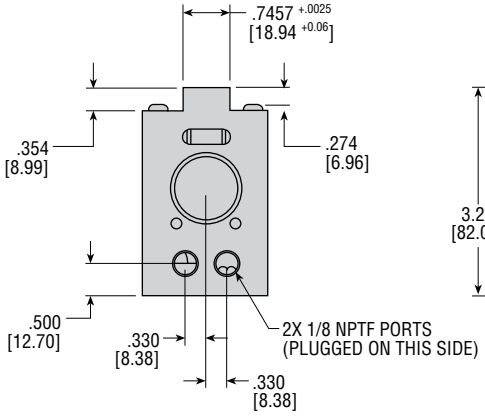
Industry Uses

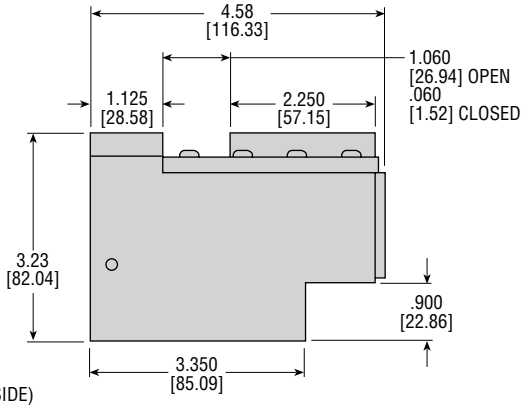
- Grinding processes
- Material transfer

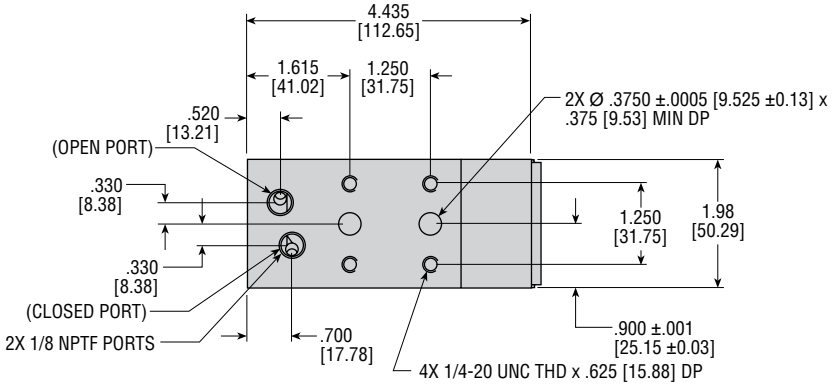
DIMENSIONS: Mono - MODEL# ML219177











NOTES:
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2) NUMBERS IN [ ] ARE IN mm.

Compact 4 Jaw Styles

MODEL# ML306111

MODEL# ML227501

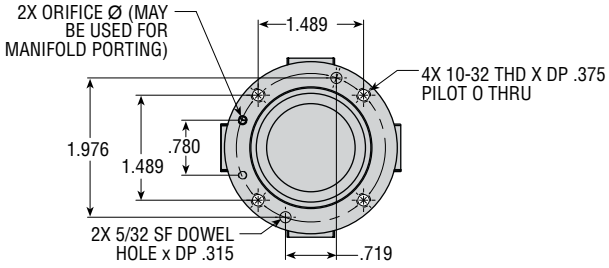
Optional Closed Cover Style, please consult PHD for details.

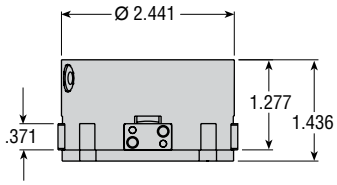
Major Benefits

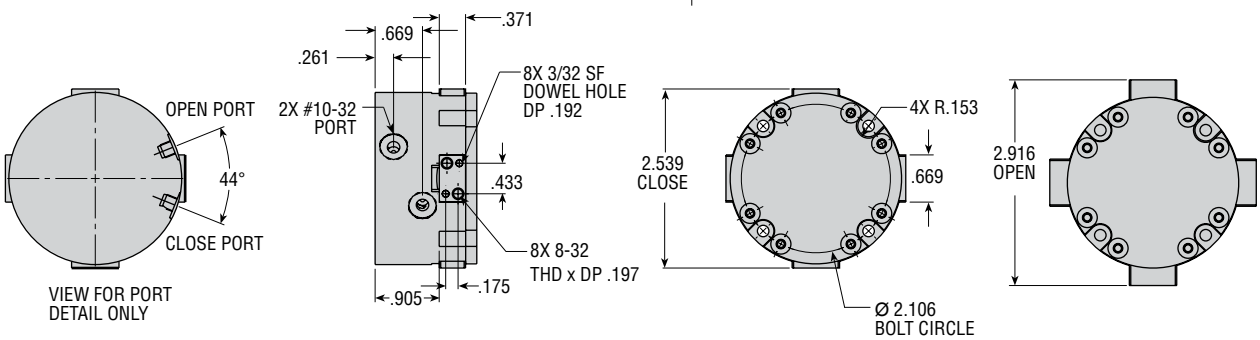
- Very low profile relative to grip force and jaw travel makes these grippers ideal for applications in confined areas
- Four jaw design provides self-centering, ideal for parts with four equally spaced gripping points.
- Available in both imperial and metric versions
- Pneumatically powered units are double-acting
- True parallel and synchronous jaw travel
- Close tolerance, hardened steel jaw mechanism minimizes play and is totally enclosed for long life
- Jaws with standard male and female key features allow precise location of jaw tooling
- Units are fully field-repairable
- Consult PHD for delivery

Industry Uses

- Packaging
- Material handling







NOTES:
1) ALL DIMENSIONS ARE REFERENCE UNLESS SPECIFICALLY TOLERANCED.
2) UNIT DESIGNED TO BE FOUR-JAW EQUIVALENT TO GRT122-1-0001.

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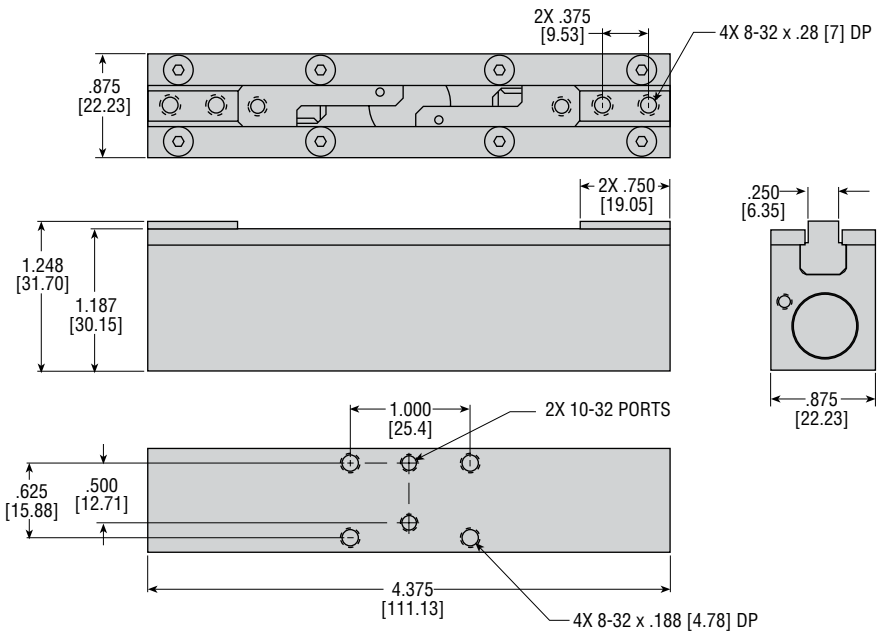
Low Profile
MODEL# ML212539

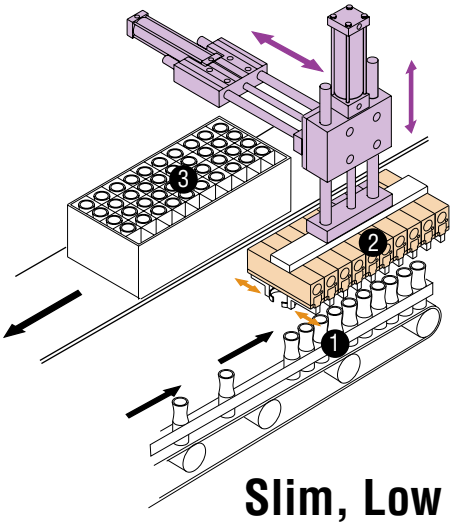
Major Benefits

- Lightweight, compact, slim profile allows close manifold mounting of multiple grippers
- Double-acting for either internal or external gripping applications
- Simple construction allows the grippers to be easily repaired in the field for extended life and value
- Consult PHD for delivery

Industry Uses

- Packaging industry
- Material transfer





Slim, Low Profile Gripper for Packaging

The gripper is designed with a narrow profile to allow for manifold mounting of several grippers side-by-side. The conveyor indexes with a closely spaced line of bottles (1). When there is a full line of bottles present on the conveyor, the grouping of grippers picks up the bottles (2), transfers, and inserts them into a carton (3) for shipping.

NOTE:
NUMBERS IN [ ] ARE IN mm

All dimensions are reference only unless specifically toleranced.

GRS/GRL with Balluff BIL Transducer

MODEL# ML304024

MODEL# ML306735

MODEL# ML304024

MODEL# ML306735

Series GRS and GRL Grippers can be modified to accept the Balluff Series BIL (non-contact analog) position transducer. These grippers can grip parts that vary in size while providing continuous position feedback to the controller.

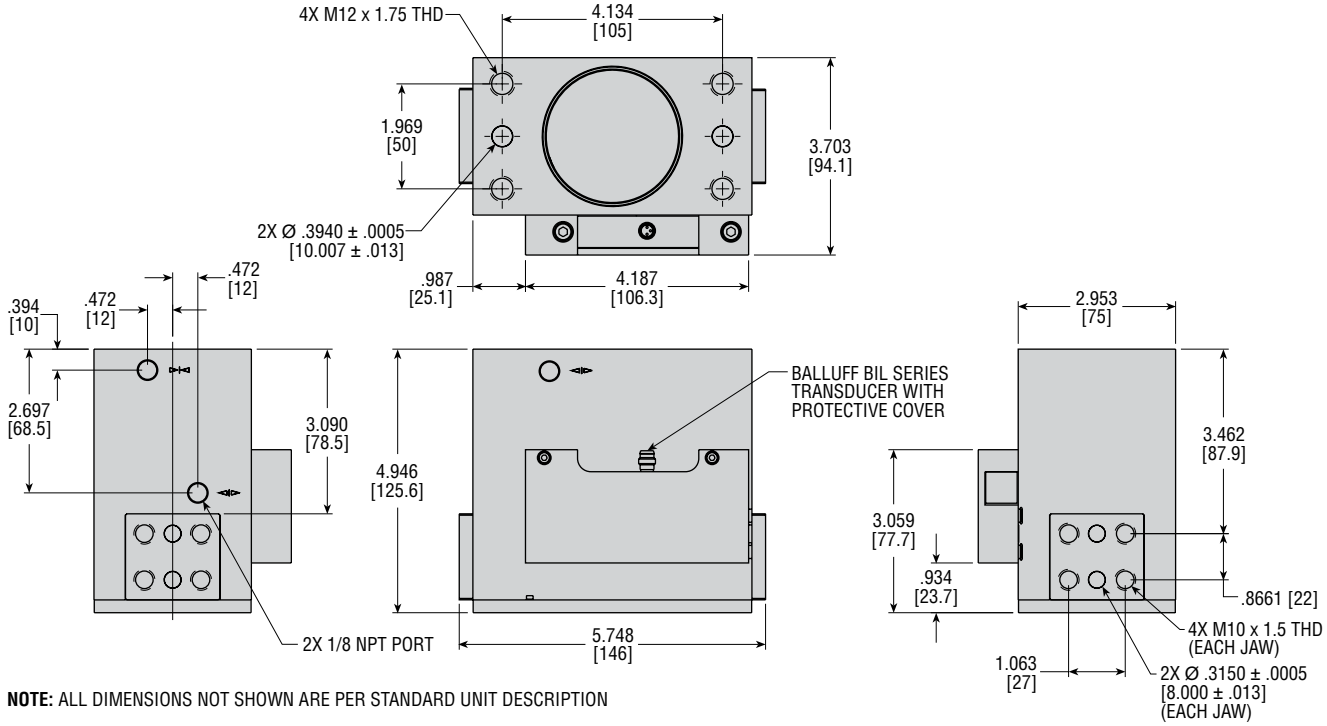
Major Benefits

- The Balluff Series BIL position transducer provides a 0 to 10 Volt feedback signal
- Feedback from the transducer is based on gripper jaw position
- A sensor cover is provided to protect the PHD magnet from external contaminants (MODEL# ML304024 only)
- Balluff sensor is protected from the environment (IP67)
- MODEL# ML304024 includes Balluff BIL transducer and cordset. Transducer can be used with other common cordsets.
- MODEL# ML306735 provides a GRL with provisions and bracket for mounting Balluff Micro-BIL transducer. Transducer can be used with Balluff or other common cordsets.
- Consult PHD for delivery

Industry Uses

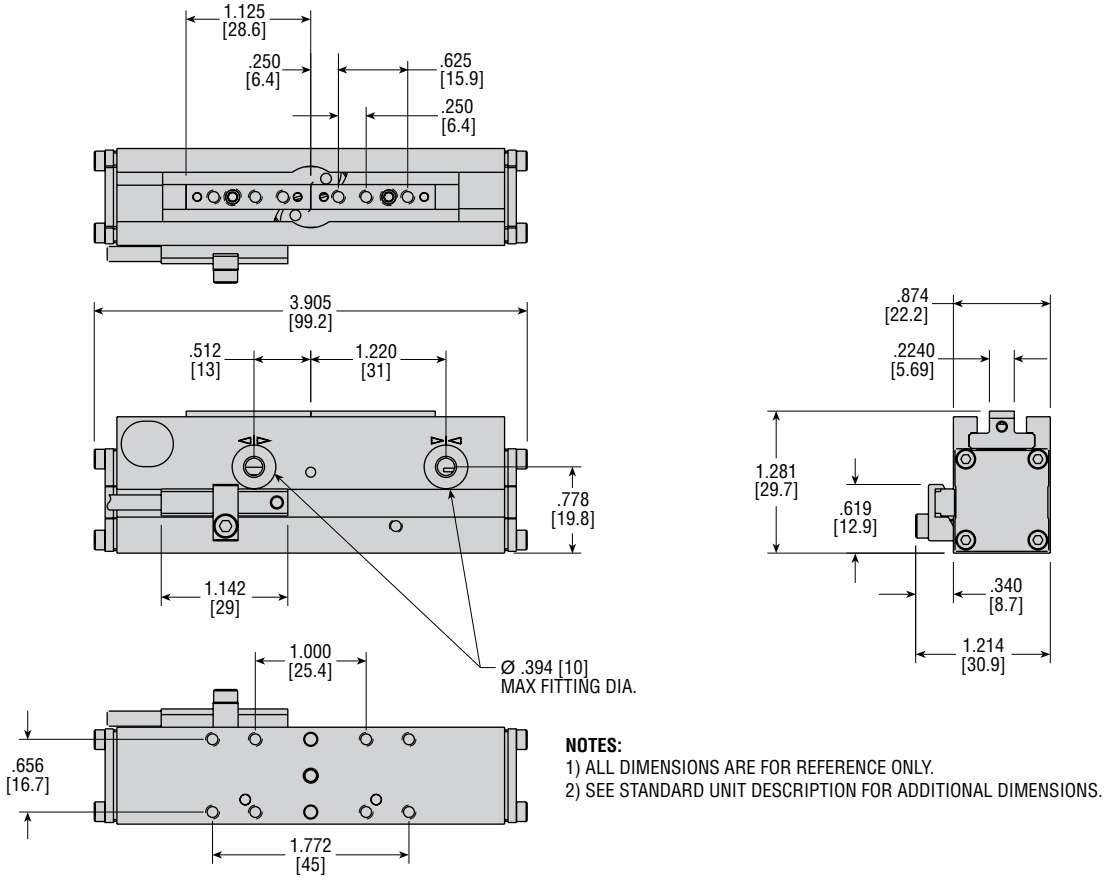
- Part transfer
- Robotics
- Assembly machine building
- Auto parts manufacturing

MODEL# ML304024



NOTE: ALL DIMENSIONS NOT SHOWN ARE PER STANDARD UNIT DESCRIPTION

MODEL# ML306735



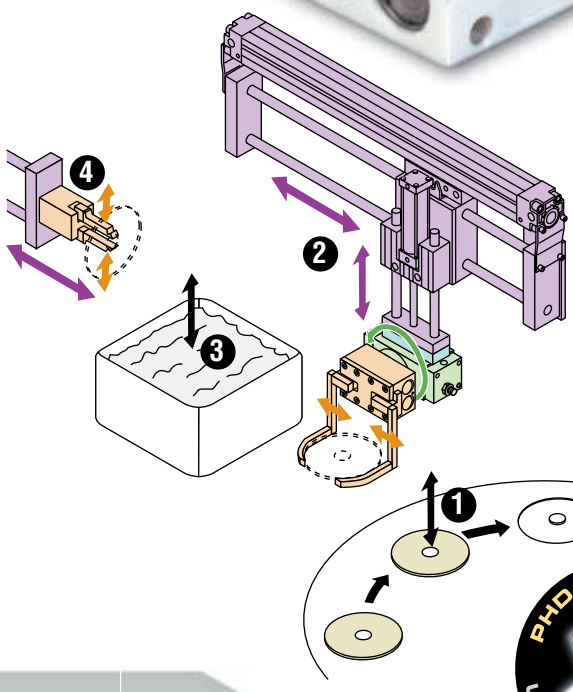
NOTES:
1) ALL DIMENSIONS ARE FOR REFERENCE ONLY.
2) SEE STANDARD UNIT DESCRIPTION FOR ADDITIONAL DIMENSIONS.

Polymer (PET)

MODEL# ML213853

Plastic Gripper Used To Rinse/Transfer Material in Harsh Environment

After a polishing operation on a turntable (1) is completed, the plastic (PET) gripper picks up the part by its outside diameter. The part is transferred (2) to a deionized water bath (3) to rinse off the abrasive slurry. After the rinsing process, the first gripper positions the part into the vertical axis to the second ID gripper (4). This ID gripper transfers the part onto a stack.

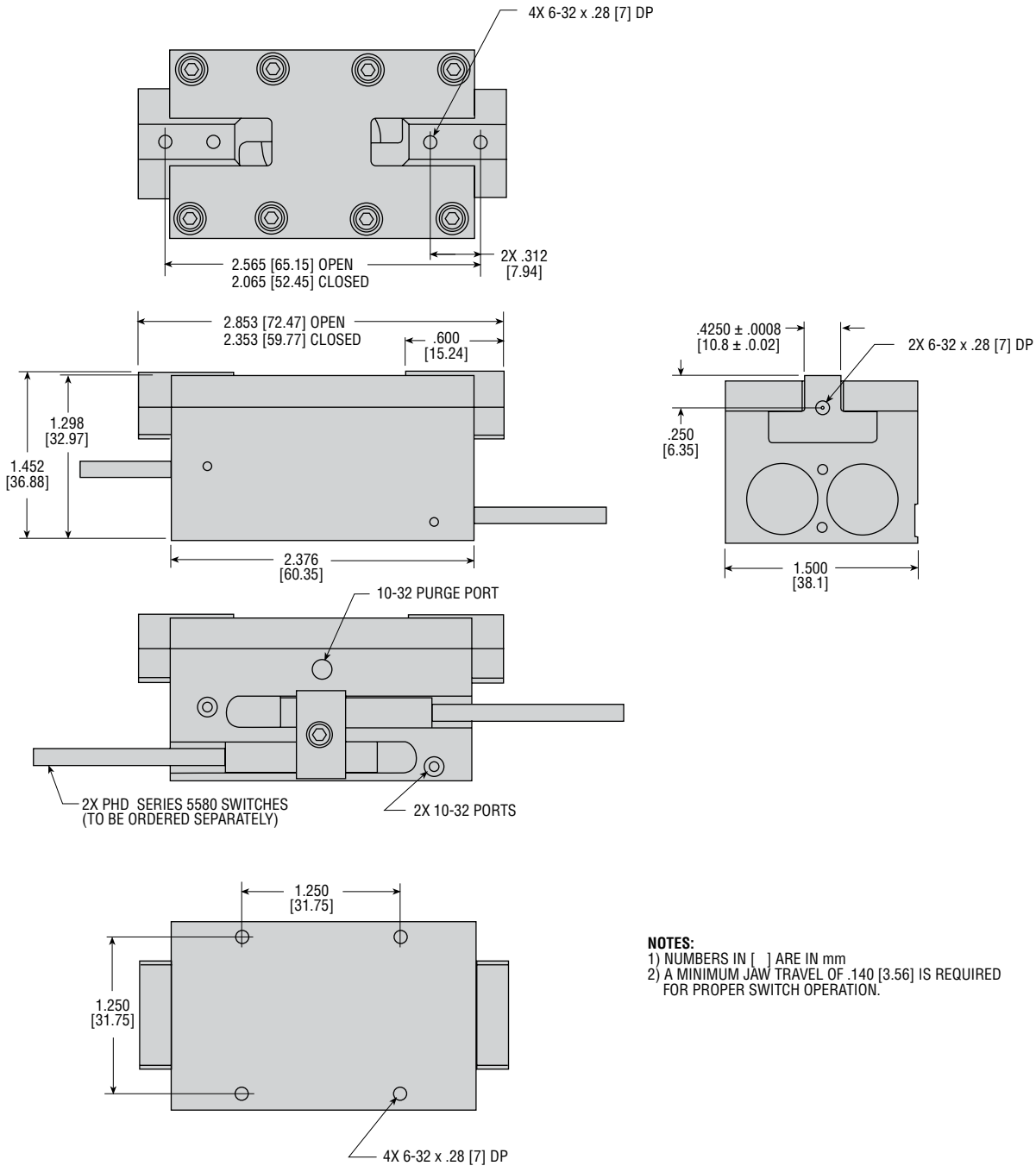


Major Benefits

- Constructed of PET plastic and passivated stainless steel with nitrile piston seals for harsh environments
- Compact size with long jaw travel
- Designed for part production in a deionized water environment
- Ported body allows for the connection of pressure of vacuum to the jaw area
- Fully field repairable
- Simple design, long life
- Double-acting for either internal or external gripping
- Parallel motion is ideal for gripping parts of varying sizes while maintaining the parallel relationship of the jaws to the part
- Consult PHD for delivery

Industry Uses

- Food processing
- Semiconductor processes



NOTES:
1) NUMBERS IN [ ] ARE IN mm
2) A MINIMUM JAW TRAVEL OF .140 [3.56] IS REQUIRED FOR PROPER SWITCH OPERATION.

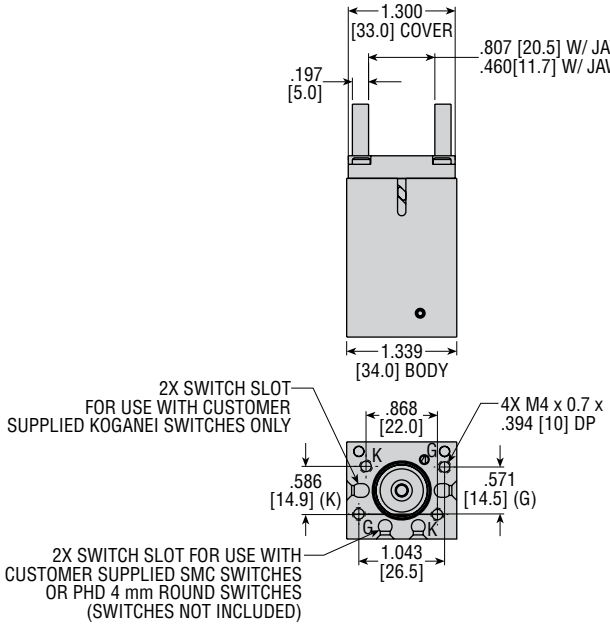
PET Replacement
MODEL# ML303025

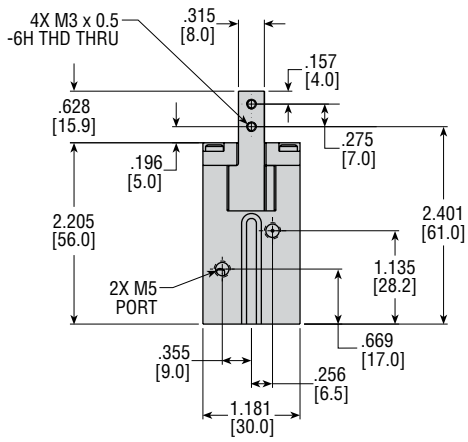
Major Benefits

- Features PET body and cover with stainless steel jaws, jaw driver, and fasteners; providing protection in deionized water applications and eliminates the need for protective jaw boots
- Compact, lightweight design allows for maximum application flexibility
- Double-acting for use in both internal and external gripping applications
- This gripper accepts select competitor switches, saving hours of downtime associated with switch change out
- Other configurations are available
- Units are fully field repairable
- Consult PHD for delivery

Industry Uses

- Deionized water applications
- Semiconductor industry





NOTES:
1) DIMENSIONS ARE FOR REFERENCE ONLY
2) NUMBERS IN [ ] ARE IN mm

All dimensions are reference only unless specifically toleranced.

Polymer Series GRW with Stainless Steel Jaws

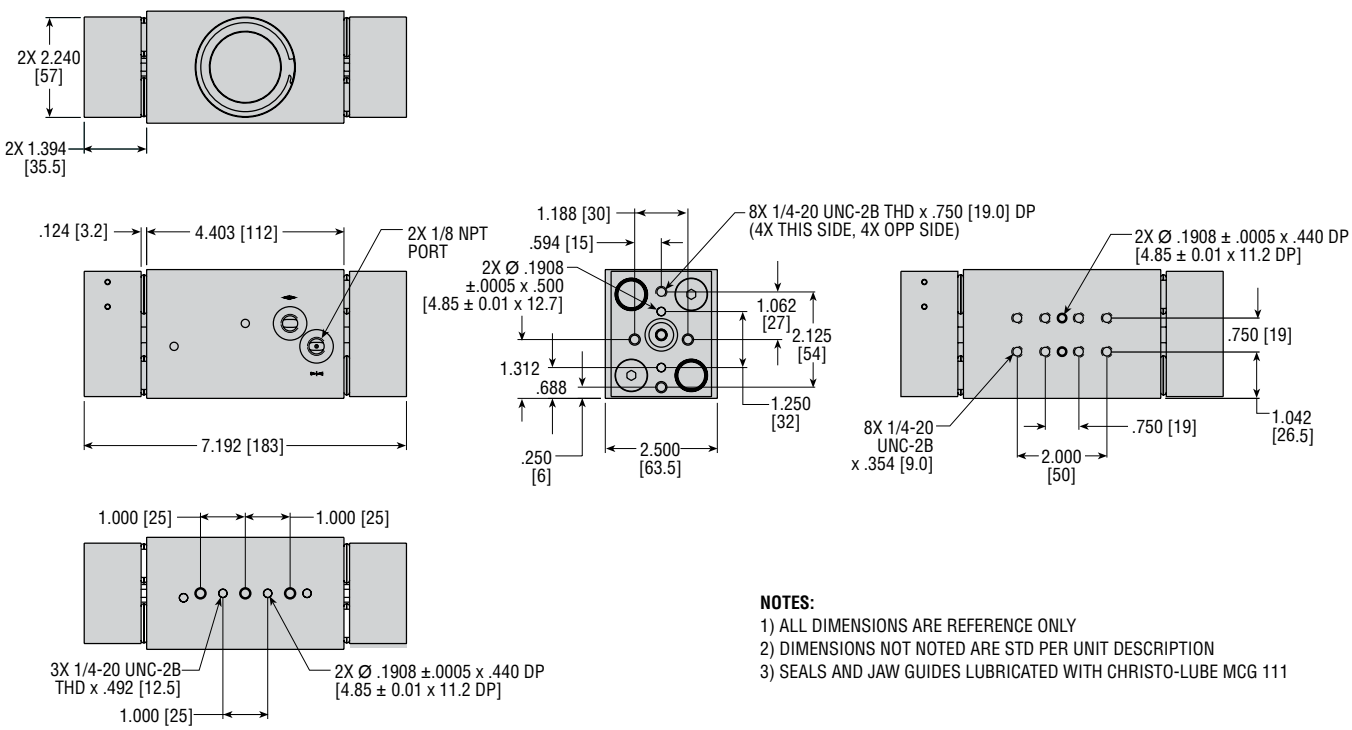
MODEL# ML302657

Major Benefits

- PET body and bushing
- Stainless steel jaws and jaw guides
- Fluoro-Elastomer seals
- Jaw guides and seals lubricated with cleanroom compatible grease
- Consult PHD for delivery

Industry Uses

- Semiconductor industry
- Food processing



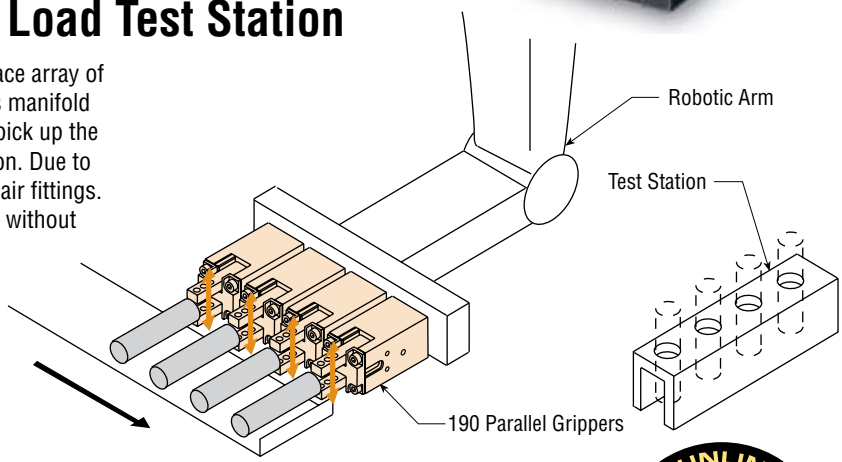
NOTES:
1) ALL DIMENSIONS ARE REFERENCE ONLY
2) DIMENSIONS NOT NOTED ARE STD PER UNIT DESCRIPTION
3) SEALS AND JAW GUIDES LUBRICATED WITH CHRISTO-LUBE MCG 111

190 Parallel with Centralized Manifold Port

MODEL# ML301764

Manifold Ported Grippers Load Test Station

Modified for any industry that requires a minimal space array of grippers. In this example, an array of four grippers is manifold mounted to a crossbar of robotic arm. The grippers pick up the machined tubes and reposition them into a test station. Due to space constraints, the grippers cannot have external air fittings. Each gripper can be rotated to the required positions without re-machining the mounting holes.

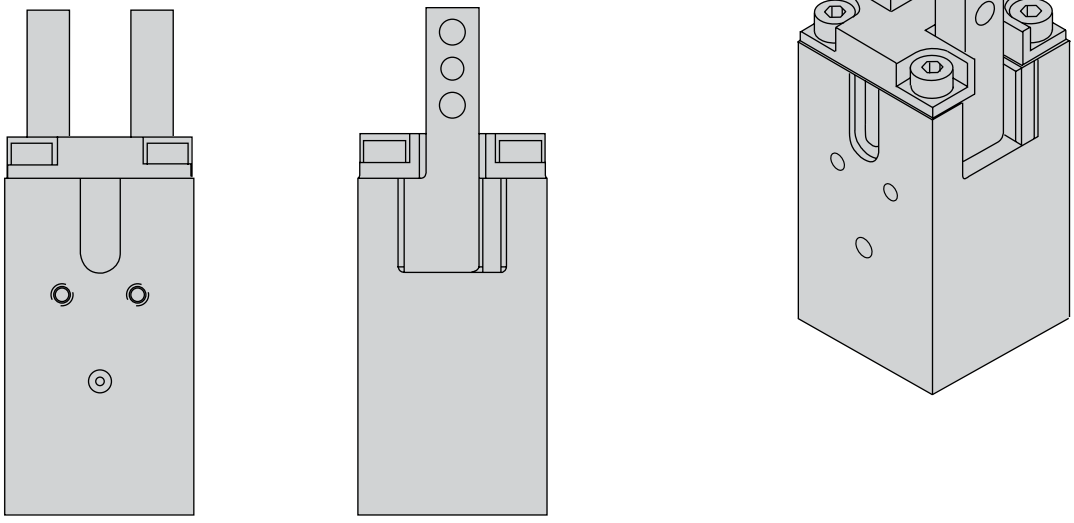


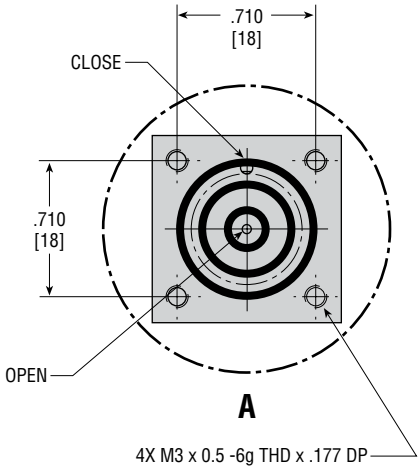
Major Benefits

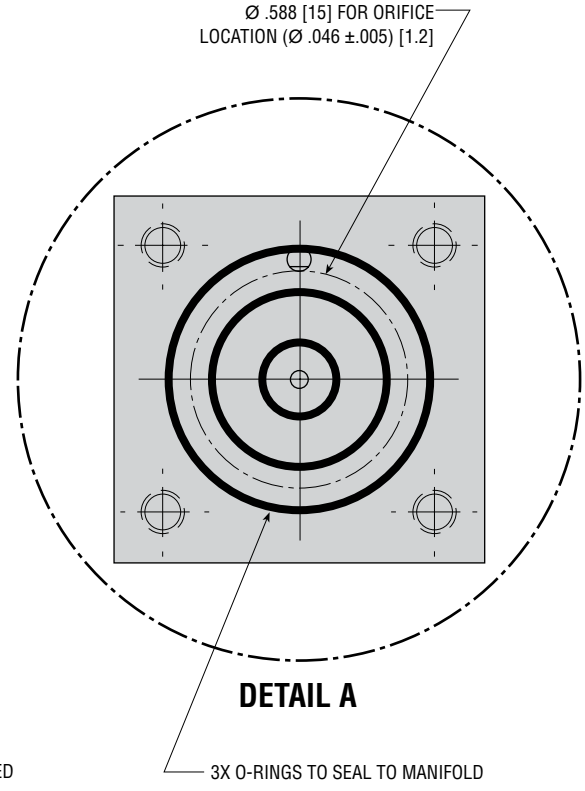
- The symmetrical manifold design allows flexibility for any bottom mount orientation. Eliminates the need for airlines, and allows for grippers to be mounted closer together
- Fully field repairable
- Compact size is ideal for handling small parts in confined areas
- Units provide true parallel jaw travel for easy tooling design
- Double-acting for either internal or external gripping applications
- Rugged jaw and body construction can withstand high impact and shock loads
- Internal jaw mechanism constructed of hardened steel components for a maintenance-free service life exceeding 10 million cycles
- Close tolerance components eliminate jaw play. Jaws have dowel holes or male keys for precise tooling location
- Consult PHD for delivery

Industry Uses

- Robotic industries
- Quality testing
- Packaging
- Pharmaceutical







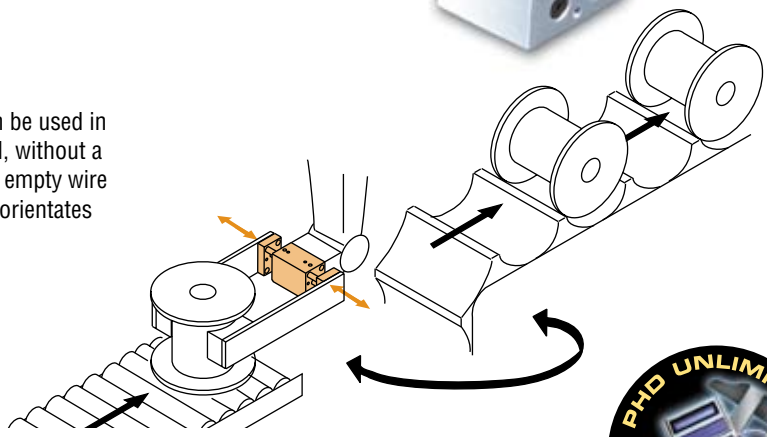
NOTES:
1) ALL DIMENSIONS ARE REFERENCE ONLY UNLESS SPECIFICALLY TOLERANCED
2) NUMBERS IN [ ] ARE IN mm.
3) BORE IS .472 [12] TOTAL STROKE IS 1/2" (1/4" PER JAW) [13]
4) JAWS ARE STAINLESS STEEL, MOST OTHER PARTS ARE PLASTIC

Series GRW with Long Jaw Travel

MODEL# ML301025

Long Travel Application

The long travel of this unique Series GRW Gripper can be used in numerous applications where longer travel is required, without a major increase in unit weight. One application grips an empty wire spool off one conveyor line, via a robotic arm, then reorientates and places the spool on a new conveyor.

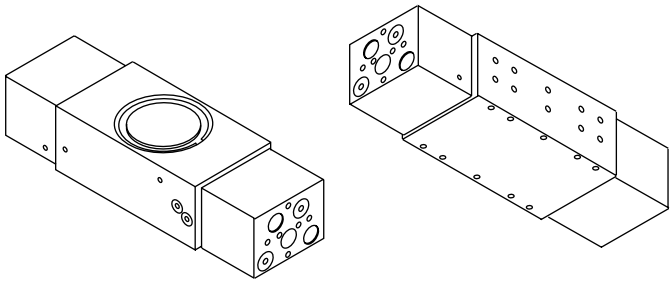


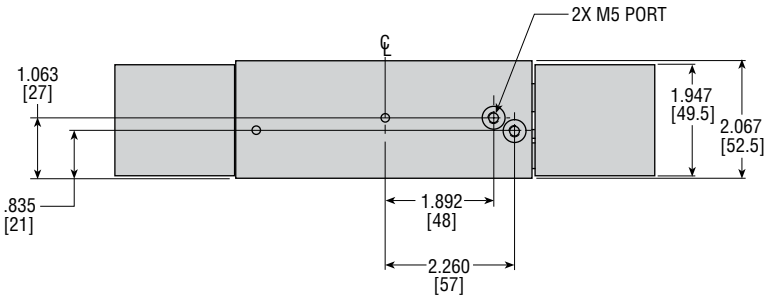
Major Benefits

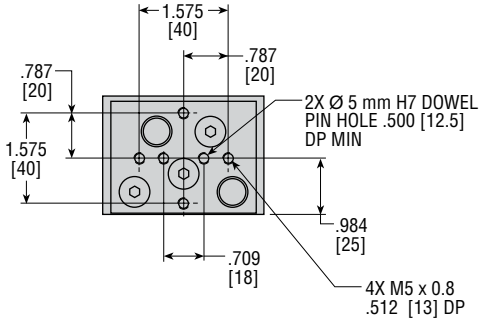
- Longer than standard jaw travel for increased range of applications (4 in [100 mm] total)
- True parallel synchronous jaw motion simplifies jaw tooling design
- Large diameter jaw guides supported through the length of the body provide superior jaw stability, long allowable tooling lengths, and high moment capability
- Standard shock pads at both ends of jaw travel provide quiet operation and absorb impact
- Double acting for use in both internal and external gripping applications
- Specially formulated piston and rod seals provide long service life
- Optional manifold porting available on either of the two standard mounting surfaces
- Units can be field converted to a non-synchronous version
- Units are fully field repairable
- Other jaw travels available, consult PHD
- Consult PHD for delivery

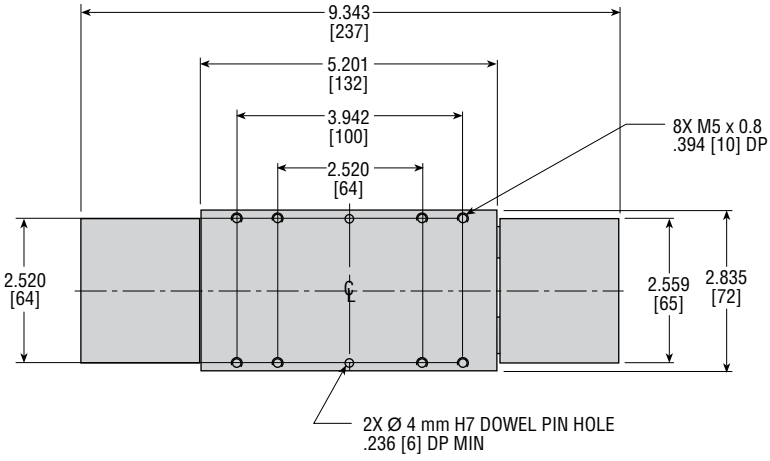
Industry Uses

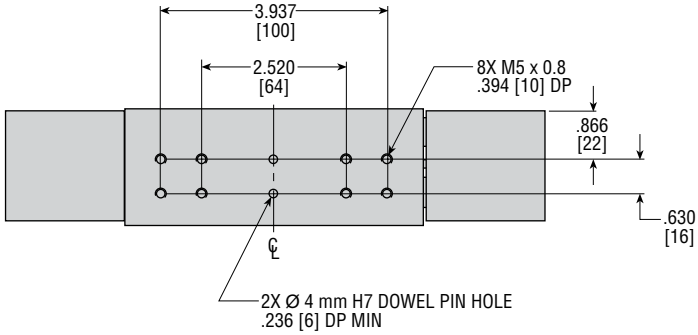
- Wire drawing
- Metal processes
- Material handling
- Assembly machine







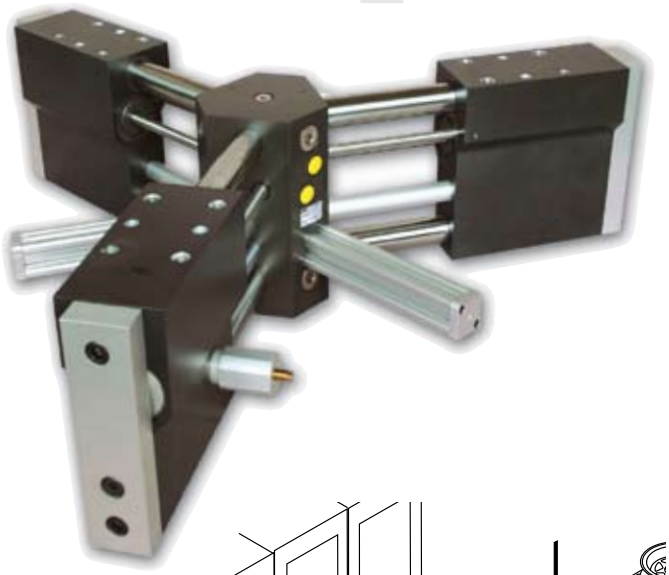




NOTES:
1) ALL DIMENSIONS ARE FOR REFERENCE ONLY
2) DESIGNATED CENTERLINE IS CENTERLINE OF UNIT

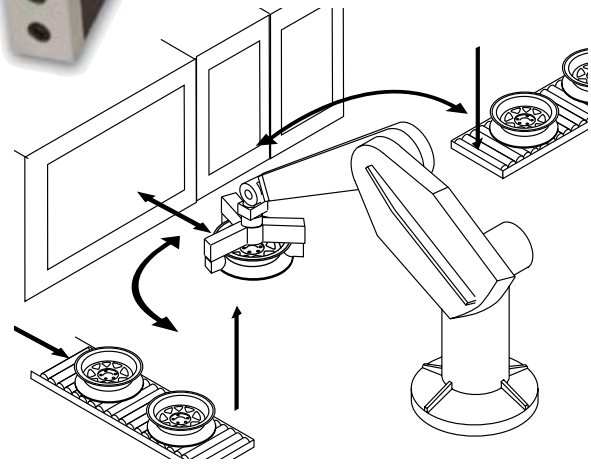
3 Jaw Parallel

MODEL# ML305843



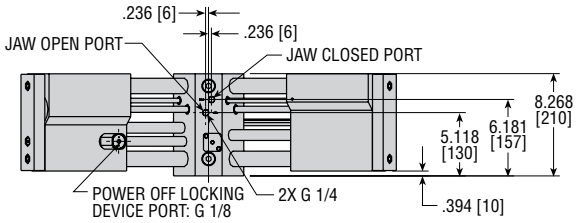
Major Benefits

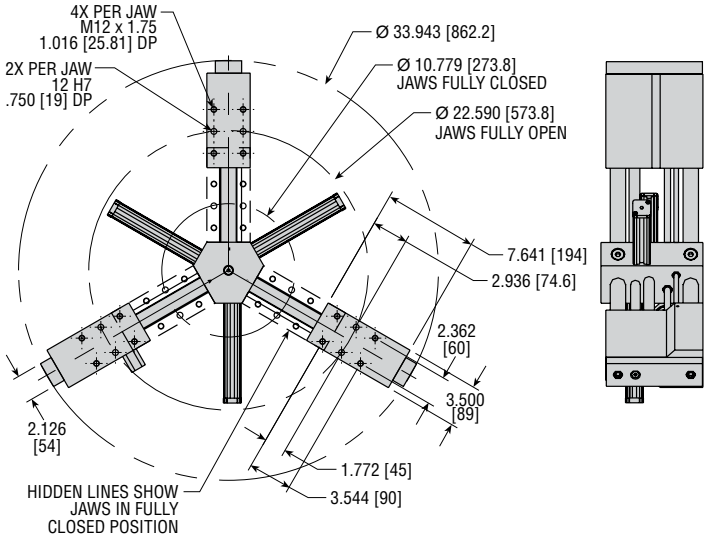
- Handles 14" to 24" rims
- Rack and pinion synchronizer minimizes backlash
- Based on proven GRR technology
- Very robust design
- Used in machining and testing application where it is not possible to grip inside hub or inside rim well
- Flat design allows easier handling inside machine
- Multiple jaw-position sensing possible
- Optional Rodlok® locks the jaws mechanically in a stationary position in the event air pressure is lost

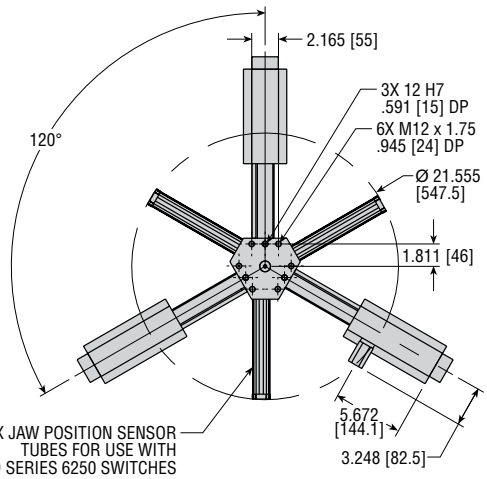


Industry Uses

- Wheel manufacturing
- Material handling







All dimensions are reference only unless specifically toleranced.

Unlimited™
UNIQUE SOLUTIONS

Series GHT
Heavy Duty, Long Jaw Travel, 3 Jaw

TO ORDER SPECIFY:
Design No., Size, and Options required.

G	H	T	0	1	2	-	1	-	25

PRODUCT LINE
G - Gripper

TYPE
Three Jaw

SYNCHRONIZATION
1 - Synchronized

DESIGN NUMBER
1 - Imperial
2 - Metric

SERIES
Heavy Duty

TYPE OPTION 1
0 - None/Open

JAW STYLE
2 - Jaw Style

BORE SIZE
25 = 25 mm
40 = 40 mm
63 = 63 mm
100 = 100 mm

Major Benefits

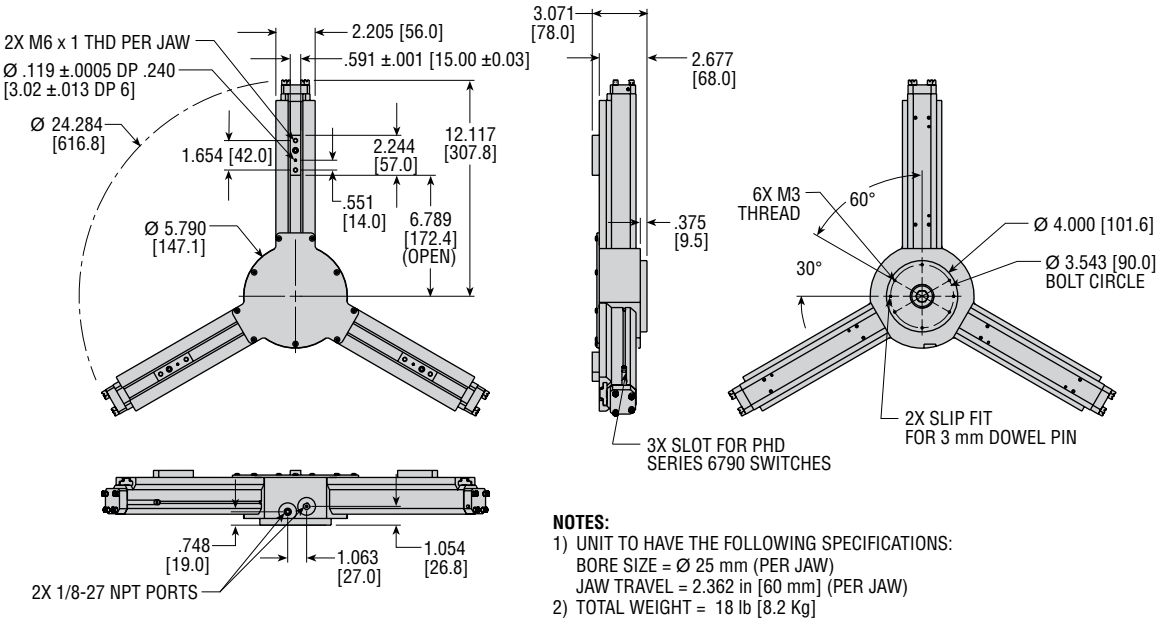
- Has longer jaw travel than the standard Series GRT Gripper
- Designed for gripping large, round parts that vary in size
- Incorporates direct mounting to a robot without the use of transition plates
- Rugged jaw and body construction can withstand high impact and shock loads
- Dowel pin holes on jaws provided for accurate tooling location
- Provides high grip force and high moment loading capacity
- Synchronized jaw movement
- Shock pads provide smooth end of stroke deceleration
- Consult PHD for delivery

Industry Uses

- Wheel manufacturing
- Robotic integrators

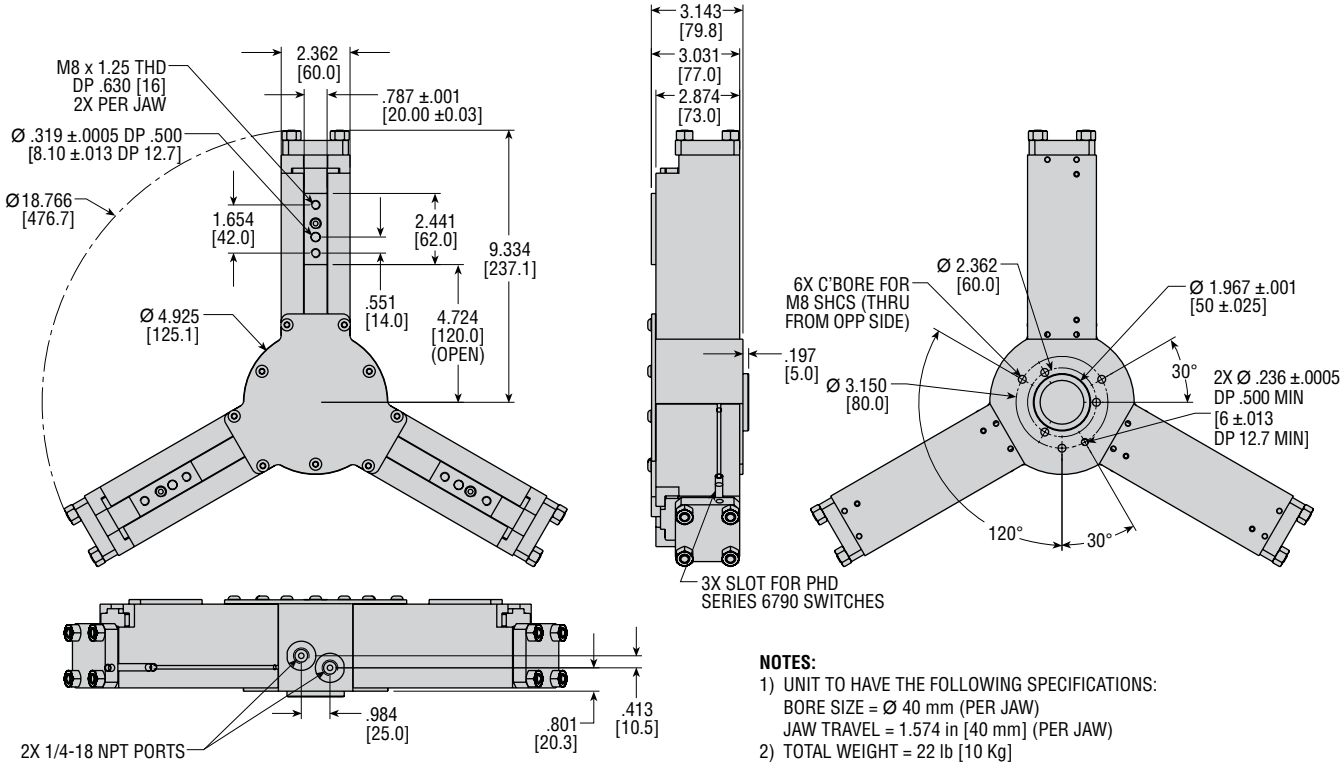
DIMENSIONS: Heavy Duty, Long Jaw Travel, 3 Jaw - Series GHT

25 mm bore



NOTES:
1) UNIT TO HAVE THE FOLLOWING SPECIFICATIONS:
   BORE SIZE = Ø 25 mm (PER JAW)
   JAW TRAVEL = 2.362 in [60 mm] (PER JAW)
2) TOTAL WEIGHT = 18 lb [8.2 Kg]

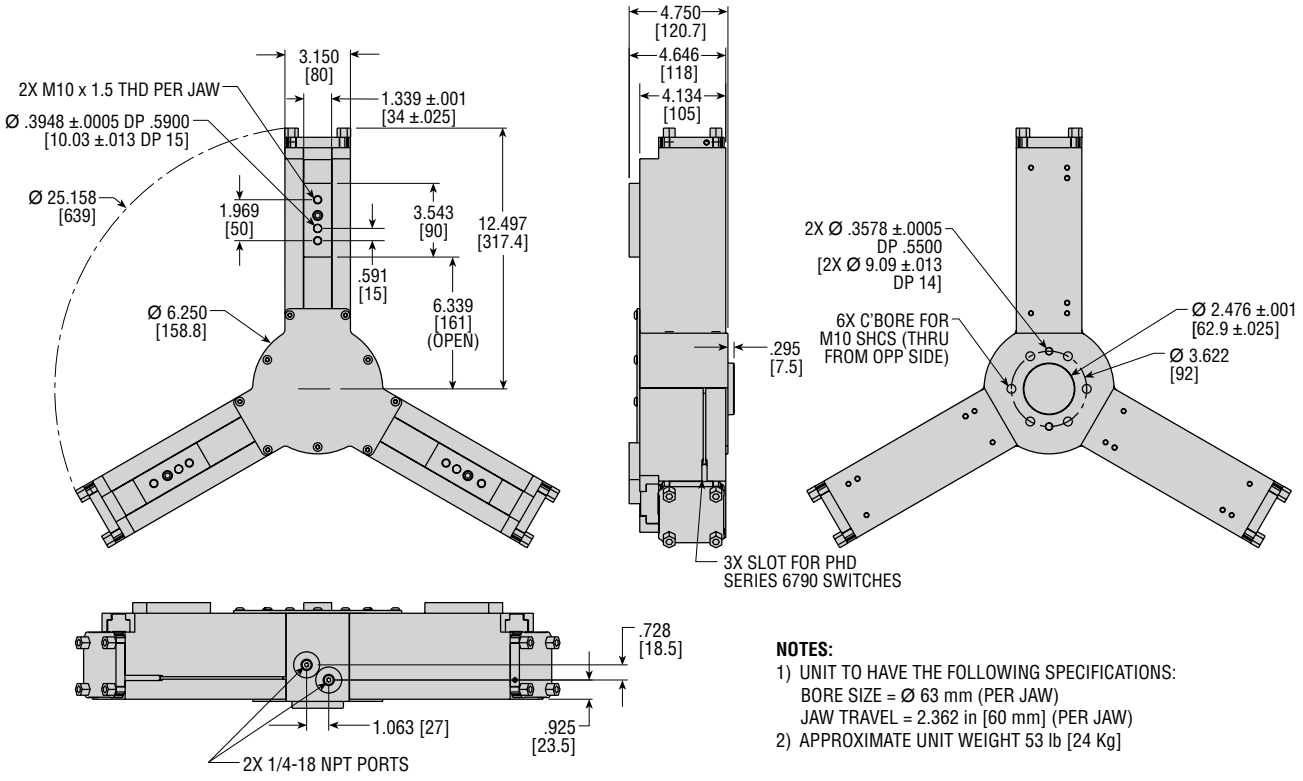
40 mm bore



NOTES:
1) UNIT TO HAVE THE FOLLOWING SPECIFICATIONS:
   BORE SIZE = Ø 40 mm (PER JAW)
   JAW TRAVEL = 1.574 in [40 mm] (PER JAW)
2) TOTAL WEIGHT = 22 lb [10 Kg]

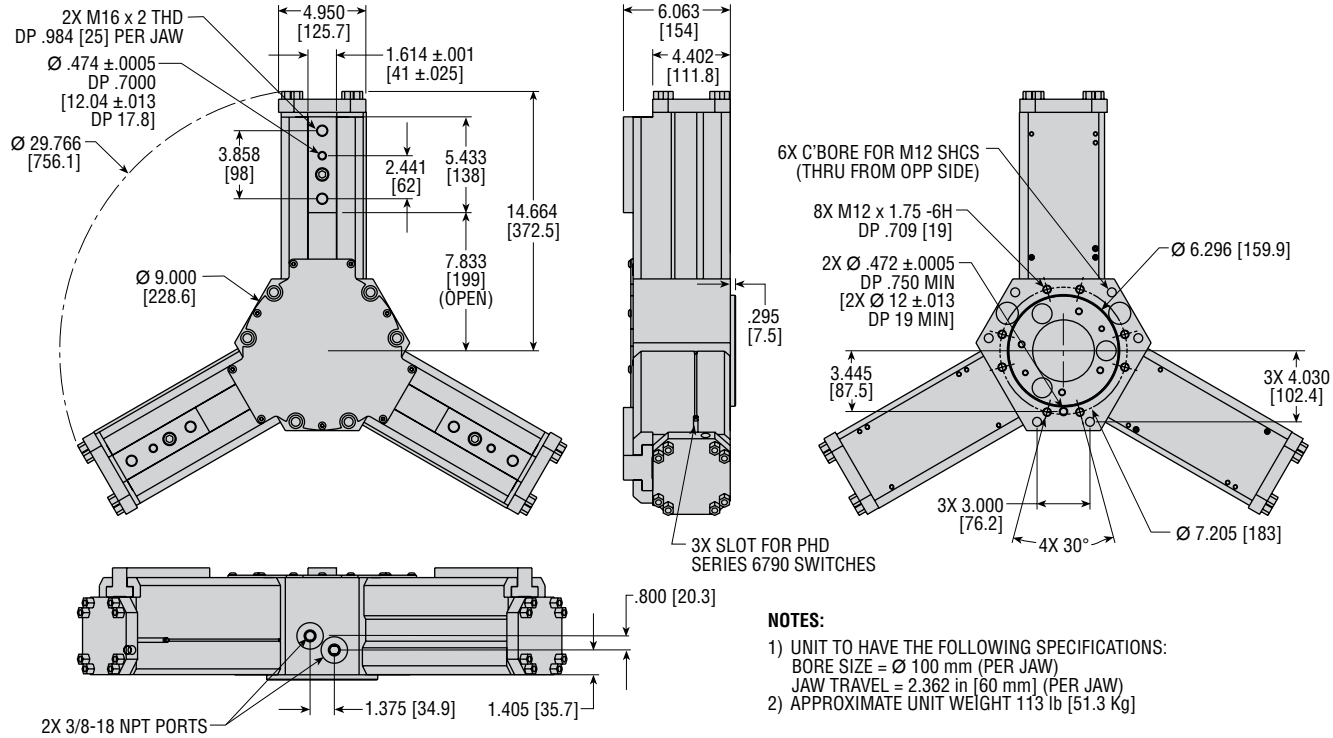
All dimensions are reference only unless specifically toleranced.

63 mm bore



NOTES:
1) UNIT TO HAVE THE FOLLOWING SPECIFICATIONS:
   BORE SIZE = Ø 63 mm (PER JAW)
   JAW TRAVEL = 2.362 in [60 mm] (PER JAW)
2) APPROXIMATE UNIT WEIGHT 53 lb [24 Kg]

100 mm bore



NOTES:
1) UNIT TO HAVE THE FOLLOWING SPECIFICATIONS:
   BORE SIZE = Ø 100 mm (PER JAW)
   JAW TRAVEL = 2.362 in [60 mm] (PER JAW)
2) APPROXIMATE UNIT WEIGHT 113 lb [51.3 Kg]

Polymer Long Jaw Travel

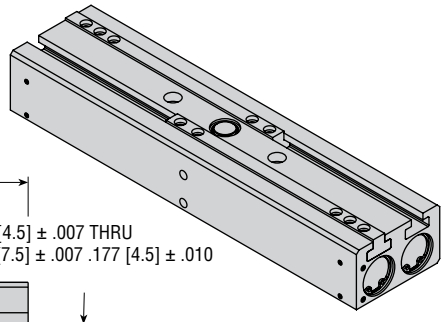
MODEL# ML307562

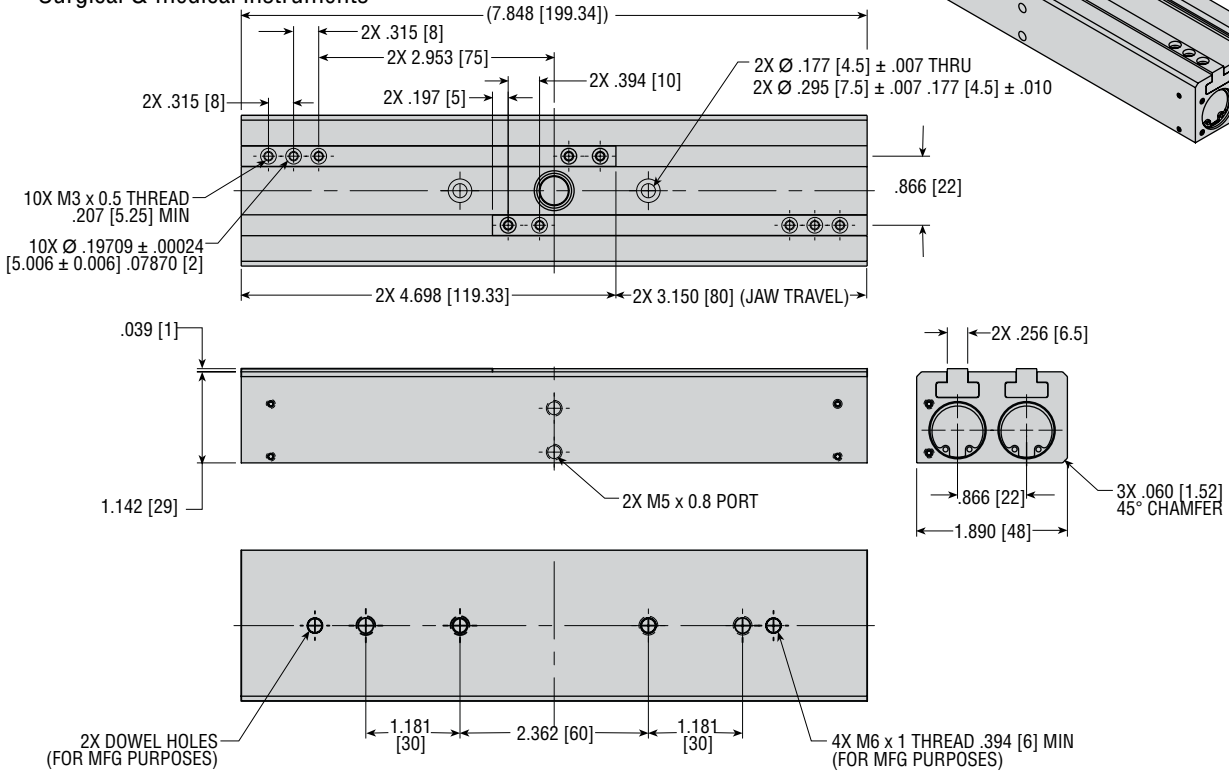
Major Benefits

- Synchronized jaw travel
- Long jaw travel
- PET Plastic body
- Stainless steel jaws
- Consult PHD for delivery

Industry Uses

- Pharmaceutical
- IV bag producers
- Surgical & medical instruments





NOTES:

1) ALL DIMENSIONS ARE FOR REFERENCE ONLY UNLESS SPECIFICALLY TOLERANCED. STANDARD TITLEBLOCK TOLERANCES DO NOT APPLY.
2) UNIT IS A 14 mm TWIN BORE x 80 mm STROKE (PER JAW) SYNCHRONIZED GRIPPER TO REPLACE TECHNO-SOMMER GRIPPER PER GH6080.
3) GRIPPER BODY IS MADE FROM PET PLASTIC, JAWS ARE STAINLESS STEEL.

All dimensions are reference only unless specifically toleranced.

2 Jaw Angular Replacement

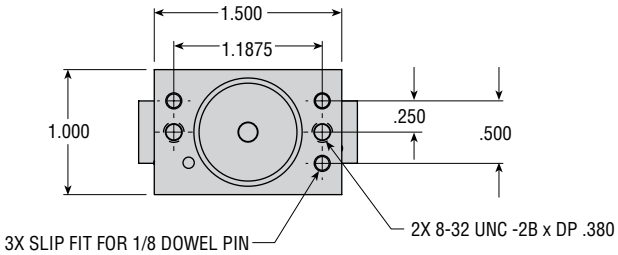
MODEL# ML304302

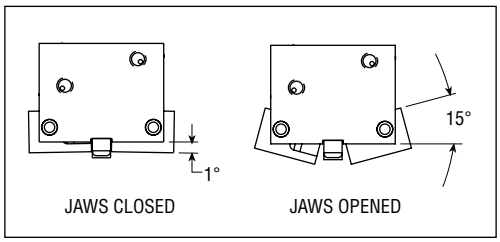
Major Benefits

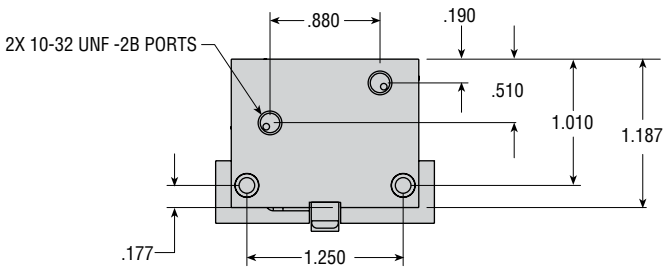
- Electroless nickel-plated jaws
- Oversized mounting threads
- Hardened steel jaw travel
- Built-in stroke adjustment screw
- Heavy duty jaw pivot pins

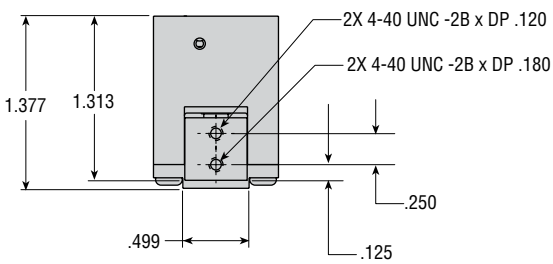
Industry Uses

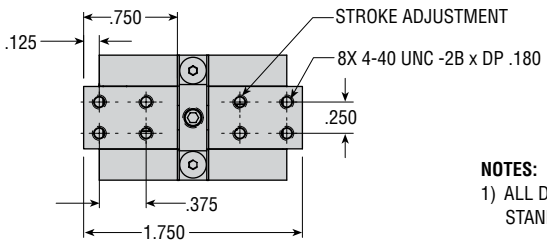
- Sheet metal handling
- Specialty machines











NOTES:

1) ALL DIMENSIONS ARE FOR REFERENCE ONLY UNLESS SPECIFICALLY TOLERANCED. STANDARD TITLEBLOCK TOLERANCES DO NOT APPLY.

Angular Replacement

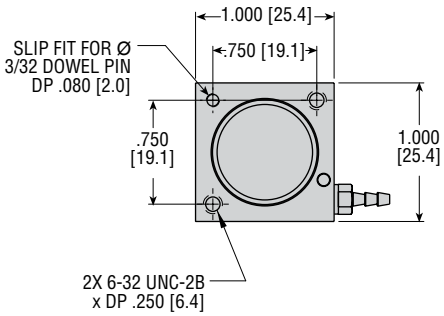
MODEL# ML307584

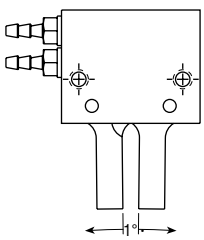
Major Benefits

- Stainless steel jaws
- Direct drop-in replacement
- Consult PHD for delivery

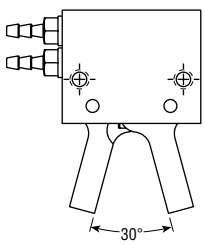
Industry Uses

- Pharmaceutical
- IV bag producers
- Surgical & medical instruments

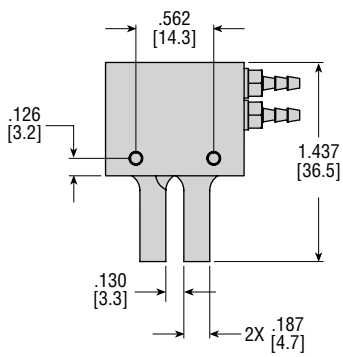


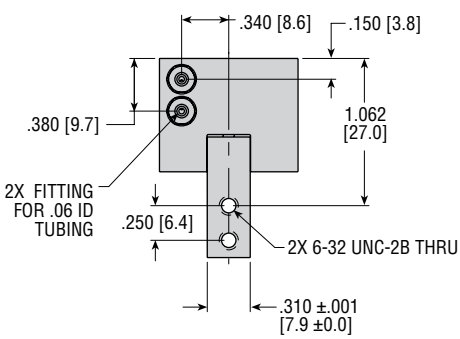


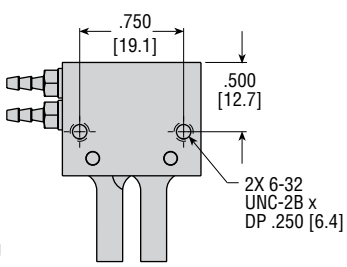
JAWS CLOSED



JAWS OPEN







NOTES:
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2) STANDARD TITLEBLOCK TOLERANCES DO NOT APPLY.

rotary actuators

SERIES		SIZE	MAXIMUM TORQUE OUTPUT	MAJOR BENEFIT	APPLICATION	INDUSTRY USE
RCC (Cable) **page 5-3**		8 mm 12 mm 16 mm	1.8 to 13.7 in-lb at 100 psi [.20 to 1.55 Nm at 7 bar]	• low cost • compact size • low profile • high thrust loads	• Part rotation • Electronic assembly • Labeling • Grip & flip	• Electronics • Packaging • Assembly machine
RF (Low Profile) **page 5-9**		14 mm - 25 mm	7 to 67 in-lb at 100 psi [0.8 to 7.7 Nm at 7 bar]	• compact size • low profile • one piece hub & piston assembly • fully adjustable stops • modularity with SHP & GRT	• Part orientation • Sensing • Turntables	• Electronics • Packaging • Assembly machine
RL **page 5-19**		12 mm - 63 mm	4.4 to 544 in-lb at 150 psi [.5 to 59.4 Nm at 10 bar]	• low cost • OEM style rotaries • high radial axial bearing loads • high torque/package size	• Turntables • Machine load/unload • Label application	• Automotive • Machine builders • General industrial use • Labeling/packaging
RA **page 5-31**		20 mm - 50 mm	14 to 228 in-lb at 150 psi [1.6 to 24.9 Nm at 10 bar]	• full featured rotary • high radial axial bearing loads • zero backlash at ends of rotation • wide variety of options & accessories	• Turntables • Part orientation • Machine load/unload	• Automotive • Machine OEM's • General industrial use
RI **page 5-41**		25 mm - 50 mm	37 to 476 in-lb at 100 psi [4.3 to 54.6 Nm at 7 bar]	• high torque • high axial & radial bearing load • thru hole shaft for built-in air communication ports	• Part orientation • Pick & place • Machine load/unload	• Automotive • General machine builders • Electronics • Stamping
1000-8000 **page 5-57**		1 in - 3 in	**Pneumatic:** 58 to 3,180 in-lb @ 150 psi [6.4 to 347 Nm @ 10 bar] **Hydraulic:** 585 to 31,800 in-lb @ 1500 psi [66 to 3579 Nm @ 103 bar]	• heavy duty • wide variety of options & accessories • versatile design • high torque	• Pneumatic or Hydraulic • General purpose rotary application • Machine load/unload	• Automotive • General machine builders
AIR/OIL TANDEM 2000-8000 **page 5-69**		1 in - 3 in	58 to 1,590 in-lb @ 150 psi [6.4 to 174 Nm @ 10 bar]	• smooth rotation throughout rotation • controlled velocity	• Machine load/unload • Turntable • Pick & place	• Automotive • General industrial machines
MULTI-POSITION 2000-8000 **page 5-81**		1 in - 3 in	**Pneumatic:** 58 to 1,590 in-lb @ 150 psi [6.4 to 174 Nm @ 10 bar] **Hydraulic:** 585 to 15,900 in-lb @ 1500 psi [66 to 1789 Nm @ 103 bar]	• 3, 4, or 5 rotary positions	• Machine load/unload • Pick & place • Part orientation • Reject/accept station	• Automotive • General industrial machines

phd Unlimited™ UNIQUE SOLUTIONS

unique solutions

Ball Valve Rotary
Model# ML302704
Pneumatic ball valve actuator
page 5-95

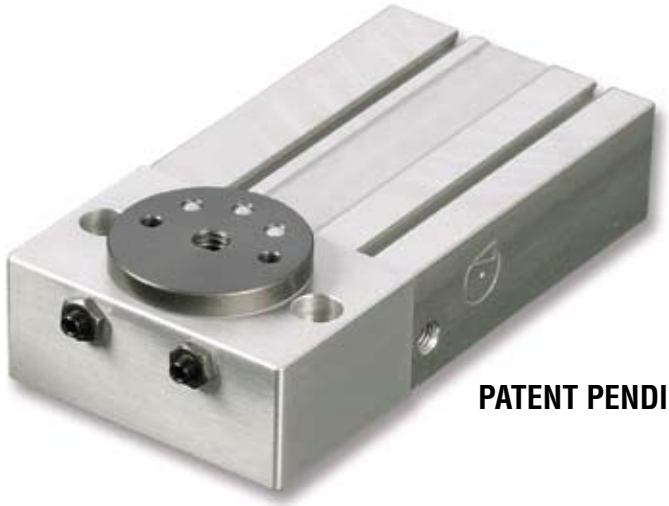
Replacement Rotary
Model# ML216496
Direct mounting replacement
page 5-97

RLS with Clutch
Model# ML302064
Rotary with unidirectional clutch
page 5-98

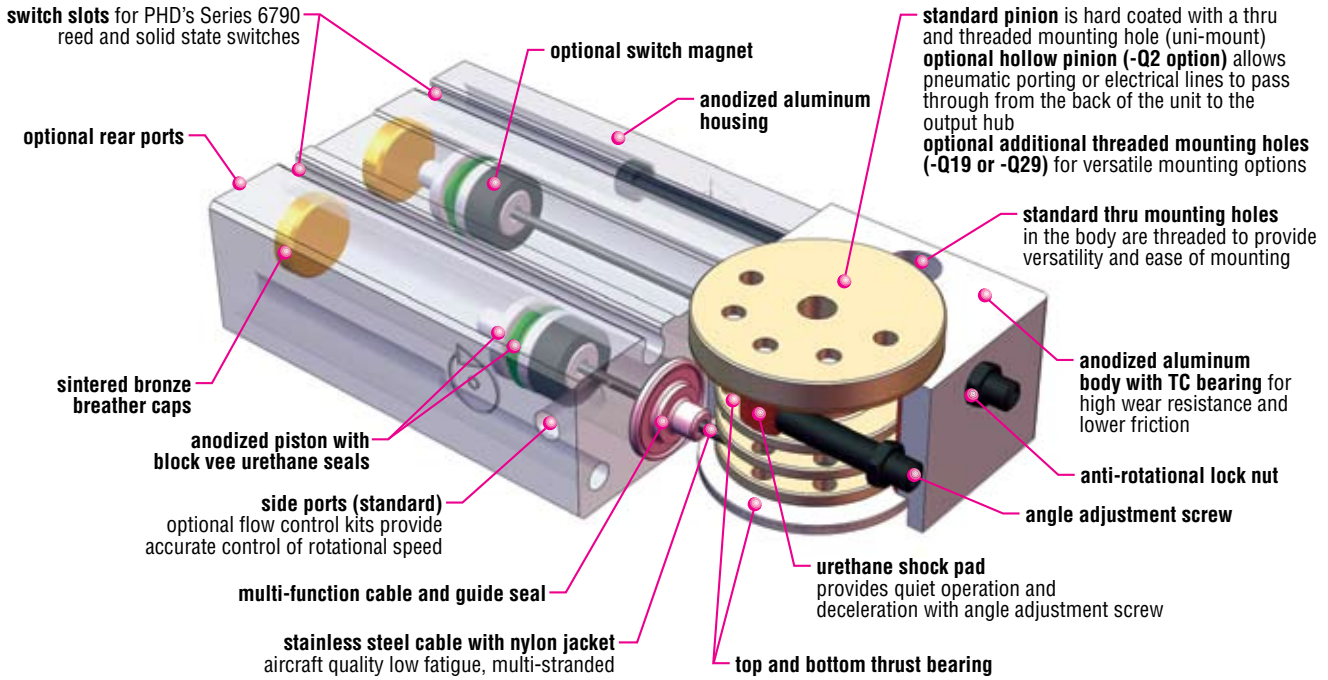
360° Rotary with Gripper
Model# ML307464
360° Series RLS Rotary with Series 8400 Angular Gripper
page 5-100

RCC

COMPACT
LOW PROFILE
HIGH THRUST LOADS



PATENT PENDING



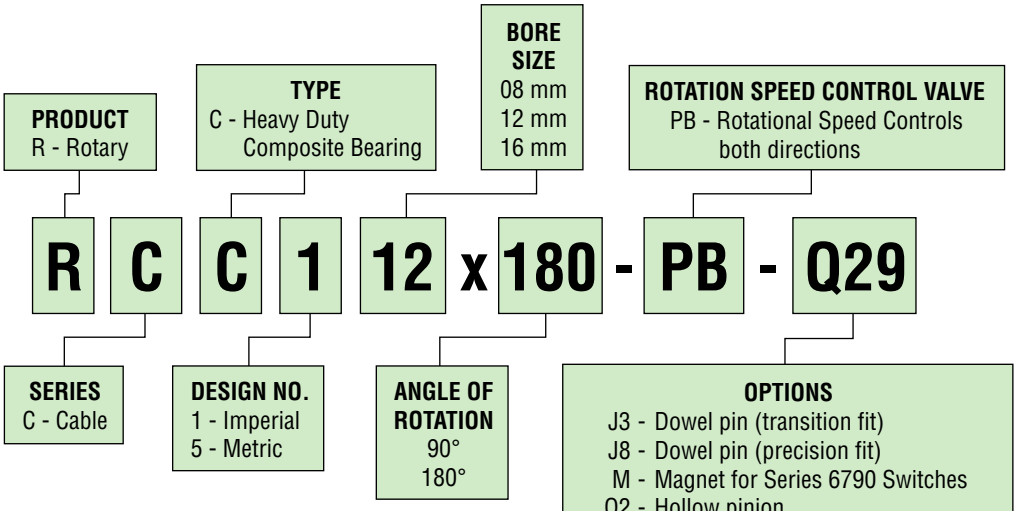
Major Benefits

- Exceptionally low profile for confined spaces
- Three bore sizes and two standard rotations, 90° and 180°
- Standard internal shock pad eliminates metal to metal contact, reducing noise and end-of-rotation impact forces
- The rotary housing incorporates switch slots for convenient mounting of PHD's Series 6790 4 mm Reed and Solid State Switches. Magnet option (-M) is required when using Series 6790 Switches
- Standard angle adjustment of ± 5° each direction
- Standard pinion has a threaded thru hole
- High axial thrust load capabilities

Industry Uses

- Light part rotation
- Electronic assembly
- Labeling applications
- Grip and flip applications

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



Options may affect unit length. See unit dimension and options pages for adders.

RCC

SERIES 6790 SWITCHES

PART NO.	DESCRIPTION
67902-1-02	NPN (Sink) or PNP (Source) DC Reed, 2 m cable
67902-1-05	NPN (Sink) or PNP (Source) DC Reed, 5 m cable
67903-1-02	NPN (Sink) DC Solid State, 2 m cable
67903-1-05	NPN (Sink) DC Solid State, 5 m cable
67904-1-02	PNP (Source) DC Solid State, 2 m cable
67904-1-05	PNP (Source) DC Solid State, 5 m cable
67922-1	NPN (Sink) or PNP (Source) DC Reed, Quick Connect
67923-1	NPN (Sink) DC Solid State, Quick Connect
67924-1	PNP (Source) DC Solid State, Quick Connect
67929-2	AC Reed, Current Limited, Quick Connect
63549-02	2 m Cordset with Quick Connect
63549-05	5 m Cordset with Quick Connect

UNIQUE ROTARY ACTUATORS
ARE AVAILABLE. SEE UNIQUE PRODUCTS
AT THE END OF THIS SECTION.

SPECIFICATIONS	RCCx08	RCCx12	RCCx16
MIN. OPERATING PRESSURE	30 psi [2.0 bar]	25 psi [1.7 bar]	20 psi [1.4 bar]
MAX. OPERATING PRESSURE	100 psi [7 bar]		
OPERATING TEMPERATURE RANGE	32 to 150°F [0 to 65°C]		
ROTATIONAL TOLERANCE	Nominal +10° to -10° with angle adjustment		
BACKLASH	No backlash at end of rotation		
DEGREES OF ROTATION	90° and 180°		
LUBRICATION	Permanent for non-lube air		

SIZE	ROTATION	BASE WEIGHT lb	BASE WEIGHT kg	BORE DIAMETER in	BORE DIAMETER mm	DISPLACEMENT VOLUME in²	DISPLACEMENT VOLUME mm²	THEORETICAL TORQUE OUTPUT in-lb/psi	THEORETICAL TORQUE OUTPUT Nm/bar	ROTATIONAL VELOCITY MAX. deg/sec	MAX. AXIAL BEARING LOAD lb	MAX. AXIAL BEARING LOAD N	MAX. RADIAL BEARING LOAD* lb	MAX. RADIAL BEARING LOAD* N
08	90°	.32	.15	.315	8	.146	240	.018	.0021	180°/.16	7.0	31.1	1.3	5.8
	180°	.31	.14			.292	479							
12	90°	.65	.30	.472	12	.263	432	.050	.0056	180°/.24	15.0	66.7	3.5	15.6
	180°	.61	.28			.527	863							
16	90°	1.20	.55	.630	16	.514	842	.137	.0155	180°/.24	30.0	133.4	9.0	40.0
	180°	1.16	.53			1.027	1683							

NOTE: *At .5 in [12.7 mm] from hub face

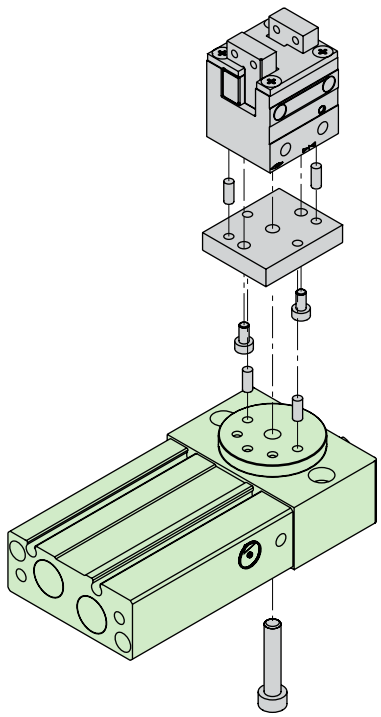
SIZING AND APPLICATION ASSISTANCE
See PHD Product Sizing Catalog for specific and complete sizing information.
Online sizing assistance is available at: ***www.phdinc.com/apps/sizing***

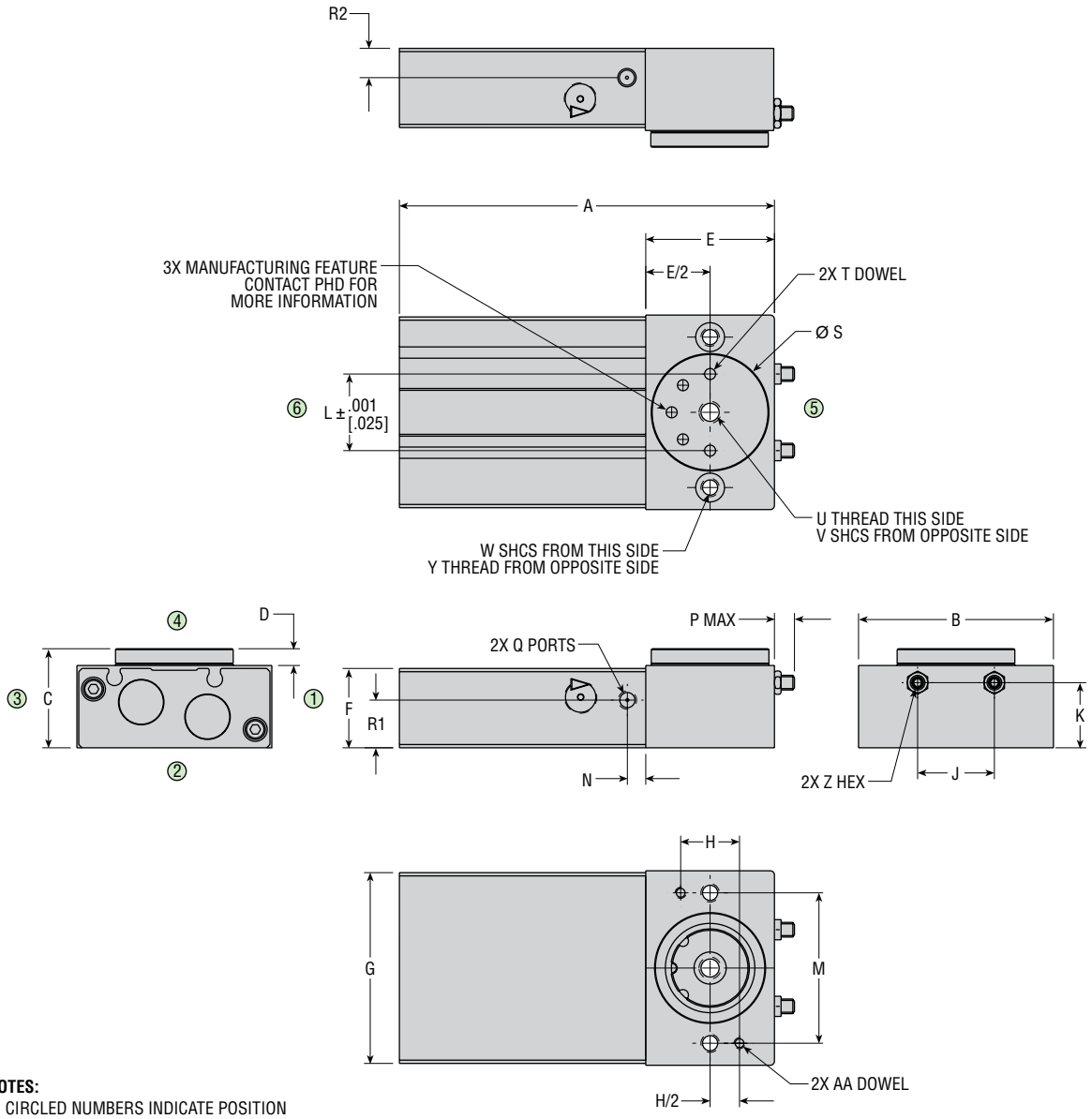
MOUNTING INSTRUCTIONS

PHD recommends mounting load or tooling with pinion in mid-rotation. Support pinion while tightening fasteners. Recommended mounting torques (for screw thread engagement of one diameter or greater) are shown in the Mounting Torques Table. Torque for port fittings is the minimum amount required to prevent leakage.

MOUNTING TORQUES

SIZE	in-lb	Nm
M2	2.6	0.3
M3	9	1.0
M4	18	2.0
M5	39	4.4
M6	60	6.8
M8	130	14.7
#4-40	9	1.0
#6-32	15	1.7
#10-24	40	4.5
#1/4-20	95	10.7
#5/16-18	120	13.6





NOTES:
1) CIRCLED NUMBERS INDICATE POSITION
2) HUB SHOWN IN MID-ROTATION POSITION

BORE SIZE	NOMINAL ROTATION	A	B	C	D	E	F	G	H	J	K	L	M	N	P
08 mm	90° or 180°	3.346 [85]	1.614 [41]	.861 [21.9]	.168 [4.3]	1.142 [29]	.652 [16.6]	1.575 [40]	.394 [10]	.590 [15]	.505 [12.8]	.591 [15]	1.299 [33]	.197 [5]	.227 [5.8]
12 mm	90° or 180°	4.016 [102]	2.087 [53]	1.065 [27.1]	.182 [4.6]	1.378 [35]	.851 [21.6]	2.047 [52]	.630 [16]	.822 [20.9]	.699 [17.8]	.822 [20.9]	1.614 [41]	.197 [5]	.276 [7.0]
16 mm	90° or 180°	5.246 [133.2]	2.598 [66]	1.297 [32.9]	.197 [5.0]	1.900 [48.3]	1.100 [27.9]	2.559 [65]	.630 [16]	1.140 [29]	.880 [22.4]	1.140 [29]	2.126 [54]	.197 [5]	.496 [12.6]

BORE SIZE	NOMINAL ROTATION	Q	R1 (CW)	R2 (CCW)	S	T	U	V	W	Y	Z	AA
08 mm	90° or 180°	10-32 THD [M5 x 0.8]	.370 [9.4]	.228 [5.8]	1.063 [27]	[3 x 3 mm DP]	10-24 THD [M5 x 0.8]	#6 [M4]	#5 [M3]	8-32 THD [M4 x 0.7]	[M2]	[3 x 4 mm DP]
12 mm	90° or 180°	10-32 THD [M5 x 0.8]	.512 [13]	.315 [8]	1.260 [32]	[3 x 3 mm DP]	1/4-20 THD [M6 x 1]	#10 [M5]	#6 [M4]	10-24 THD [M5 x 0.8]	[M2]	[3 x 4 mm DP]
16 mm	90° or 180°	10-32 THD [M5 x 0.8]	.628 [16]	.407 [10.3]	1.732 [44]	[4 x 4 mm DP]	5/16-18 THD [M8 x 1.25]	1/4 [M6]	#6 [M4]	10-24 THD [M5 x 0.8]	[M2.5]	[4 x 4 mm DP]

All dimensions are reference only unless specifically toleranced.

J3 TRANSITIONAL FIT DOWEL PIN HOLES

This option provides a compromise fit between clearance and interference. Transitional fits are used where accuracy of location is important, but a small amount of clearance is permissible.

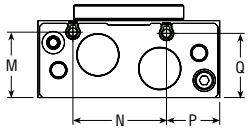
J8 PRECISION FIT DOWEL PIN HOLES

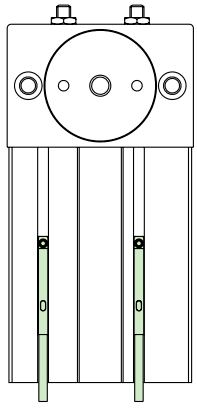
This option provides a H7 tolerance precision fit with dowel pins. Precision fits are used where accuracy of location is of prime importance and for parts requiring rigidity and alignment.

SIZE	J3 DIAMETER	J3 DEPTH	J3 TOLERANCE	J8 [H7] DIAMETER	J8 [H7] DEPTH	J8 [H7] TOLERANCE
08	Ø .1189 [Ø 3.020]	x .118 DP [x 3.0 DP]	± .0005 [± .013]	Ø .1183 [Ø 3.005]	x .118 DP [x 3.0 DP]	± .0002 [± .0127]
12	Ø .1189 [Ø 3.020]	x .118 DP [x 3.0 DP]	±.0005 [± .013]	Ø .1183 [Ø 3.005]	x .118 DP [x 3.0 DP]	± .0002 [± .0127]
16	Ø .1585 [Ø 4.026]	x .157 DP [x 4.0 DP]	± .0005 [± .013]	Ø .15765 [Ø 4.004]	x .157 DP [x 4.0 DP]	+.0003/-.0002 [± .0127]

M MAGNET FOR PHD SERIES 6790 REED AND SOLID STATE SWITCHES

This option equips the unit with a magnetic piston for use with PHD's Series 6790 Switch. These switches mount easily into small grooves located on the top of the rotary housing and are locked into place with a set screw. For recommended torque specifications and dimensional data see the table. See Switches and Sensors section for complete switch specifications.





SIZE	M in	M mm	N in	N mm	P in	P mm	Q in	Q mm	SWITCH TORQUE in-oz	SWITCH TORQUE Nm
08	.565	14.4	.858	21.8	.359	9.1	.565	14.4		
12	.750	19.1	1.074	27.3	.383	9.7	.737	18.7	16	.11
16	.983	25.0	1.378	35.0	.421	10.7	.907	23.0		

PB FLOW CONTROLS

PB – UB66

The PHD Series RCC offers optional external compact flow control fittings to adjust output hub rotation speed. The speed of the hub is controlled by regulating the cylinder exhaust.

The PHD Series RCC flow control fittings are mounted directly to the housing and provide integral tube fitting connections. They swivel 360° around the ports, to ease tube routing and installation. Standard -PB location option is shown in Figure 1. Alternate flow control location is shown in Figure 2, with -PB and -UB66 options.

FIGURE 1
-PB OPTION

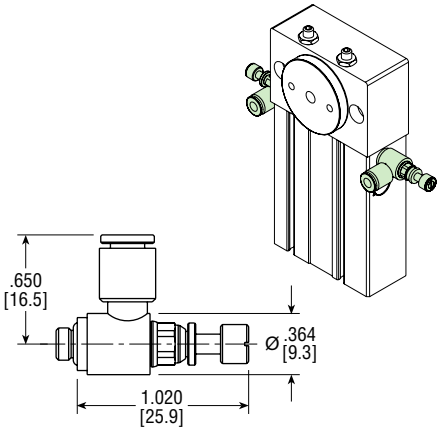
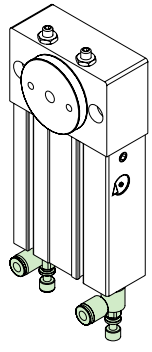


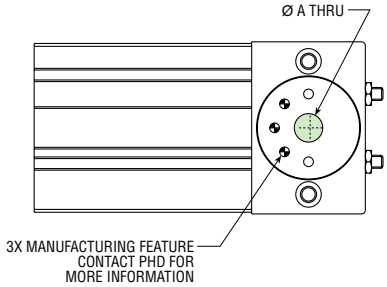
FIGURE 2
-PB-UB66 OPTION



Q2 HOLLOW PINION

This option provides a through hole for feeding pneumatic or electrical lines through the pinion.

SIZE	A in	A mm
08	.325	8.3
12	.345	8.8
16	.521	13.2



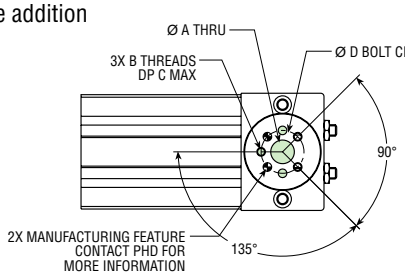
Q19 HOLLOW PINION WITH HUB MOUNTING HOLES

This option provides the Q2 pinion, along with the addition of threaded mounting holes.

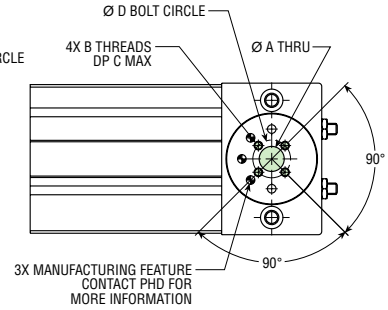
Hub shown at mid-rotation position.

SIZE	A in	A mm	B		C in	C mm	D in	D mm
08	.325	8.3	#4-40	[M3 x .5]	.157	4.0	.591	15.0
12	.345	8.8	#4-40	[M3 x .5]	.157	4.0	.520	13.2
16	.521	13.2	#6-32	[M4 x .7]	.210	5.3	.707	18.0

08 mm 90° UNITS ONLY



12 & 16 mm 90°/180° UNITS & 08 mm 180° UNITS



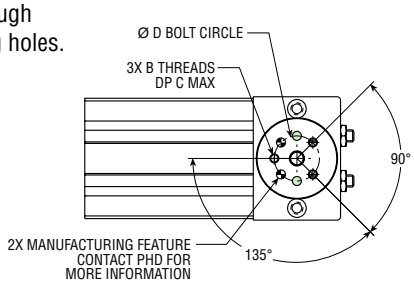
Q29 HUB MOUNTING HOLES COMBINED WITH UNI-MOUNT HOLES

This option provides the standard threaded through mounting hole and the addition of threaded mounting holes.

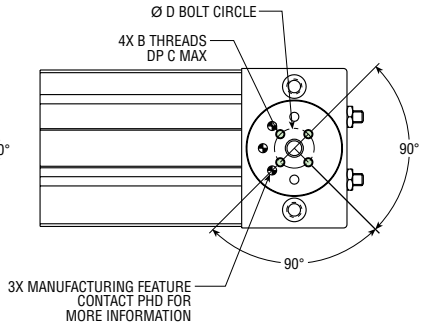
Hub shown at mid-rotation position.

SIZE	B		C in	C mm	D in	D mm
08	#4-40	[M3 x .5]	.157	4.0	.591	15.0
12	#4-40	[M3 x .5]	.157	4.0	.520	13.2
16	#6-32	[M4 x .7]	.210	5.3	.707	18.0

08 mm 90° UNITS ONLY



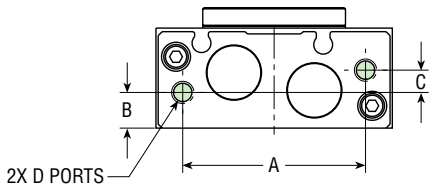
12 & 16 mm 90°/180° UNITS & 08 mm 180° UNITS



UB66 REAR PORTS

This option provides both ports located on the rear of the housing, creating the narrowest possible profile when installed.

SIZE	A in	A mm	B in	B mm	C in	C mm	D	
08	1.181	30	.181	4.6	.236	6.0	10-32 THD	[M5 x .8]
12	1.614	41	.315	8	.197	5	10-32 THD	[M5 x .8]
16	2.078	52.8	.407	10.3	.221	5.6	10-32 THD	[M5 x .8]



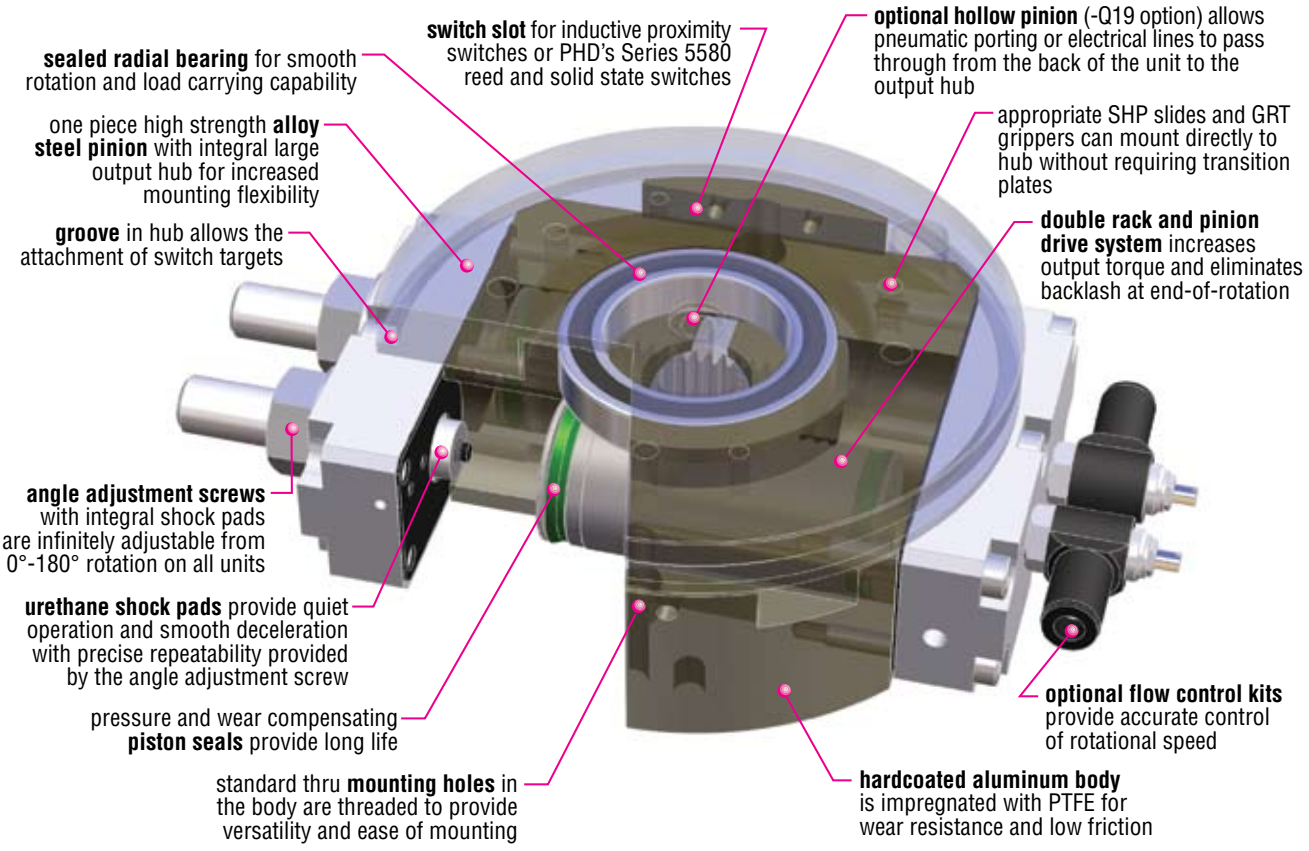
Z1 CORROSION RESISTANT

This option provides stainless steel socket head cap screws, retainers, and angle adjustments.

All dimensions are reference only unless specifically toleranced.

RF

LOW PROFILE DESIGN PROVIDES HIGH TORQUE



Major Benefits

- Compact size
- Low profile
- One piece hub and piston assembly
- Fully adjustable stops
- Modular with Series SHP Slide and Series GRT Gripper

Industry Uses

- Electronics
- Packaging
- Assembly machine

ORDERING DATA: SERIES RF ROTARY ACTUATOR

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

PRODUCT
R - Rotary

TYPE
S - Pneumatic

BORE SIZE
14 mm
20 mm
25 mm

ROTATION SPEED CONTROL VALVE
PB - Rotational Speed Controls both directions
PC - Rotational Speed Controls counterclockwise
PW - Rotational Speed Controls clockwise

OPTIONS
Q19 - Hollow Pinion (Size 20 & 25)

R F S 1 25 x 180 - PB - AB - Q19

SERIES
F - Low Profile

DESIGN NO.
1 - Imperial
5 - Metric

ROTATION
180°

ANGLE ADJUSTMENT
(Standard)
AB - Angle adjustment with shock pad installed both ends
This option must be ordered with the unit.

NOTE:
1) Switches and switch kits must be ordered separately.

ROTATION SPEED CONTROL REPLACEMENT KITS

UNIT	IMPERIAL NO.	METRIC NO.
RFSx14 RFSx20	70695-01	70696-01
RFSx25	70695-03	70696-03

NOTE: One Rotational Speed Control fitting per kit.

PROXIMITY SWITCH KITS

UNIT	KIT NO.
RFSx14	69700
RFSx20	69700
RFSx25	69702

CORDSETS WITH QUICK CONNECT

PART NO.	LENGTH
63549-02	2 meter cable
63549-05	5 meter cable

SERIES 5580 SOLID STATE SWITCHES

PART NO.	DESCRIPTION
55803-1-02	NPN 4.5 - 24 VDC with 2 meter cable
55804-1-02	PNP 4.5 - 24 VDC with 2 meter cable
55823-1	NPN 4.5 - 24 VDC with Quick Connect
55824-1	PNP 4.5 - 24 VDC with Quick Connect

SERIES 5580 REED SWITCHES

PART NO.	DESCRIPTION
55802-1-02	NPN or PNP 4.5 - 24 VDC with 2 meter cable
55822-1	NPN or PNP 4.5 - 24 VDC with Quick Connect

6mm SQUARE INDUCTIVE PROXIMITY SWITCHES

PART NO.	DESCRIPTION
18431-001-02	NPN 10 - 30 VDC with 2 meter cable
18431-002-02	PNP 10 - 30 VDC with 2 meter cable

PHD UNLIMITED UNIQUE SOLUTIONS™

UNIQUE ROTARY ACTUATORS ARE AVAILABLE. SEE UNIQUE PRODUCTS AT THE END OF THIS SECTION.

Options may affect unit length. See unit dimension and options pages for adders.

SPECIFICATIONS	SERIES RF
OPERATING PRESSURE	20 to 100 psi max [1.4 to 6.8 bar]
OPERATING TEMPERATURE	-20° to 160°F [-29° to 71°C]
RATED LIFE	5 million cycles
ROTATIONAL TOLERANCE	Nominal rotation +6° to -180° with angle adjustments
BACKLASH*	0° at end of rotation
LUBRICATION	Factory lubricated for rated life
MAINTENANCE	Field repairable

NOTE: *Angle adjustment screw must be engaged or adjusted to achieve 0° backlash.

SIZE	ROTATION	BASE WEIGHT lb	BASE WEIGHT kg	BORE DIAMETER in	BORE DIAMETER mm	DISPLACEMENT VOLUME in^3	DISPLACEMENT VOLUME mm^3	THEORETICAL TORQUE OUTPUT in-lb/psi	THEORETICAL TORQUE OUTPUT Nm/bar	ROTATION RATES @ 80 psi MAXIMUM VELOCITY deg/sec	ROTATION RATES @ 80 psi MAXIMUM VELOCITY deg/sec
14	180°	.62	.28	.551	14	.44	7.17	.07	.11	180°/.35	90°/0.24
20	180°	1.88	.85	.787	20	1.53	25.07	.24	.40	180°/.43	90°/0.26
25	180°	3.43	1.56	.984	25	4.18	68.55	.67	1.09	180°/.37	90°/0.23

BACKLASH AT MID-ROTATION

UNIT SIZE	± Degrees
14	2.80
20	1.38
25	0.82

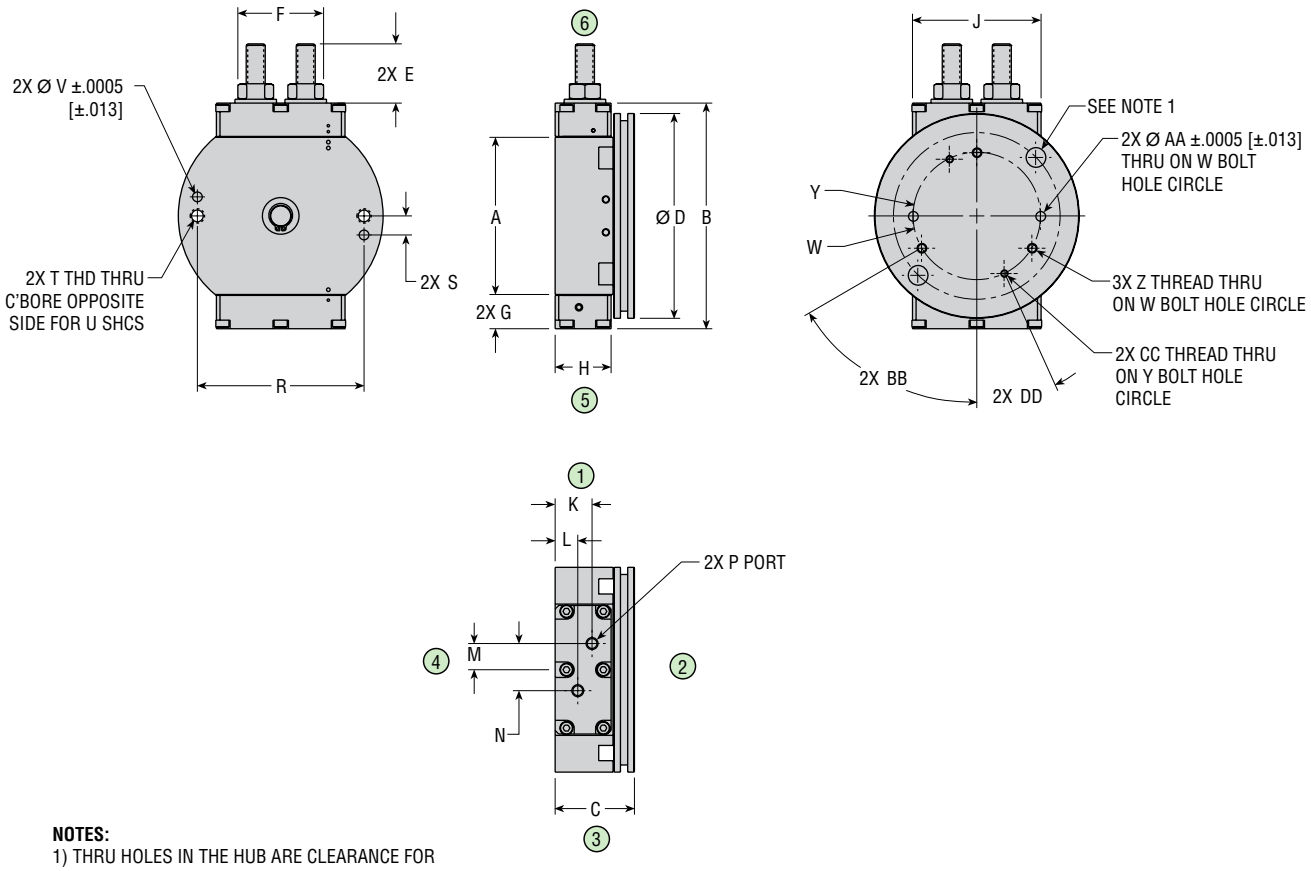
BEARING LOADS TABLE

UNIT SIZE	MAX AXIAL BEARING LOAD lb	MAX AXIAL BEARING LOAD N	MAX RADIAL BEARING LOAD lb	MAX RADIAL BEARING LOAD N	MAXIMUM COMBINED RADIAL AND AXIAL PAYLOAD lb	MAXIMUM COMBINED RADIAL AND AXIAL PAYLOAD N
14	2.5	11	3.0	13	1.7	7.6
20	4.9	22	5.8	26	3.3	14.7
25	8.1	36	9.7	43	5.5	24.5

SIZING AND APPLICATION ASSISTANCE

See PHD Product Sizing Catalog for specific and complete sizing information.
Online sizing assistance is available at: ***www.phdinc.com/apps/sizing***

DIMENSIONS: SERIES RF ROTARY ACTUATOR, SIZE 14 & 20



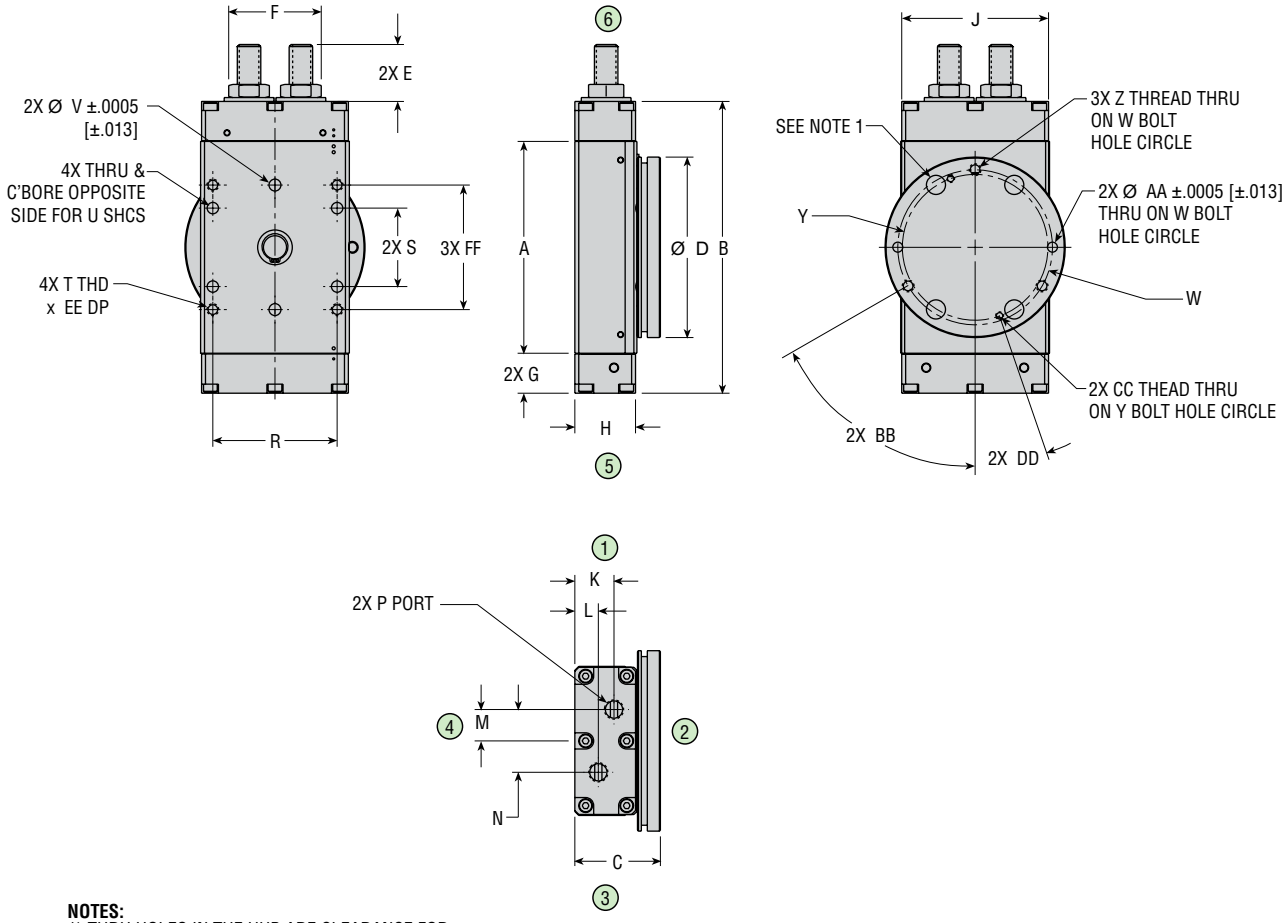
NOTES:
1) THRU HOLES IN THE HUB ARE CLEARANCE FOR SHCS MOUNTING OF THE UNIT FROM THE HUB SIDE
2) NUMBERS IN CIRCLES INDICATE PORT POSITION
3) OUTPUT HUB SHOWN AT MID-ROTATION POSITION

UNIT SIZE	LETTER DIMENSION																
	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T
RFS114	1.713	2.541	.977	2.244	.546	1.059	.394	.669	1.417	.473	.197	.303	.606	10-32	1.772	.236	1/4-20
RFS514	[43.5]	[64.54]	[24.8]	[57.0]	[13.9]	[26.9]	[10.0]	[17.0]	[36.0]	[12.0]	[5.0]	[7.7]	[15.4]	[M5 x 0.8]	[45.0]	[6.0]	[M6 x 1.0]
RFS120	2.598	3.747	1.320	3.386	.979	1.418	.551	.925	2.126	.610	.374	.433	.780	10-32	2.756	.315	1/4-20
RFS520	[66.0]	[95.17]	[33.5]	[86.0]	[24.9]	[36.0]	[14.0]	[23.5]	[54.0]	[15.5]	[9.5]	[11.0]	[19.8]	[M5 x 0.8]	[70.0]	[8.0]	[M6 x 1.0]

UNIT SIZE	LETTER DIMENSION								
	U	V	W	Y	Z	AA	BB	CC	DD
RFS114	#8	.1283	1.4940	1.7080	5-40	.1283	60°	5-40	26°
RFS514	[M4]	[3.083]	[37.9]	[43.4]	[M3 x 0.5]	[3.08]	[60°]	[M3 x 0.5]	[26°]
RFS120	#8	.1908	2.106	2.0960	8-32	.1283	60°	5-40	26°
RFS520	[M4]	[4.089]	[53.5]	[53.2]	[M4 x 0.7]	[4.09]	[60°]	[M3 x 0.5]	[26°]

METRIC INFORMATION SHOWN IN [ ].

All dimensions are reference only unless specifically toleranced.



NOTES:
1) THRU HOLES IN THE HUB ARE CLEARANCE FOR SHCS MOUNTING OF THE UNIT FROM THE HUB SIDE
2) NUMBERS IN CIRCLES INDICATE PORT POSITION
3) OUTPUT HUB SHOWN AT MID-ROTATION POSITION

UNIT SIZE	LETTER DIMENSION																
	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T
RFS125	4.252	5.872	1.728	3.622	1.137	1.870	.787	1.220	2.953	.787	.472	.630	1.260	1/8 NPT	2.500	1.575	1/4-20
RFS525	[108.0]	[149.15]	[43.9]	[92.0]	[28.9]	[47.5]	[20.0]	[31.0]	[75.0]	[20.0]	[12.0]	[16.0]	[32.0]	[1/8 BSPP]	[63.5]	[40.0]	[M6 x 1.0]

UNIT SIZE	LETTER DIMENSION										
	U	V	W	Y	Z	AA	BB	CC	DD	EE	FF
RFS125	#10	.2533	3.110	2.926	1/4-20	.2533	60°	6-32	20°	.433	2.500
RFS525	[M5]	[6.088]	[79.0]	[74.3]	[M6 x 1.0]	[5.09]	[60°]	[M4 x 0.7]	[20°]	[11.0]	[63.5]

METRIC INFORMATION SHOWN IN [ ].

PB ROTATION SPEED CONTROL BOTH DIRECTIONS

PC ROTATION SPEED CONTROL COUNTERCLOCKWISE DIRECTION

PW ROTATION SPEED CONTROL CLOCKWISE DIRECTION

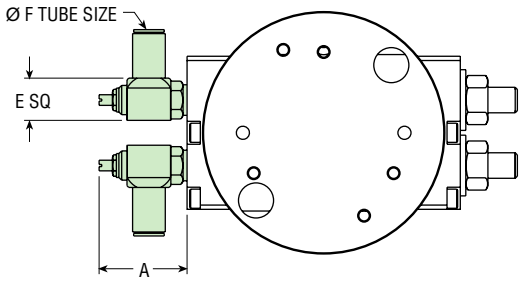
The PHD Series RF Rotary Actuators offer optional external compact flow control fittings for adjusting output hub rotation speed. The speed of the hub is controlled by regulating the cylinder exhaust. The control fittings are unidirectional flow control valves where intake air flows freely through the flow control and exhaust is metered out through an adjustment screw. Intake capacity is slightly greater than the full open exhaust capacity, enabling maximum variation of hub rotation speed.

The PHD Series RF flow control fittings are mounted directly to the caps and provide an integral tube fitting connection. They also swivel 360° around the ports, providing easy installation of tubing. Rotational velocities are adjusted and maintained by the captivated fine adjustment screw with a locking nut to ensure precise velocity control and repeatability in output hub rotation speed.

NOTE: Flow control fitting is effective between 15 to 100 psi [1.0 to 7.0 bar] and from 5° to 160°F [-15° to 71.1°C].

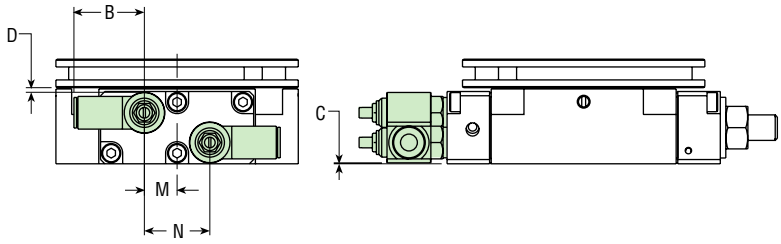
UNIT SIZE	LETTER DIMENSION							
	A	B	C	D	E	Ø F	M	N
RFS114	.984	.827	.015	.035	.394	.156	.303	.606
RFS514	[25.0]	[21.0]	[0.4]	[0.9]	[10.0]	[4.0]	[7.7]	[15.4]
RFS120	.984	1.043	.136	.156	.394	.156	.433	.780
RFS520	[25.0]	[26.5]	[3.5]	[4.0]	[10.0]	[4.0]	[11.0]	[19.8]
RFS125	1.614	1.043	.089	.109	.650	.250	.630	1.26
RFS525	[41.0]	[26.5]	[2.3]	[2.8]	[16.5]	[6.4]	[16.0]	[32.0]

METRIC INFORMATION SHOWN IN [ ].



UNIT SIZE	ROTATION SPEED CONTROL REPLACEMENT KIT NO.	
	IMPERIAL	METRIC
RFSx14 and RFSx20	70695-01	70696-01
RFSx25	76095-03	70696-03

1 KIT REQUIRED PER END OF ADJUSTMENT DESIRED
NOTE: ONE FLOW CONTROL FITTING PER KIT



All dimensions are reference only unless specifically toleranced.

AB ANGLE ADJUSTMENTS WITH SHOCK PAD INSTALLED BOTH ENDS (STANDARD)

The angle adjustment screw has a standard shock pad providing energy dissipation, accurate mechanical repeatability, and quiet actuator operation at end of rotation.

The standard rotation for Series RF is 180 degrees. The mechanical stop provides an adjustment range of 90 degrees from each end of rotation. The ability to adjust over this wide range eliminates the need to order special units with specific angles of rotation.

See PHD Product Sizing Catalog for details on the stopping capacity of the installed angle adjustment with shock pad. Reference the Angle Adjust Specifications Chart for nominal effective angle of rotation in each direction.

The angle adjustment is factory installed and must remain installed prior to operation. Operation of units without an angle adjustment can damage the units and void any and all warranties. Only the PHD angle adjustment with integral shock pad should be used in Series RF Rotary Actuators. The use of any other angle adjustment screw will affect the actuator performance and life expectancy.

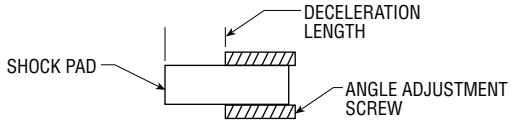
PHD recommends operating Series RFS units at a minimum of 60 psi [4 bar] in order to fully compress the integral shock pad and provide a repeatable hard stop. The shock pad provides a deceleration length given in the chart. See detail and chart.

ANGLE ADJUSTMENT SPECIFICATIONS

UNIT SIZE	ANGLE ADJUSTMENT REPLACEMENT KIT NO.	THREAD TYPE mm	DECELERATION LENGTH LINEAR in	DECELERATION LENGTH LINEAR mm	DECELERATION LENGTH EFFECTIVE ANGLE	WEIGHT lb	WEIGHT kg	KINETIC ENERGY LOAD in-lb	KINETIC ENERGY LOAD Nm	LENGTH in	LENGTH mm	WRENCH HEX SIZE mm
14	69713	M6 x 1.0	0.028	0.71	12°	0.01	0.005	0.041	0.0046	0.96	24	3
20	69714	M8 x 1.25	0.061	1.55	14°	0.03	0.014	0.145	0.0164	1.56	40	4
25	69715	M12 x 1.75	0.061	1.55	8°	0.07	0.032	0.395	0.0446	1.97	50	6

Angle Adjustment Replacement Kits Include:
- 1 - Angle adjustment screw with integral shock pad
- 1 - Nut
- 1 - Thread Seal

1 Kit is required per end of adjustment desired



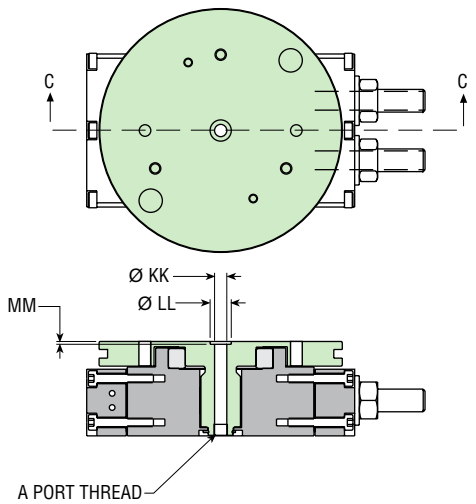
RF

Q19 OUTPUT HUB WITH HOLLOW PINION (sizes 20 & 25 only)

This option provides a hole through the standard output hub and pinion shaft for feeding pneumatic or electrical lines from the back of the rotary actuator to the output hub. The hub has the same mounting as the standard unit. A port is provided on the bottom of the pinion shaft and an o-ring interface on the face of the output hub.

UNIT SIZE	LETTER DIMENSION Ø A	Ø KK	Ø LL	MM
RFS120	10-32	.176	.295	.039
RFS520	[5 x 0.8]	[4.5]	[7.5]	[1.0]
RFS125	1/8 NPT	.339	.433	.039
RFS525	[1/8 BSPP]	[8.6]	[11.0]	[1.0]

METRIC INFORMATION SHOWN IN [ ].



SECTION C-C

HOLLOW PINION O-RING KIT

UNIT SIZE	KIT NO.
14	—
20	3642-059-1
25	3642-064-1

PROXIMITY SWITCH KIT

This accessory provides for the mounting of a 6 mm square, PHD Series 5580 solid state switch, or PHD 18431 inductive proximity switch. One switch mounting kit is required per switch, with the typical application requiring two kits. The kit includes a switch target as well as the required mounting hardware.

The Series RF body accepts two proximity switches, which are easily mounted on the actuator using the switch slots in the sides of the body.

The switch targets mount in the groove around the output hub OD. The switch target has a magnet on one side for use with the Series 5580 switch and is to be installed with the magnet toward the switch face. If the Series 18431 switch is used, the magnet should be installed away from the switch face.

Proximity switches are ordered separately, see Switches and Sensors section for complete switch specifications.

PROXIMITY SWITCH KITS

UNIT SIZE	KIT NO.	SWITCH FASTENER SIZE	REQUIRED TORQUE SWITCH FASTENER in-lb	REQUIRED TORQUE SWITCH FASTENER Nm	TARGET FASTENER SIZE	REQUIRED TORQUE TARGET FASTENER in-lb	REQUIRED TORQUE TARGET FASTENER Nm
14	69700	M3 x 0.5 x 4	5	0.6	M4 x 0.7	5	0.6
20	69700	M3 x 0.5 x 4	5	0.6	M4 x 0.7	5	0.6
25	69702	M3 x 0.5 x 14	10	1.1	M4 x 0.7	5	0.6

EACH SWITCH KIT CONTAINS THE FOLLOWING:
- 1 - TARGET ASSEMBLY W/MAGNET
- 1 - TARGET FASTENER
- 1 - SWITCH FASTENER

RFSx25 UNIT KITS ALSO INCLUDE:
- 1 - SWITCH BRACKET

SERIES 5580 SOLID STATE SWITCHES

PART NO.	DESCRIPTION
55803-1-02	NPN 4.5 - 24 VDC with 2 meter cable
55804-1-02	PNP 4.5 - 24 VDC with 2 meter cable
55823-1	NPN 4.5 - 24 VDC with Quick Connect
55824-1	PNP 4.5 - 24 VDC with Quick Connect

SERIES 5580 REED SWITCHES

PART NO.	DESCRIPTION
55802-1-02	NPN or PNP 4.5 - 24 VDC with 2 meter cable
55822-1	NPN or PNP 4.5 - 24 VDC with Quick Connect

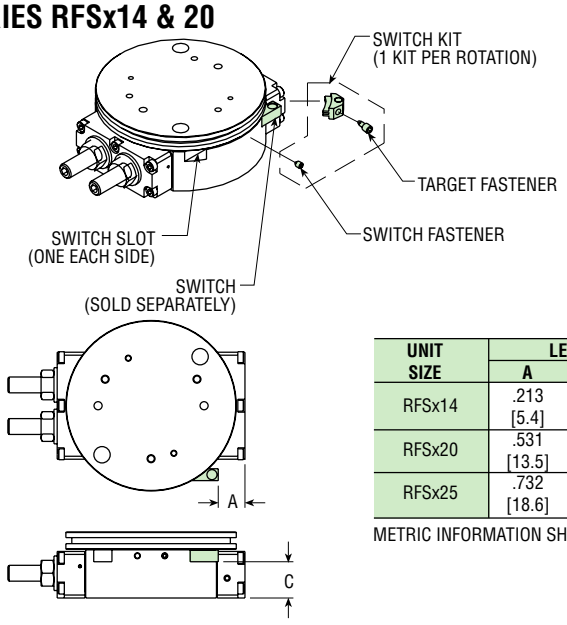
6 mm SQUARE INDUCTIVE PROXIMITY SWITCHES

PART NO.	DESCRIPTION
18431-001-02	NPN 10 - 30 VDC with 2 meter cable
18431-002-02	PNP 10 - 30 VDC with 2 meter cable

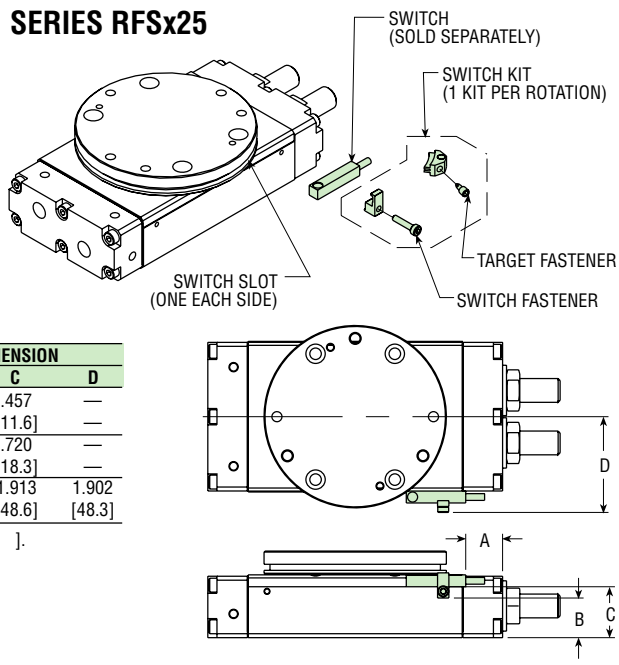
CORDSETS WITH QUICK CONNECT

PART NO.	LENGTH
63549-02	2 meter cable
63549-05	5 meter cable

SERIES RFSx14 & 20



SERIES RFSx25



UNIT SIZE	LETTER DIMENSION A	B	C	D
RFSx14	.213 [5.4]	—	.457 [11.6]	—
RFSx20	.531 [13.5]	—	.720 [18.3]	—
RFSx25	.732 [18.6]	.788 [20.0]	1.913 [48.6]	1.902 [48.3]

METRIC INFORMATION SHOWN IN [ ].

All dimensions are reference only unless specifically toleranced.

GRT MOUNTING KIT

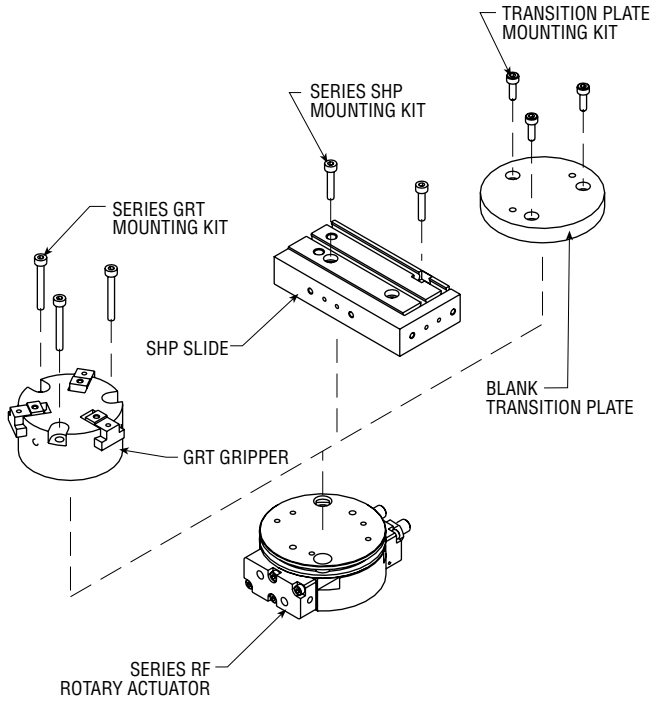
The PHD Series RF Rotary Actuator features a mounting hole pattern that directly connects specific sizes of the PHD Series GRT Gripper to the hub. This mounting kit provides the necessary mounting hardware for mounting a Series GRT Gripper onto a Series RF Rotary Actuator.

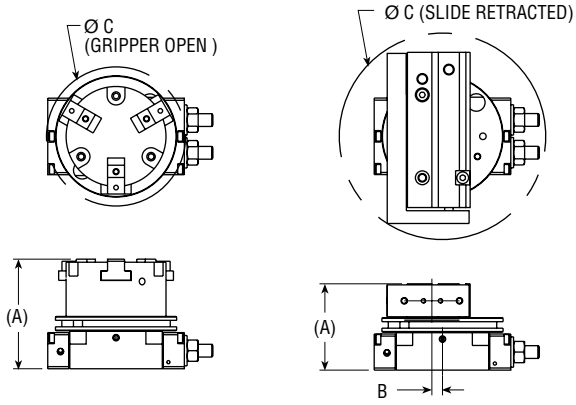
SHP MOUNTING KIT

The PHD Series RF Rotary Actuator features a mounting hole pattern that directly connects specific sizes of the PHD Series SHP Slides to the hub. This mounting kit provides the necessary mounting hardware for mounting a Series SHP Slide to a Series RF Rotary Actuator.

BLANK TRANSITION PLATE MOUNTING KIT

This accessory provides for the mounting of devices other than PHD Series GRT Grippers and Series SHP Slides to the Series RF Rotary Actuator. The kit includes an anodized, 6061-T6 aluminum, transition plate, pre-drilled to mount to the rotary actuator hub, along with the associated mounting hardware. The mounting holes for the secondary unit are to be machined by the customer.





GRT DIMENSIONS

UNIT SIZE	LETTER DIMENSION A	LETTER DIMENSION Ø B
RFS114	2.038	2.132
RFS514	[51.8]	[54.2]
RFS120	2.756	2.792
RFS520	[70.0]	[70.9]
RFS125	3.696	3.898
RFS525	[93.9]	[99.0]

SHP DIMENSIONS

UNIT SIZE	LETTER DIMENSION A	LETTER DIMENSION B	LETTER DIMENSION Ø C
RFS114	1.607	.197	3.823
RFS514	[40.8]	[5.0]	[97.1]
RFS120	2.107	.039	4.733
RFS520	[53.5]	[1.0]	[120.2]
RFS125	2.712	.433	5.835
RFS525	[68.9]	[11.0]	[148.2]

METRIC INFORMATION SHOWN IN [ ].

GRT MOUNTING KIT

UNIT SIZE	KIT NO.	SERIES GRT GRIPPER UNIT SIZE	FASTENER SIZE	REQUIRED TORQUE in-lb	REQUIRED TORQUE Nm
RFS114	69726	GRT112	5-40 x 1	20	[2.3]
RFS514	69741	GRT512	[M3 x 0.5 x 25]	20	[2.3]
RFS120	69727	GRT122	8-32 x 1 1/8	40	[4.5]
RFS520	69742	GRT522	[M4 x 0.7 x 30]	40	[4.5]
RFS125	69728	GRT142	1/4-20 x 1 5/8	140	[15.8]
RFS525	69743	GRT542	[M6 x 1.0 x 40]	140	[15.8]

SHP MOUNTING KIT

UNIT SIZE	KIT NO.	SERIES SHP SLIDE UNIT SIZE	FASTENER SIZE	REQUIRED TORQUE in-lb	REQUIRED TORQUE Nm
RFS114	69703	SHP108 x 40	5-40 x 5/8	20	[2.3]
RFS514	69706	SHP508 x 40	[M3 x 0.5 x 16]	20	[2.3]
RFS120	69704	SHP112 x 40	5-40 x 7/8	20	[2.3]
RFS520	69707	SHP512 x 40	[M3 x 0.5 x 20]	20	[2.3]
RFS125	69705	SHP116 x 55	6-32 x 1	40	[4.5]
RFS525	69708	SHP516 x 55	[M4 x 0.7 x 30]	40	[4.5]

CUSTOMER SUPPLIED DOWEL PINS

UNIT SIZE	SERIES GRT GRIPPER PIN SIZE	SERIES SHP SLIDE PIN SIZE	BLANK TRANSITION PLATE PIN SIZE
RFS114	Ø 1/8 x 3/8	—	Ø 1/8 x 1/2
RFS514	[Ø 3 x 12]	—	[Ø 3 x 14]
RFS120	Ø 3/16 x 5/8	—	Ø 3/16 x 3/4
RFS520	[Ø 4 x 16]	—	[Ø 4 x 18]
RFS125	Ø 1/4 x 3/4	—	Ø 1/4 x 3/4
RFS525	[Ø 6 x 20]	—	[Ø 6 x 20]

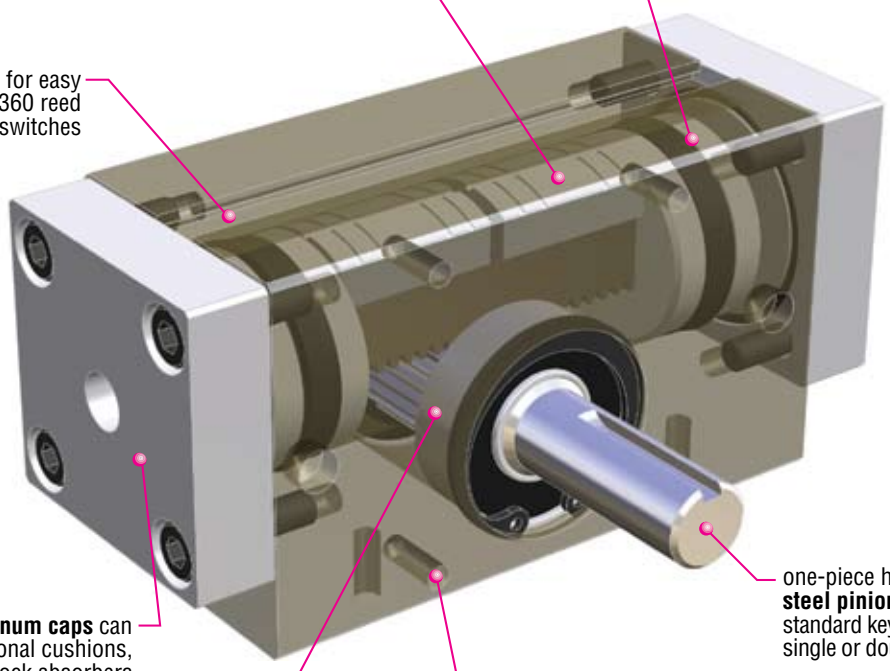
BLANK TRANSITION PLATE MOUNTING KIT

UNIT SIZE	KIT NO.	BLANK TRANSITION PLATE NO.	TRANSITION PLATE SIZE	FASTENER SIZE	REQUIRED TORQUE in-lb	REQUIRED TORQUE Nm
RFS114	69729	69721-1	.312 x Ø 2.205	5-40 x 3/8	20	[2.3]
RFS514	69732	69721-5	[7.9 x Ø 56.0]	[M3 x 0.5 x 10]	20	[2.3]
RFS120	69730	69722-1	.433 x Ø 3.346	8-32 x 1/2	40	[4.5]
RFS520	69733	69722-5	[11.0 x Ø 85.0]	[M4 x 0.7 x 12]	40	[4.5]
RFS125	69731	69723-1	.500 x Ø 3.583	1/4-20 x 5/8	140	[15.8]
RFS525	69734	69723-5	[12.7 x Ø 91.0]	[M6 x 1.0 x 16]	140	[15.8]

METRIC INFORMATION SHOWN IN [ ].

RL

LOW COST, HIGH TORQUE, COMPACT SIZE



acetal wear pads prevent metal-to-metal contact and contain lubricating reservoirs to keep piston bore well lubricated for extended life

free floating **acetal pistons** with pressure and wear compensating piston seals provide long life and low friction

t-slot switch grooves for easy installaton of Series 5360 reed and solid state switches

one-piece high strength alloy **steel pinion** is available with standard keyed shaft with either single or double shaft extension

clear anodized aluminum caps can be specified with optional cushions, shock pads or shock absorbers

threaded mounting holes are standard on front and bottom sides of the body for flexible mounting configurations

threaded holes can be specified in the back and bottom(-GX option)

heavy duty sealed ball bearings ensure shaft stability under heavy and high impact loading

Major Benefits

- Low cost
- OEM style rotaries
- High axial & radial bearing load
- High torque/package size

Industry Uses

- Automotive
- Machine builders
- General industrial use
- Labeling/packaging

ORDERING DATA: SERIES RL ROTARY ACTUATORS

TO ORDER SPECIFY:
Product, Series, Type, Design No., Bore Size, Angle of Rotation, and Options.

PRODUCT
R - Rotary Actuator

TYPE
S - 150 psi [10 bar] Air Max.

BORE SIZE
12 mm
16 mm
20 mm
25 mm
32 mm
40 mm
50 mm
63 mm

SHOCK ABSORBER
NB - Shock both directions
NC - Shock counterclockwise
NW - Shock clockwise
GS - Shock ready both directions
GT - Shock ready counterclockwise
GU - Shock ready clockwise
Shock absorber options not available on 12 mm, 16 mm, and 20 mm units.

SWITCH READY
E - Magnets for Series 5360 Solid State Hall Effect Switches
I - Magnets for Series 5360 Magnetoresistive Switches
M - Magnets for Series 5360 Reed Switches
Switches must be ordered separately. See notes 2, 3, 4, and option page.

MISCELLANEOUS
GX - Mounting holes in Positions 3 & 4 (Positions 2 & 3 standard)
Q13 - Double shaft extension
U4 - Port Position 2
U6 - Port Position 3
U8 - Port Position 4
-U options apply only to caps with angle adjustment or shock absorber options. Port Positions on all other caps are in Position 5.

R L S 1 40 x 180 - NC - BW - AW - E - Q13

SERIES
L - Medium Duty

DESIGN NO.
1 - Imperial
5 - Metric

ANGLE OF ROTATION
45°, 90°, 135°, 180°, 225°, 270°

CUSHION CONTROL
DB - Cushion both directions
DC - Cushion counterclockwise
DW - Cushion clockwise
BB - Shock Pad both directions
BC - Shock Pad counterclockwise
BW - Shock Pad clockwise
Cushions and shock pads not available on same end of actuator. Shock pad options not available on 12 mm units.

ANGLE ADJUSTMENT
AB - 45° Angle Adjustment both directions
AC - 45° Angle Adjustment counterclockwise
AW - 45° Angle Adjustment clockwise

NOTES:
1) Shock pad and/or angle adjustment options not available in the same direction with cushion or shock absorber options.
2) -E option not available on 12 mm and 16 mm units.
3) -M option not available on 12 mm units and a minimum of 90° of rotation required for one switch and 135° of rotation for two switches on 16 mm units
4) -I option a minimum of 90° of rotation required on 12 mm and 16 mm bores.
5) For keyless hub adaptor kits, see accessories page.

SHOCK ABSORBER CHART

BORE SIZE	PHD SHOCK ABSORBER NO.
25 mm	60335-04
32 mm	60335-05
40 mm	60335-06
50 mm	60335-06
63 mm	60335-07

UNIQUE ROTARY ACTUATORS ARE AVAILABLE. SEE UNIQUE PRODUCTS AT THE END OF THIS SECTION.

SPECIFICATIONS	SERIES RL
OPERATING PRESSURE	20 to 150 psi [1.4 to 10 bar]
OPERATING TEMPERATURE	-20° to 180°F [-29° to 82°C]
RATED LIFE	5 million cycles
ROTATIONAL TOLERANCE	Nominal rotation +10° to -0°
BACKLASH AT END OF ROTATION	1° 30' (12/16mm), 1° 0' (20/25mm) 0° 45' (32/40mm), 0° 30' (50/63mm)
LUBRICATION	Factory lubricated for rated life
MAINTENANCE	Field repairable

SIZE	ROTATION	BASE WEIGHT lb	BASE WEIGHT kg	BORE DIAMETER in	BORE DIAMETER mm	DISPLACEMENT VOLUME/DEG in^3/°	DISPLACEMENT VOLUME/DEG mm^3/°	THEORETICAL TORQUE OUTPUT in-lb/psi	THEORETICAL TORQUE OUTPUT Nm/bar	ROTATIONAL VELOCITY MAX deg/sec	MAX AXIAL BEARING LOAD lb	MAX AXIAL BEARING LOAD N	MAX RADIAL BEARING LOAD lb	MAX RADIAL BEARING LOAD N	DISTANCE BETWEEN BEARINGS in	DISTANCE BETWEEN BEARINGS mm
12	45°/90°	.3	.13	.472	12	.0005	8.19	.029	.05	180°/.03	26	115	165	734	.65	16.6
	135°/180°	.4	.18													
	225°/270°	.4	.18													
16	45°/90°	.4	.18	.630	16	.001	16.39	.062	.10	180°/.03	39	173	230	1023	.73	18.6
	135°/180°	.5	.22													
	225°/270°	.6	.27													
20	45°/90°	.7	.32	.787	20	.002	32.77	.122	.20	180°/.05	39	173	230	1023	.89	22.6
	135°/180°	.8	.36													
	225°/270°	.9	.41													
25	45°/90°	1.1	.50	.984	25	.004	65.55	.228	.37	180°/.05	110	489	320	1423	1.11	28.1
	135°/180°	1.2	.54													
	225°/270°	1.4	.64													
32	45°/90°	1.7	.77	1.260	32	.008	131.10	.468	.77	180°/.05	160	711	390	1734	1.28	32.6
	135°/180°	2.0	.91													
	225°/270°	2.3	1.04													
40	45°/90°	2.6	1.17	1.575	40	.017	278.58	.974	1.60	180°/.06	184	818	420	1868	1.60	40.6
	135°/180°	3.3	1.49													
	225°/270°	4.3	1.95													
50	45°/90°	5.2	2.36	1.969	50	.032	524.39	1.826	2.99	180°/.075	285	1267	660	2935	1.93	49.1
	135°/180°	6.0	2.72													
	225°/270°	6.9	3.13													
63	45°/90°	9.2	4.17	2.480	63	.063	1032.38	3.624	5.94	180°/.075	450	2001	925	4114	2.52	64.1
	135°/180°	10.5	4.76													
	225°/270°	12.3	5.57													

SIZING AND APPLICATION ASSISTANCE

See PHD Product Sizing Catalog for specific and complete sizing information.
Online sizing assistance is available at: ***www.phdinc.com/apps/sizing***

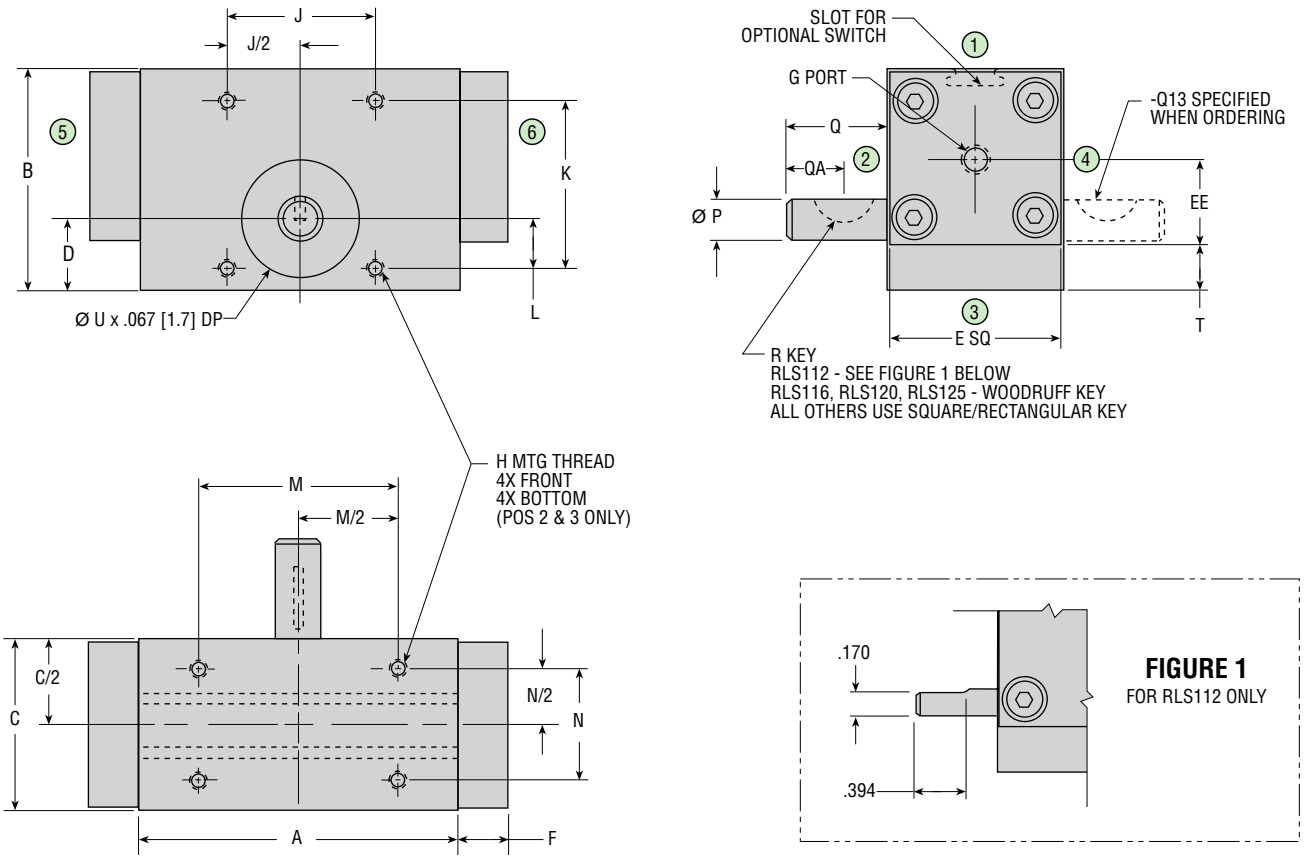


FIGURE 1
FOR RLS112 ONLY

NOTES:
1) CIRCLED NUMBERS INDICATE MOUNTING SURFACE POSITION
2) NUMBERS IN [ ] ARE FOR METRIC UNITS AND ARE IN mm
3) KEYWAY SHOWN AT MID-ROTATION POSITION

BORE SIZE	NOMINAL ROTATION	A	B	C	D	E	EE	F	G PORT	H
12 mm	45° OR 90°	2.047 [52.0]	1.201 [30.5]	1.024 [26.0]	.448 [11.5]	.964 [24.5]	.482 [12.25]	.374 [9.5]	10-32 THD [M5 x 0.8]	4-40 x .224 [M3 x 0.5 x 6.0]
	135° OR 180°	2.579 [65.5]								
	225° OR 270°	3.110 [79.0]								
16 mm	45° OR 90°	2.461 [62.5]	1.378 [35.0]	1.142 [29.0]	.530 [13.5]	1.082 [27.5]	.541 [13.75]	.374 [9.5]	10-32 THD [M5 x 0.8]	4-40 x .224 [M3 x 0.5 x 6.0]
	135° OR 180°	3.091 [78.5]								
	225° OR 270°	3.563 [90.5]								
20 mm	45° OR 90°	2.854 [72.5]	1.634 [41.5]	1.300 [33.0]	.532 [13.5]	1.260 [32.0]	.630 [16.0]	.374 [9.5]	10-32 THD [M5 x 0.8]	6-32 x .276 [M4 x 0.7 x 8.0]
	135° OR 180°	3.248 [82.5]								
	225° OR 270°	3.957 [100.5]								
25 mm	45° OR 90°	3.504 [89.0]	1.811 [46.0]	1.556 [39.5]	.623 [16.0]	1.516 [38.5]	.758 [19.25]	.473 [12.0]	1/8 NPT [1/8 BSP]	10-24 x .380 [M5 x 0.8 x 10.0]
	135° OR 180°	3.976 [101.0]								
	225° OR 270°	4.921 [125.0]								
32 mm	45° OR 90°	3.720 [94.5]	2.244 [57.0]	1.772 [45.0]	.788 [20.0]	1.732 [44.0]	.866 [22.0]	.473 [12.0]	1/8 NPT [1/8 BSP]	10-24 x .380 [M5 x 0.8 x 10.0]
	135° OR 180°	4.705 [119.5]								
	225° OR 270°	5.866 [149.0]								
40 mm	45° OR 90°	4.626 [117.5]	2.579 [65.5]	2.126 [54.0]	.866 [22.0]	2.086 [53.0]	1.043 [26.5]	.473 [12.0]	1/8 NPT [1/8 BSP]	1/4-20 x .500 [M6 x 1.0 x 12.0]
	135° OR 180°	5.925 [150.5]								
	225° OR 270°	7.500 [190.0]								
50 mm	45° OR 90°	5.295 [134.5]	3.248 [82.5]	2.540 [64.5]	1.004 [25.5]	2.480 [63.0]	1.240 [31.5]	.650 [16.5]	1/4 NPT [1/4 BSP]	5/16-18 x .625 [M8 x 1.25 x 16.0]
	135° OR 180°	6.850 [174.0]								
	225° OR 270°	8.661 [220.0]								
63 mm	45° OR 90°	6.535 [166.0]	3.858 [98.0]	3.168 [80.5]	1.279 [32.5]	2.972 [75.5]	1.486 [37.75]	.650 [16.5]	1/4 NPT [1/4 BSP]	5/16-18 x .625 [M8 x 1.25 x 16.0]
	135° OR 180°	8.504 [216.0]								
	225° OR 270°	10.846 [275.5]								

BORE SIZE	J	K	L	M	N	P [h8]	Q	QA	R	T	U
12 mm	1.062 [27.0]	.866 [22.0]	.335 [8.5]	1.378 [35.0]	.630 [16.0]	.1875 [6.0]	.630 [16.0]	—	SEE FIGURE 1 [2.0 SQ x 10.0]	.233 [5.9]	.7485 [19.0]
16 mm	1.142 [29.0]	1.004 [25.5]	.373 [9.5]	1.536 [39.0]	.650 [16.5]	.2495 [8.0]	.748 [19.0]	.312 [7.92]	203 WOODRUFF [3.0 SQ x 14.0]	.289 [7.3]	.8666 [22.0]
20 mm	1.102 [28.0]	1.220 [31.0]	.354 [9.0]	1.516 [38.5]	.906 [23.0]	.3125 [8.0]	.748 [19.0]	.437 [11.1]	204 WOODRUFF [3.0 SQ x 14.0]	.349 [8.9]	.8666 [22.0]
25 mm	1.378 [35.0]	1.397 [35.5]	.443 [11.25]	1.968 [50.0]	1.182 [30.0]	.3745 [10.0]	1.004 [25.5]	.437 [11.1]	204 WOODRUFF [3.0 SQ x 16.0]	.292 [7.4]	1.0241 [26.0]
32 mm	1.614 [41.0]	1.850 [47.0]	.631 [16.0]	2.204 [56.0]	1.260 [32.0]	.4995 [14.0]	1.260 [32.0]	—	1/8 SQ x 3/4 [5.0 SQ x 20.0]	.488 [12.4]	1.2603 [32.0]
40 mm	2.028 [51.5]	2.146 [54.5]	.650 [16.5]	2.874 [73.0]	1.534 [39.0]	.6245 [16.0]	1.496 [38.0]	—	3/16 SQ x 1.00 [5.0 SQ x 25.0]	.476 [12.1]	1.3785 [35.0]
50 mm	2.480 [63.0]	2.677 [68.0]	.670 [17.0]	3.308 [84.0]	1.850 [47.0]	.7495 [20.0]	1.752 [44.5]	—	3/16 SQ x 1-1/4 [6.0 SQ x 30.0]	.725 [18.4]	1.6540 [42.0]
63 mm	2.716 [69.0]	3.248 [82.5]	.945 [24.0]	3.544 [90.0]	2.204 [56.0]	.9995 [30.0]	2.007 [51.0]	—	1/4 SQ x 1-3/8 [8.0 x 7.0 x 36.0 RECT]	.849 [21.6]	2.1659 [55.0]

Numbers in [ ] are for metric units and are in mm.

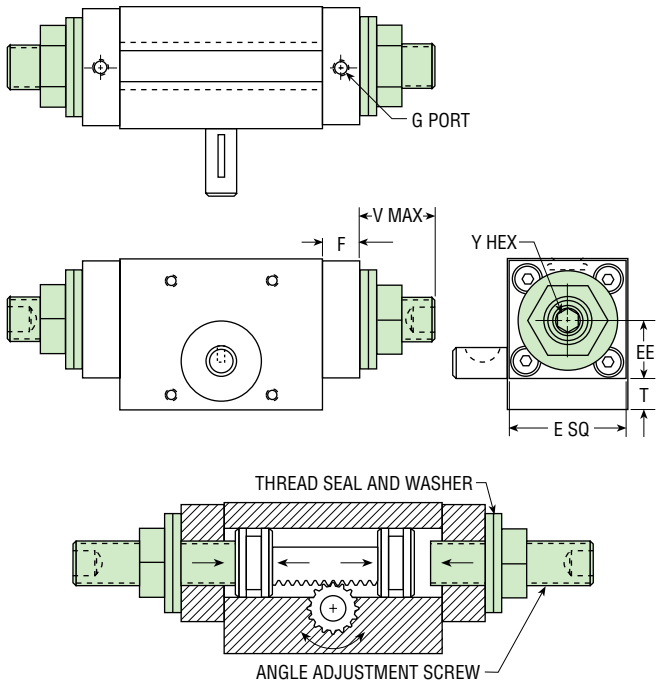
AB 45° ANGLE ADJUSTMENT BOTH DIRECTIONS

AC 45° ANGLE ADJUSTMENT COUNTERCLOCKWISE DIRECTION

AW 45° ANGLE ADJUSTMENT CLOCKWISE DIRECTION

Angle adjustment screws allow the nominal angle of rotation to be reduced by up to 45° from each end of rotation (-AC or -AW options). With adjustments at both ends of the unit, a total reduction of 90° (-AB option) can be achieved. Angle adjustment is available in either or both directions.

NOTE: Angle adjustment options are not available with cushion or shock absorber options in the same direction.



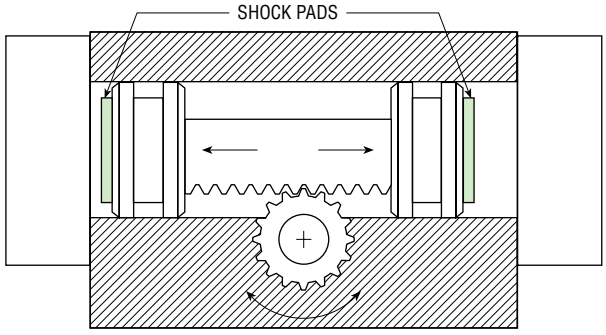
BORE SIZE	NOMINAL ROTATION	E	EE	F	G	T	V	Y
12 mm	45°, 90°, 180°, 270°	.964 [24.5]	.482 [12.25]	.552 [14.0]	10-32 THD [M5 x 0.8]	.233 [5.9]	.511 [13.0]	4 mm
16 mm	45°, 90°, 180°, 270°	1.082 [27.5]	.541 [13.75]	.552 [14.0]	10-32 THD [M5 x 0.8]	.289 [7.3]	.649 [16.5]	4 mm
20 mm	45°, 90°, 180°, 270°	1.260 [32.0]	.630 [16.0]	.552 [14.0]	10-32 THD [M5 x 0.8]	.349 [8.9]	.747 [19.0]	6 mm
25 mm	45°, 90°, 180°, 270°	1.516 [38.5]	.758 [19.25]	.827 [21.0]	1/8 NPT [1/8 BSP]	.292 [7.4]	.767 [19.5]	6 mm
32 mm	45°, 90°, 180°, 270°	1.732 [44.0]	.866 [22.0]	.827 [21.0]	1/8 NPT [1/8 BSP]	.488 [12.4]	.984 [25.0]	8 mm
40 mm	45°, 90°, 180°, 270°	2.086 [53.0]	1.043 [26.5]	.984 [25.0]	1/8 NPT [1/8 BSP]	.476 [12.1]	1.421 [36.1]	10 mm
50 mm	45°, 90°, 180°, 270°	2.480 [63.0]	1.240 [31.5]	1.024 [26.0]	1/4 NPT [1/4 BSP]	.725 [18.4]	1.378 [35.0]	10 mm
63 mm	45°, 90°, 180°, 270°	2.972 [75.5]	1.486 [37.75]	1.024 [26.0]	1/4 NPT [1/4 BSP]	.849 [21.6]	1.378 [35.0]	10 mm

Numbers in [ ] are for metric units and are in mm.

BB SHOCK PAD INSTALLED BOTH DIRECTIONS

BC SHOCK PAD INSTALLED COUNTERCLOCKWISE DIRECTION

BW SHOCK PAD INSTALLED CLOCKWISE DIRECTION



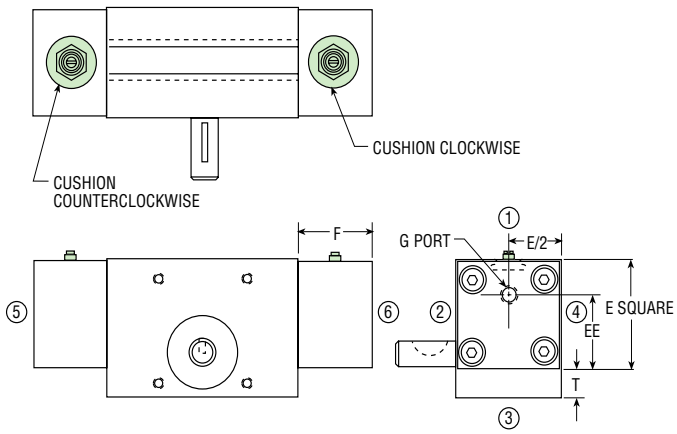
Polyurethane shock pads for noise reduction and absorption of shock at ends of rotation are available on each end of Series RL Rotary Actuators. Reduction of shock permits higher piston velocities for shorter cycle times. Noise reduction is beneficial for the working environment. See PHD Product Sizing Catalog for information on unit stopping capacity.

NOTE: Shock pad options are not available on 12 mm units, or with shock absorber or cushion options in the same direction.

DB CUSHION BOTH DIRECTIONS

DC CUSHION COUNTERCLOCKWISE DIRECTION

DW CUSHION CLOCKWISE DIRECTION



PHD Cushions allow smooth deceleration at the end of rotation. When a cushion is activated, the remaining volume of air in the exhaust side of the actuator is expelled through an adjustable needle valve, controlling the rate of deceleration of the pinion shaft. The effective cushion length is approximately 40° at the end of full nominal rotation. See PHD Product Sizing Catalog for information on unit stopping capacity.

Cushion performance will not be realized on units of 45° or less due to 40° of effective cushion length.

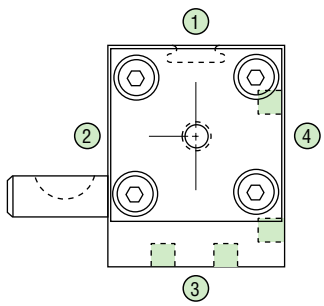
NOTE: Cushion options are not available with angle adjustment, shock absorber, or shock pad options in the same direction.

BORE SIZE	NOMINAL ROTATION	E	EE	F	G	T
12 mm	45°, 90°, 135°,180°, 225°, 270°	.964 [24.5]	.226 [5.75]	.728 [18.5]	10-32 THD [M5 x 0.8]	.233 [5.9]
16 mm	45°, 90°, 135°,180°, 225°, 270°	1.082 [27.5]	.728 [18.5]	.827 [21.0]	10-32 THD [M5 x 0.8]	.289 [7.3]
20 mm	45°, 90°, 135°,180°, 225°, 270°	1.260 [32.0]	.856 [21.75]	.866 [22.0]	10-32 THD [M5 x 0.8]	.349 [8.9]
25 mm	45°, 90°, 135°,180°, 225°, 270°	1.516 [38.5]	1.043 [26.5]	1.004 [25.5]	1/8 NPT [1/8 BSP]	.292 [7.4]
32 mm	45°, 90°, 135°,180°, 225°, 270°	1.732 [44.0]	1.161 [29.5]	1.063 [27.0]	1/8 NPT [1/8 BSP]	.488 [12.4]
40 mm	45°, 90°, 135°,180°, 225°, 270°	2.086 [53.0]	1.457 [37.0]	1.142 [29.0]	1/8 NPT [1/8 BSP]	.476 [12.1]
50 mm	45°, 90°, 135°,180°, 225°, 270°	2.480 [63.0]	1.752 [44.5]	1.260 [32.0]	1/4 NPT [1/4 BSP]	.725 [18.4]
63 mm	45°, 90°, 135°,180°, 225°, 270°	2.972 [75.5]	1.998 [50.75]	1.260 [32.0]	1/4 NPT [1/4 BSP]	.849 [21.6]

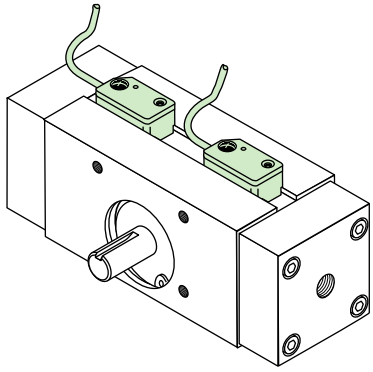
Numbers in [ ] are for metric units and are in mm.

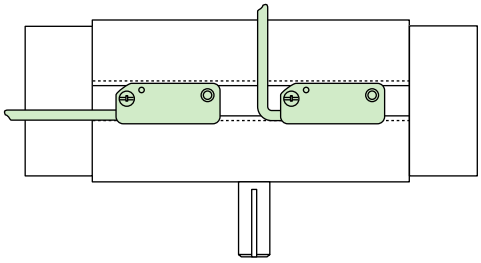
GX MOUNTING HOLES IN POSITIONS 3 & 4

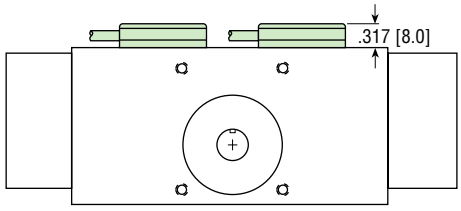
This option provides mounting holes on the back side (position 4) and the bottom side (position 3). Standard units are supplied with mounting holes on the front side (position 2) and the bottom side (position 3). The mounting pattern for this option is identical to the pattern shown in the dimensions.



PHD Series 5360 Hall Effect, Reed, and Magnetoresistive Switches are designed specifically to provide an input signal to various types of programmable controllers of logic systems. See Switches and Sensors section for information on the Series 5360 Switches.







E MAGNETS FOR PHD SOLID STATE HALL EFFECT SWITCHES

This option equips the rotary actuator with magnets on the rack for use with PHD Series 5360 Hall Effect Switches. These switches mount easily to the actuator using the "T" slot in the top of the body. Not available on 12 mm and 16 mm units.

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

I MAGNETS FOR PHD SOLID STATE MAGNETORESISTIVE SWITCHES

This option equips the rotary actuator with magnets on the rack for use with PHD Magnetoresistive Switches. These switches mount easily to the actuator using the "T" slot in the top of the body. Minimum sensing rotation of 90° for 12 mm and 16 mm units.

PART NO.	COLOR	DESCRIPTION
53605-1-02	Black	NPN 6-24 VDC, 2 m cable
53606-1-02	Orange	PNP 6-24 VDC, 2 m cable
53625-1	Black	NPN 6-24 VDC, Quick Connect
53626-1	Orange	PNP 6-24 VDC, Quick Connect

M MAGNETS FOR PHD REED SWITCHES

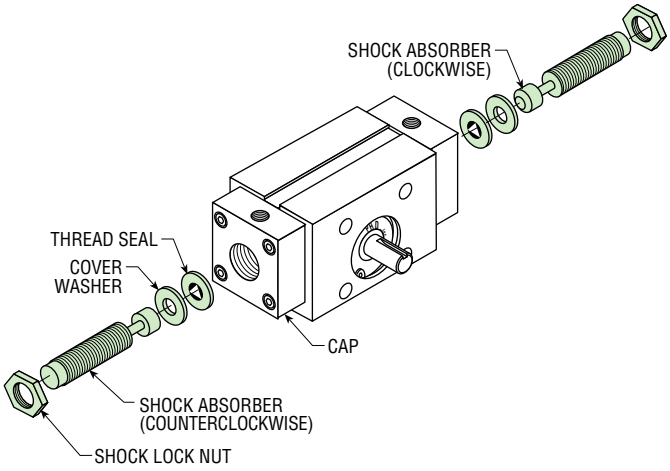
This option equips the rotary actuator with magnets on the rack for use with PHD Series 5360 Reed Switches. These switches mount easily to the actuator using the "T" slot in the top of the body. Not available on 12 mm units. For 16 mm bore units, minimum sensing rotation of 90° for one switch, and 135° for two switches is required.

PART NO.	COLOR	DESCRIPTION
53602-2-02	White	Sink or Source Type 4.5-24 VDC, 2 meter cable
53609-2-02	Green	AC Type 110-120 VAC with Current Limit, 2 meter cable
53622-2	White	Sink or Source Type VDC, Quick Connect
53629-2	Green	AC Type 110-120 VAC, Quick Connect with Current Limit

NB SHOCK ABSORBER INSTALLED BOTH DIRECTIONS

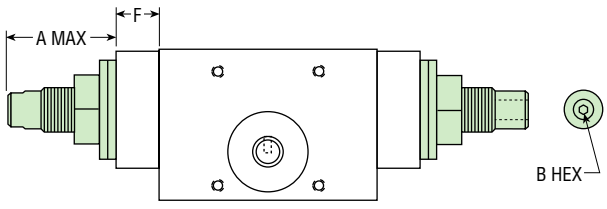
NC SHOCK ABSORBER INSTALLED COUNTERCLOCKWISE DIRECTION

NW SHOCK ABSORBER INSTALLED CLOCKWISE DIRECTION



Hydraulic shock absorbers provide optimum control of deceleration and maximum load stopping capacity. The -NB, -NC, and -NW options equip the rotary actuator with a hydraulic shock absorber installed in the cap(s). See PHD Product Sizing Catalog for details of stopping capacity with built-in shock absorbers. Shock absorbers are nominally effective for 45° of rotation each direction.

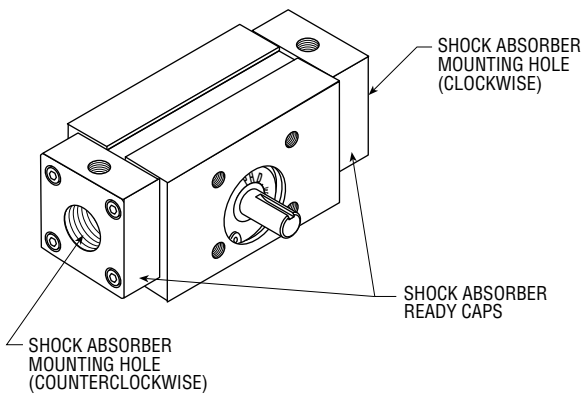
NOTE: The shock absorber also provides the rotation adjustment. Shock absorber options are not available on 12 mm, 16 mm, or 20 mm units or with angle adjustment, cushion, or shock pad options in the same direction.



GS SHOCK ABSORBER READY BOTH DIRECTIONS

GT SHOCK ABSORBER READY COUNTERCLOCKWISE DIRECTION

GU SHOCK ABSORBER READY CLOCKWISE DIRECTION



The -GS, -GT, and -GU options should only be ordered if the shock absorber(s) is to be supplied separately from the rotary actuator. These options make provisions for the installation of hydraulic shock absorbers but do not include the shock absorber units. They include the shock sealing kit for each direction ordered. See PHD Product Sizing Catalog for details of stopping capacity with built-in shock absorbers.

NOTE: The shock absorber also provides rotation adjustment. Shock absorbers **must** be installed in the rotary actuator body prior to operating the unit. Operation without shock absorbers can damage the actuator and void the warranty. Only shock absorbers specified by PHD should be used in Series RL Rotary Actuators. The use of any other shock absorbers will adversely affect actuator performance and service life.

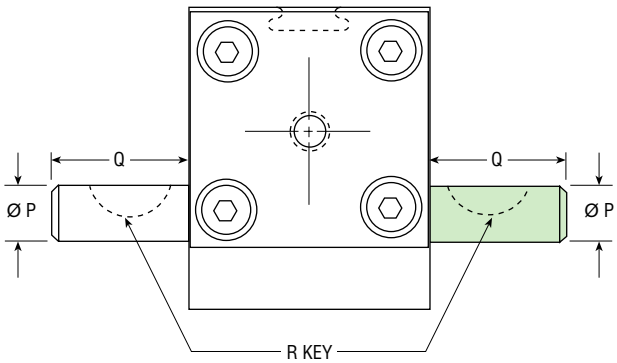
SHOCK ABSORBER SPECIFICATIONS

BORE SIZE	PHD SHOCK ABSORBER NUMBER	THREAD TYPE	STROKE		SHOCK ABSORBER WEIGHT		KINETIC ENERGY LOAD		A MAX.		B HEX		F	
			in	mm	lb	kg	in-lb	Nm	in	mm	in	mm	in	mm
25 mm	60335-04	9/16-18	.19	4.83	.12	.05	2.00	.23	2.35	59.7	.25	6.4	.827	21.0
32 mm	60335-05	3/4-16	.25	6.35	.34	.15	4.00	.45	2.75	69.6	.31	7.9	.827	21.0
40 mm	60335-06	1-12	.29	7.37	.57	.26	10.00	1.13	3.81	96.8	.38	9.5	.984	25.0
50 mm	60335-06	1-12	.29	7.37	.57	.26	16.00	1.81	3.77	95.8	.38	9.5	1.024	26.0
63 mm	60335-07	1-12	.37	9.40	.57	.26	28.00	3.16	3.76	95.4	.38	9.5	1.024	26.0

All dimensions are reference only unless specifically toleranced.

Q13 DOUBLE SHAFT EXTENSION

This option provides a shaft extension out the front side (position 2) and the back side (position 4) of the actuator. This double shaft extension can be used for mounting tooling, fixturing, or for tripping external proximity switches. The one-piece pinion construction provides the same bearing load capacities for both front and rear shaft extensions.



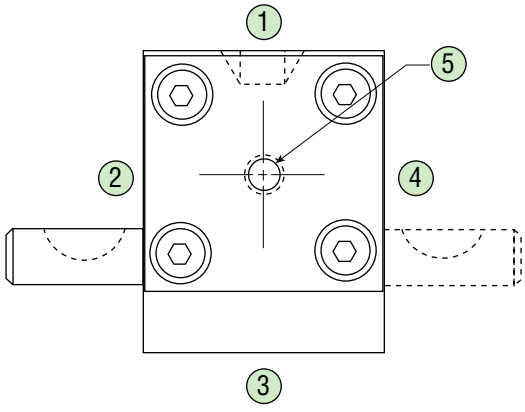
BORE SIZE	P [h8]	Q	R
12 mm	.1875 [6.0]	.630 [16.0]	SEE FIGURE 1, PAGE 5-22 [2.0 SQ x 10.0]
16 mm	.2495 [8.0]	.748 [19.0]	203 WOODRUFF [3.0 SQ x 14.0]
20 mm	.3125 [8.0]	.748 [19.0]	204 WOODRUFF [3.0 SQ x 14.0]
25 mm	.3745 [10.0]	1.004 [25.5]	204 WOODRUFF [3.0 SQ x 16.0]
32 mm	.4995 [14.0]	1.260 [32.0]	1/8 SQ x 3/4 [5.0 SQ x 20.0]
40 mm	.6245 [16.0]	1.496 [38.0]	3/16 SQ x 1.00 [5.0 SQ x 25.0]
50 mm	.7495 [20.0]	1.752 [44.5]	3/16 SQ x 1-1/4 [6.0 SQ x 30.0]
63 mm	.9995 [30.0]	2.007 [51.0]	1/4 SQ x 1-3/8 [8.0 x 7.0 x 36.0 RECT]

Numbers in [ ] are for metric units and are in mm.

U4 PORT POSITION 2

U6 PORT POSITION 3

U8 PORT POSITION 4

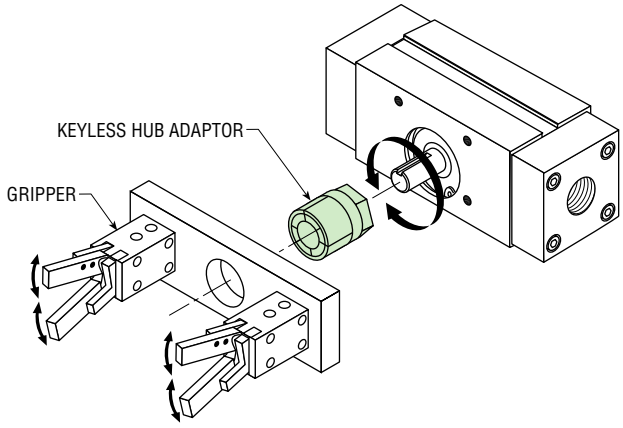


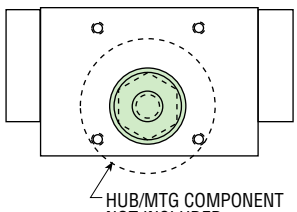
Port positions on units with angle adjustment or shock absorber options are provided with a standard port in position 1. The port position may be rotated by specifying the desired option.

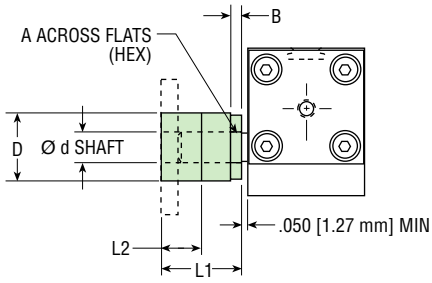
All dimensions are reference only unless specifically toleranced.

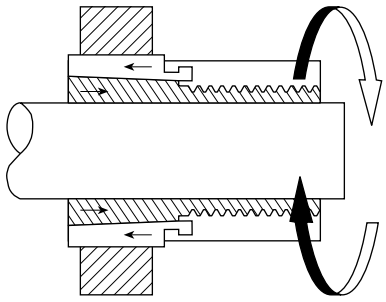
KEYLESS HUB ADAPTOR KIT

This kit provides an output hub for simple attachment of tooling or other PHD actuators to the Series RL Rotary Actuators. The PHD Keyless Hub Adaptor can be precisely adjusted to any angular and axial position on the rotary actuator shaft for maximum application versatility.









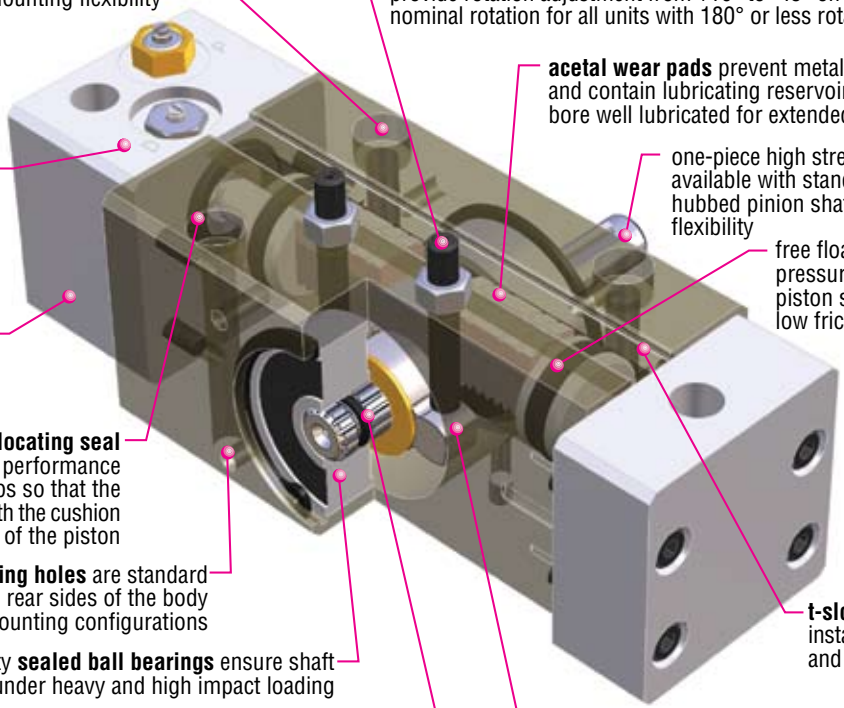
IMPERIAL UNIT	TRANTORQUE PART NUMBER	PHD PART NUMBER	d in	D in	D TOL.	L1 in	L2 in	B in	A in	MAX. TRANSMISSIBLE TORQUE in-lb	MAX. TRANSMISSIBLE THRUST lb	WEIGHT oz	INSTALLATION TORQUE ON NUT in-lb
RLS112	6202103	60264-01	.188	.625	± .0015	.750	.375	.125	.500	100	700	.50	125
RLS116	6202105	60264-02	.250	.625	± .0015	.750	.375	.125	.500	150	790	.50	125
RLS120	6202107	60264-03	.313	.750	± .0015	.875	.438	.125	.625	200	890	1.0	150
RLS125	6202109	60264-04	.375	.750	± .0015	.875	.438	.125	.625	250	925	1.0	150
RLS132	6202112	60264-06	.500	.875	± .0015	1.00	.500	.188	.750	350	980	1.5	175
RLS140	6202120	60264-09	.625	1.50	± .0015	1.50	.750	.313	1.25	1750	3300	8.0	1200
RLS150	6202160	60264-11	.750	1.50	± .003	1.50	.750	.313	1.25	2500	4400	8.0	1200
RLS163	6202240	60264-15	1.00	1.75	± .003	1.875	.875	.438	1.50	3500	6600	11.0	1500

METRIC UNIT	TRANTORQUE PART NUMBER	PHD PART NUMBER	d mm	D mm	D TOL.	L1 mm	L2 mm	B mm	A mm	MAX. TRANSMISSIBLE TORQUE Nm	MAX. TRANSMISSIBLE THRUST kN	WEIGHT kg	INSTALLATION TORQUE ON NUT Nm
RLS512	6202660	60265-02	6	16.0	± .0015	19.0	9.5	3	13	16	3.4	0.014	19.1
RLS516	6202680	60265-04	8	19.0	± .0015	22.0	11.0	3	16	23	4.0	0.028	17.0
RLS520	6202680	60265-04	8	19.0	± .0015	22.0	11.0	5	16	23	4.0	0.028	17.0
RLS525	6202700	60265-06	10	22.5	± .0015	25.5	12.5	5	19	30	4.2	0.042	19.8
RLS532	6202740	60265-09	14	25.5	± .0015	28.5	16.0	5	22	44	4.4	0.560	22.6
RLS540	6202760	60265-11	16	25.5	± .0015	28.5	16.0	5	22	50	4.5	0.560	22.6
RLS550	6202811	60265-17	20	45.0	± .003	47.5	21.5	11	38	290	21.0	0.310	170
RLS563	6202835	60265-22	30	51.0	± .003	57.0	21.5	13	46	580	35.4	0.450	225

NOTE: The torque required to install Trantorque adaptors exceeds the maximum value that can be safely applied to the rack and pinion assembly of Series RL Rotary Actuators. The tooling or component attached to the Trantorque adaptor must be constrained, to avoid excessive loading on the pinion gear, while the nut is being tightened to the torque specified above. Failure to follow this procedure will result in damage to the actuator.

RA

HIGH LOAD AND STOPPING CAPACITY, ZERO BACKLASH



counterbored thru holes are standard on the top of the actuator for even greater mounting flexibility

high strength **alloy steel stroke adjustment screws** provide rotation adjustment from +10° to -45° on each nominal rotation for all units with 180° or less rotation

acetal wear pads prevent metal-to-metal contact and contain lubricating reservoirs to keep piston bore well lubricated for extended life

one-piece high strength **alloy steel pinion** is available with standard keyed shaft or with hubbed pinion shaft for tooling mounting flexibility

free floating **acetal pistons** with pressure and wear compensating piston seals provide long life and low friction

clear anodized aluminum caps with optional port control and cushions located all on the same side of the cap

optional caps can be specified for shock absorbers

custom molded **locating seal** improves the cushion performance by locating the caps so that the cushion seal is inline with the cushion studs of the piston

threaded mounting holes are standard on front and rear sides of the body for flexible mounting configurations

heavy duty **sealed ball bearings** ensure shaft stability under heavy and high impact loading

pinion seals help prevent lubrication from leaving the actuator

t-slot switch grooves for easy installation of Series 5360 reed and solid state switches

built-in high strength **alloy steel stop cam** provides travel adjustment for all units up to 180° of rotation

Major Benefits

- Full featured rotary
- High axial and radial bearing loads
- Zero backlash at ends of rotation
- Wide variety of options and accessories

Industry Uses

- Automotive
- Machine OEMs
- General industrial use

ORDERING DATA: SERIES RA ROTARY ACTUATORS

TO ORDER SPECIFY:
Product, Series, Type, Design No., Bore Size, Angle of Rotation, and Options.

PRODUCT
R - Rotary Actuator

TYPE
S - 150 psi [10 bar] Air Max.

BORE SIZE
20 mm (.78")
25 mm (1.0")
32 mm (1.25")
40 mm (1.5")
50 mm (2.0")

PORT CONTROL
PB - Both directions
PC - Counterclockwise
PW- Clockwise

SWITCH READY
E -Magnets for Series 5360 Solid State Hall Effect Switches
I -Magnets for Series 5360 Magnetoresistive Switches
M-Magnets for Series 5360 Reed Switches

Switches must be ordered separately. See page 5-37.

OUTPUT TYPES
Q10 - Output hub
Q19 - Output hub with hollow pinion shaft (Available on 32 mm–50 mm units only)
Q22 - Splined output shaft only

R A S 1 20 x 180 – PB – NB – E – Q10

SERIES
A - Standard Duty

DESIGN NO.
1 - Imperial
5 - Metric

ANGLE OF ROTATION
45°, 90°, 135°, 180°, 225°, 270°

CUSHION CONTROL
DB - Cushion both directions
DC - Cushion counterclockwise
DW- Cushion clockwise

SHOCK ABSORBER
NB - Shock installed both directions
NC - Shock installed counterclockwise
NW- Shock installed clockwise
GS - Shock ready both directions
GT - Shock ready counterclockwise
GU - Shock ready clockwise

Shock absorbers must be ordered separately for -GS, -GT, and -GU options. 225° and 270° units are standard shock ready.

SHOCK ABSORBER CHART

BORE SIZE	PHD SHOCK ABSORBER NO.
20 mm	56722-01
25 mm	56722-02
32 mm	56722-03
40 mm	56722-04
50 mm	56722-05

Options may affect unit length. See unit dimension and options pages for adders.

UNIQUE ROTARY ACTUATORS ARE AVAILABLE. SEE UNIQUE PRODUCTS AT THE END OF THIS SECTION.

SPECIFICATIONS	SERIES RA
OPERATING PRESSURE	20 to 150 psi [1.4 to 10 bar]
OPERATING TEMPERATURE	-20° to 180°F [-29° to 82°C]
RATED LIFE	10 million cycles
ROTATIONAL TOLERANCE	Nominal rotation +10° to -45° with angle adjustments
BACKLASH AT END OF ROTATION*	0°
LUBRICATION	Factory lubricated for rated life
MAINTENANCE	Field repairable

NOTE: *Angle adjustment screw must be engaged or adjusted to achieve 0° backlash

SIZE	ROTATION	BASE WEIGHT lb	BASE WEIGHT kg	BORE DIAMETER in	BORE DIAMETER mm	DISPLACEMENT VOLUME/DEG in^3/°	DISPLACEMENT VOLUME/DEG mm^3/°	THEORETICAL TORQUE OUTPUT in-lb/psi	THEORETICAL TORQUE OUTPUT Nm/bar	ROTATIONAL VELOCITY MAX deg/sec	MAX AXIAL BEARING LOAD lb	MAX AXIAL BEARING LOAD N	MAX RADIAL BEARING LOAD lb	MAX RADIAL BEARING LOAD N	DISTANCE BETWEEN BEARINGS in	DISTANCE BETWEEN BEARINGS mm
20	45°/90°	1.80	.77	.787	20	.002	32.77	.097	.16	180°/.05	97	431	376	1672	1.34	34.0
	135°/180°	1.80	.77													
	225°/270°	2.30	1.02													
25	45°/90°	2.40	1.08	.984	25	.004	65.55	.190	.31	180°/.05	118	524	453	2015	1.61	40.9
	135°/180°	2.80	1.24													
	225°/270°	3.60	1.60													
32	45°/90°	4.30	1.92	1.260	32	.007	114.71	.415	.68	180°/.05	182	809	640	2846	1.94	49.3
	135°/180°	4.90	2.19													
	225°/270°	6.50	2.94													
40	45°/90°	7.70	3.47	1.575	40	.014	229.42	.779	1.28	180°/.075	237	1054	746	3318	2.56	65.0
	135°/180°	8.80	3.96													
	225°/270°	11.80	5.31													
50	45°/90°	11.60	5.22	1.969	50	.027	442.45	1.522	2.49	180°/.075	325	1445	966	4296	2.90	73.6
	135°/180°	12.80	5.78													
	225°/270°	17.70	8.01													

RA

STANDARD ANGLE ADJUSTMENT

All PHD Series RA Rotary Actuators are supplied as standard with built-in adjustable angle stops. Together these mechanical positive stops provide an adjustment range of +10°, -45° on each nominal angle of rotation (see Table 1). (+5°, -22-1/2° from each end.)

Units with rotations of 180° or less utilize adjusting screws in the top of the actuator which stop against a stop cam attached to the pinion shaft (see Illustration A). Units with rotations of 225° and 270° use angle adjustment screws located in the end caps which stop against the auxiliary lower rack (see Illustration B). When 225° or 270° units are ordered with optional shock absorbers, the shock absorbers double as the angle adjustment screws.

The ability to adjust over such a wide range eliminates the need to order special units for specific angles of rotation. The range of nominal rotations and the +10°, -45° adjustments provide a total rotation range of 0° to 280° across the Series RA Rotary Actuator line.

NOTE: Cushions are effective for approximately the last 40° of rotation each direction. The cushion angle will decrease by the same amount that the nominal rotation is reduced by the angle adjustment. Consult PHD for non-standard angles of rotation if cushions are required.

ILLUSTRATION A
0°-180° ROTATIONS

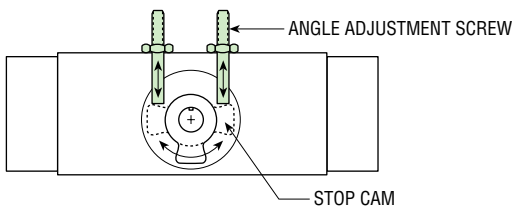
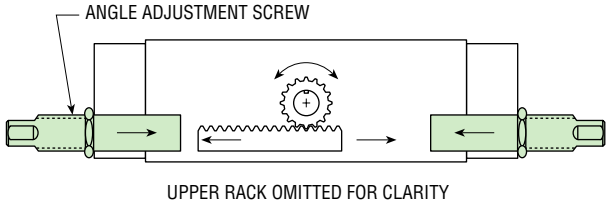


TABLE 1

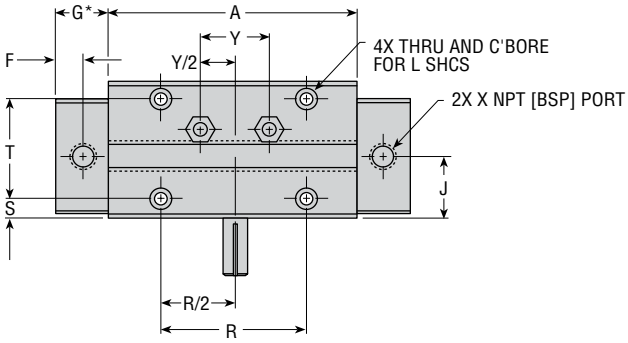
ROTATION ORDERED	STANDARD ADJUSTMENT RANGE
45°	0° through 55°
90°	45° through 100°
135°	90° through 145°
180°	135° through 190°
225° or 270°	180° through 280°

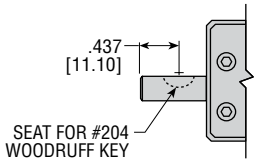
ILLUSTRATION B
181°-270° ROTATIONS



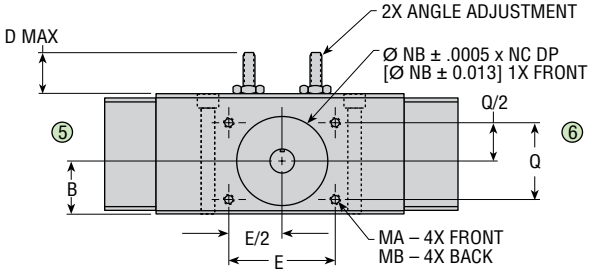
SIZING AND APPLICATION ASSISTANCE
See PHD Product Sizing Catalog for specific and complete sizing information.
Online sizing assistance is available at: ***www.phdinc.com/apps/sizing***

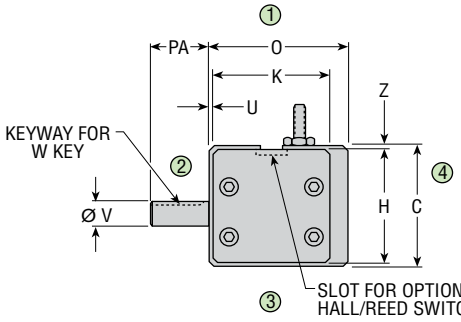
45°, 90°, 135°, or 180° ROTATION UNITS





FOR RAS120 ONLY





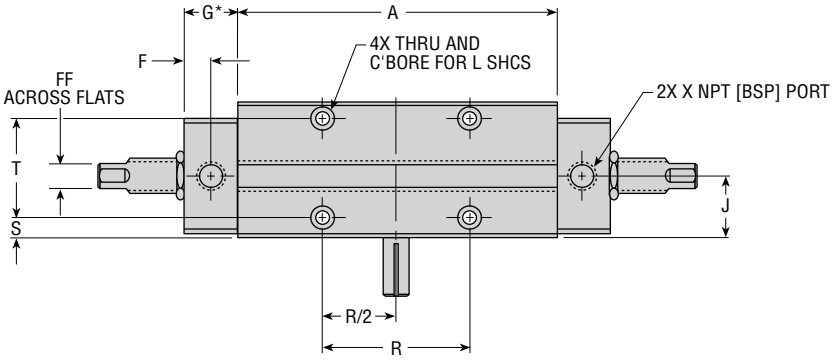
NOTES:
1) *G DIMENSION INCREASES WITH CUSHION OPTION. SEE PAGE 5-36.
2) KEYWAY SHOWN AT MID-ROTATION
3) NUMBERS IN [ ] ARE FOR METRIC UNITS AND ARE IN mm.
4) CIRCLED NUMBERS INDICATE POSITION

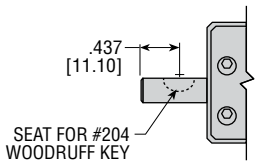
BORE SIZE	NOMINAL ROTATION	A	B	C	D	E	F	G	H	J	K
20 mm	45° OR 90°	3.524 [89.5]	.807	1.831	.604	1.574	.394	.768	1.712	.91	1.732
	135° OR 180°	3.760 [95.0]	[20.5]	[46.5]	[15.34]	[40.0]	[10.0]	[19.5]	[43.5]	[23.0]	[44.0]
25 mm	45° OR 90°	3.819 [97.0]	.983	2.224	.724	1.772	.394	.768	2.087	1.01	1.929
	135° OR 180°	4.508 [114.5]	[25.0]	[56.5]	[18.39]	[45.0]	[10.0]	[19.5]	[53.0]	[25.5]	[49.0]
32 mm	45° OR 90°	4.606 [117.0]	1.161	2.697	.920	2.166	.394	.768	2.559	1.18	2.264
	135° OR 180°	5.650 [143.5]	[29.5]	[68.5]	[23.37]	[55.0]	[10.0]	[19.5]	[65.0]	[30.0]	[57.5]
40 mm	45° OR 90°	5.256 [133.5]	1.516	3.366	.977	2.558	.472	.945	3.228	1.57	3.071
	135° OR 180°	6.476 [164.5]	[38.5]	[85.5]	[24.82]	[65.0]	[12.0]	[24.0]	[82.0]	[39.75]	[78.0]
50 mm	45° OR 90°	6.300 [160.0]	1.674	3.918	1.191	2.952	.472	.945	3.720	1.74	3.346
	135° OR 180°	7.343 [186.5]	[42.5]	[99.5]	[30.25]	[75.0]	[12.0]	[24.0]	[94.5]	[44.25]	[85.0]

BORE SIZE	L	MA	MB	NB	NC	O	PA	Q	R	S
20 mm	#10	10-24 x .281	10-24 x .375	1.3785	.085	2.047	1.000	1.180	2.166	.276
	[M5]	[M5 x 0.8 x 7]	[M5 x 0.8 x 12.5]	[35.014]	[2.16]	[52.0]	[25.0]	[30.0]	[55.0]	[7.0]
25 mm	#10	10-24 x .285	10-24 x .500	1.4572	.080	2.362	1.250	1.378	2.362	.295
	[M5]	[M5 x 0.8 x 7]	[M5 x 0.8 x 12.5]	[37.013]	[2.03]	[60.0]	[30.0]	[35.0]	[60.0]	[7.5]
32 mm	1/4	1/4-20 x .250	1/4-20 x .500	1.8509	.100	2.835	1.500	1.772	2.952	.335
	[M6]	[M6 x 1.0 x 7.5]	[M6 x 1.0 x 15]	[47.013]	[2.54]	[72.0]	[40.0]	[45.0]	[75.0]	[8.5]
40 mm	5/16	5/16-18 x .437	5/16-18 x .750	2.0477	.115	3.544	1.750	2.164	3.346	.394
	[M8]	[M8 x 1.25 x 12]	[M8 x 1.25 x 20]	[52.012]	[2.92]	[90.0]	[42.5]	[55.0]	[85.0]	[10.0]
50 mm	3/8	3/8-16 x .375	3/8-16 x .750	2.4414	.125	3.976	2.000	2.362	3.936	.452
	[M10]	[M10 x 1.5 x 10]	[M10 x 1.5 x 20]	[62.012]	[3.17]	[101.0]	[55.0]	[60.0]	[100.0]	[11.5]

BORE SIZE	T	U	V	W KEY	X NPT [BSP]	Y	Z
20 mm	1.496	.04	.375/.374	SEE ABOVE	1/8	1.004	.06
	[38.0]	[1.0]	[10 (h8)]	[3 mm SQ. x 20 mm]	[1/8]	[25.5]	[1.5]
25 mm	1.772	.04	.4727/.4714	1/8 SQ. x 1.125	1/8	1.124	.08
	[45.0]	[1.0]	[12 (h8)]	[4 mm SQ. x 25 mm]	[1/8]	[28.5]	[2.0]
32 mm	2.165	.05	.625/.624	3/16 SQ. x 1.250	1/8	1.458	.08
	[55.0]	[1.2]	[16 (h8)]	[5 mm SQ. x 32 mm]	[1/8]	[37.0]	[2.0]
40 mm	2.756	.03	.750/.749	3/16 SQ. x 1.500	1/8	1.598	.08
	[70.0]	[0.8]	[17 (h8)]	[5 mm SQ. x 35 mm]	[1/8]	[40.6]	[2.0]
50 mm	3.071	.07	.875/.874	3/16 SQ. x 1.750	1/4	1.984	.10
	[78.0]	[1.8]	[22 (h8)]	[6 mm SQ. x 45 mm]	[1/4]	[50.4]	[2.5]

225° or 270° ROTATION UNITS





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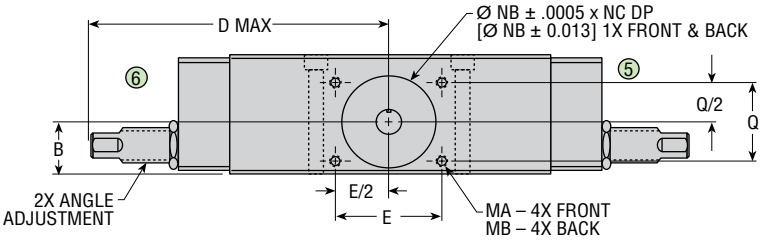
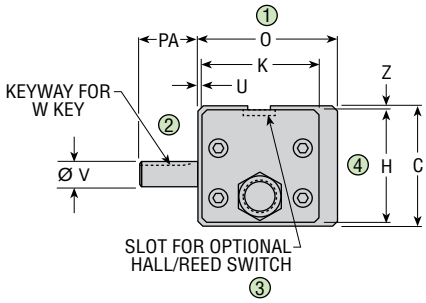




NOTES:
1) *G DIMENSION INCREASES WITH CUSHION OPTION. SEE PAGE 5-36.
2) KEYWAY SHOWN AT MID-ROTATION
3) NUMBERS IN [ ] ARE FOR METRIC UNITS AND ARE IN mm.
4) CIRCLED NUMBERS INDICATE POSITION

BORE SIZE	NOMINAL ROTATION	A	B	C	D	E	F	G	H	J	K
20 mm	225° OR 270°	4.390 [111.5]	.807 [20.5]	1.831 [46.5]	4.39 [111.5]	1.574 [40.0]	.394 [10.0]	.768 [19.5]	1.712 [43.5]	.91 [23.0]	1.732 [44.0]
25 mm	225° OR 270°	5.295 [134.5]	.983 [25.0]	2.224 [56.5]	5.06 [128.5]	1.772 [45.0]	.394 [10.0]	.768 [19.5]	2.087 [53.0]	1.01 [25.5]	1.929 [49.0]
32 mm	225° OR 270°	6.693 [170.0]	1.161 [29.5]	2.697 [68.5]	5.87 [149.1]	2.166 [55.0]	.394 [10.0]	.768 [19.5]	2.559 [65.0]	1.18 [30.0]	2.264 [57.5]
40 mm	225° OR 270°	7.736 [196.5]	1.516 [38.5]	3.366 [85.5]	6.66 [169.1]	2.558 [65.0]	.472 [12.0]	.945 [24.0]	3.228 [82.0]	1.57 [39.75]	3.071 [78.0]
50 mm	225° OR 270°	8.917 [226.5]	1.674 [42.5]	3.918 [99.5]	7.32 [186.0]	2.952 [75.0]	.472 [12.0]	.945 [24.0]	3.720 [94.5]	1.74 [44.25]	3.346 [85.0]

BORE SIZE	L	MA	MB	NB	NC	O	PA	Q	R	S
20 mm	#10 [M5]	10-24 x .281 [M5 x 0.8 x 7]	10-24 x .375 [M5 x 0.8 x 12.5]	1.3785 [35.014]	.085 [2.16]	2.047 [52.0]	1.000 [25.0]	1.180 [30.0]	2.166 [55.0]	.276 [7.0]
25 mm	#10 [M5]	10-24 x .285 [M5 x 0.8 x 7]	10-24 x .500 [M5 x 0.8 x 12.5]	1.4572 [37.013]	.080 [2.03]	2.362 [60.0]	1.250 [30.0]	1.378 [35.0]	2.362 [60.0]	.295 [7.5]
32 mm	1/4 [M6]	1/4-20 x .250 [M6 x 1.0 x 7.5]	1/4-20 x .500 [M6 x 1.0 x 15]	1.8509 [47.013]	.100 [2.54]	2.835 [72.0]	1.500 [40.0]	1.772 [45.0]	2.952 [75.0]	.335 [8.5]
40 mm	5/16 [M8]	5/16-18 x .437 [M8 x 1.25 x 12]	5/16-18 x .750 [M8 x 1.25 x 20]	2.0477 [52.012]	.115 [2.92]	3.544 [90.0]	1.750 [42.5]	2.164 [55.0]	3.346 [85.0]	.394 [10.0]
50 mm	3/8 [M10]	3/8-16 x .375 [M10 x 1.5 x 10]	3/8-16 x .750 [M10 x 1.5 x 20]	2.4414 [62.012]	.125 [3.17]	3.976 [101.0]	2.000 [55.0]	2.362 [60.0]	3.936 [100.0]	.452 [11.5]

BORE SIZE	T	U	V	W KEY	X NPT [BSP]	Z	FF
20 mm	1.496 [38.0]	.04 [1.0]	.375/.374 [10 (h8)]	SEE ABOVE [3 mm SQ. x 20 mm]	1/8 [1/8]	.06 [1.5]	.39 [10.0]
25 mm	1.772 [45.0]	.04 [1.0]	.4727/.4714 [12 (h8)]	1/8 SQ. x 1.125 [4 mm SQ. x 25 mm]	1/8 [1/8]	.08 [2.0]	.47 [12.0]
32 mm	2.165 [55.0]	.05 [1.2]	.625/.624 [16 (h8)]	3/16 SQ. x 1.250 [5 mm SQ. x 32 mm]	1/8 [1/8]	.08 [2.0]	.71 [18.0]
40 mm	2.756 [70.0]	.03 [0.8]	.750/.749 [17 (h8)]	3/16 SQ. x 1.500 [5 mm SQ. x 35 mm]	1/8 [1/8]	.08 [2.0]	.91 [23.0]
50 mm	3.071 [78.0]	.07 [1.8]	.875/.874 [22 (h8)]	3/16 SQ. x 1.750 [6 mm SQ. x 45 mm]	1/4 [1/4]	.10 [2.5]	.91 [23.0]

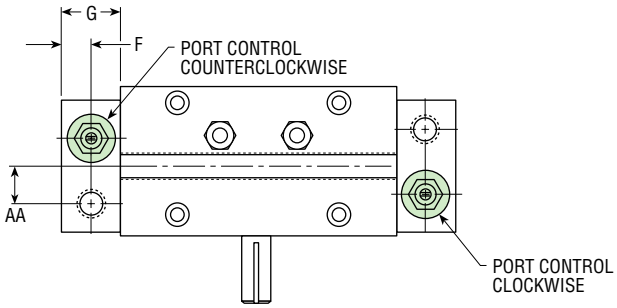
PB PORT CONTROL® BOTH DIRECTIONS

PC PORT CONTROL® COUNTERCLOCKWISE DIRECTION

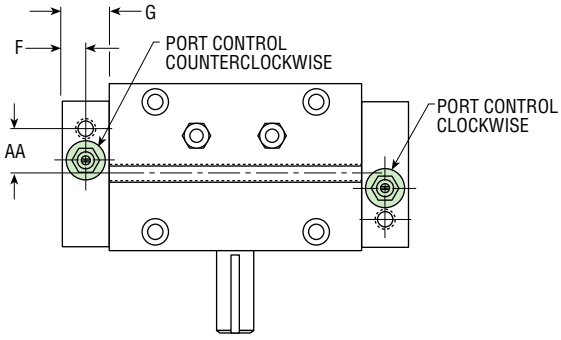
PW PORT CONTROL® CLOCKWISE DIRECTION

PHD Port Control® is a built-in flow control valve for controlling the speed through complete shaft rotation. The Port Control® is based on the "meter-out" principle and features an adjustable needle in a cartridge with an external check seal. The self-locking needle has micrometer threads and is adjustable under pressure. It determines the orifice size which controls the exhaust flow rate of the actuator. The check seal expands while air is exhausting from the actuator, forcing the air to exhaust past the adjustable needle. The check seal collapses to allow a free flow of incoming air. The PHD Port Control® saves space and eliminates the cost of fittings and installation for external flow control valves.

NOTE: Port Control® may not be effective below operating pressures of 10 psi [.7 bar].



RASx20, RASx25, RASx32



RASx40 & RASx50

BORE SIZE	F	G	AA
20 mm	.394 [10.0]	.768 [19.5]	.374 [9.5]
25 mm	.394 [10.0]	.768 [19.5]	.374 [9.5]
32 mm	.394 [10.0]	.768 [19.5]	.374 [9.5]
40 mm	.472 [12.0]	.945 [24.0]	.965 [24.5]
50 mm	.472 [12.0]	.945 [24.0]	1.083 [27.5]

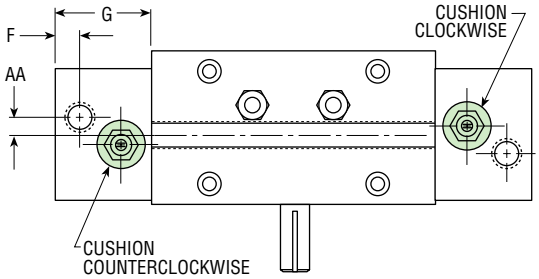
Numbers in [ ] are for metric units and are in mm.

DB CUSHION BOTH DIRECTIONS

DC CUSHION COUNTERCLOCKWISE DIRECTION

DW CUSHION CLOCKWISE DIRECTION

PHD Cushions allow for smooth deceleration at the end of rotation. When the cushion operates, the remaining volume of air in the actuator must exhaust past an adjustable needle, which controls the deceleration of the pinion shaft. The effective length of the cushion is approximately 40° of rotation at the end of full nominal rotation. The use of angle adjustment screws to reduce the angle of rotation has a direct effect on the length of cushion engagement. Example: 5° of angle reduction on one end will reduce cushion engagement by 5° on that end of rotation.

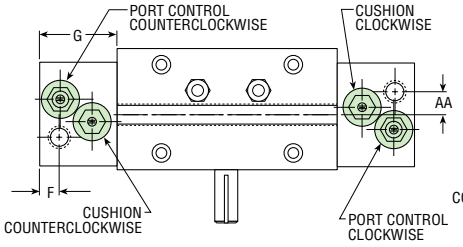


BORE SIZE	F	G	AA
20 mm	.315 [8.0]	1.280 [32.5]	.118 [3.0]
25 mm	.315 [8.0]	1.280 [32.5]	.118 [3.0]
32 mm	.315 [8.0]	1.280 [32.5]	.118 [3.0]
40 mm	.394 [10.0]	1.378 [35.0]	—
50 mm	.394 [10.0]	1.378 [35.0]	—

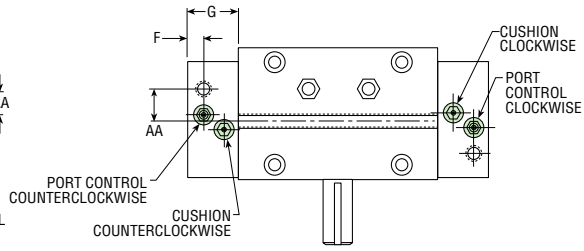
Numbers in [ ] are for metric units and are in mm.

All dimensions are reference only unless specifically toleranced.

PORT CONTROL® AND CUSHION LOCATIONS



RASx20, RASx25, RASx32, RASx40



RASx50

BORE SIZE	F	G	AA
20 mm	.335 [8.5]	1.280 [32.5]	.374 [9.5]
25 mm	.335 [8.5]	1.280 [32.5]	.374 [9.5]
32 mm	.335 [8.5]	1.280 [32.5]	.374 [9.5]
40 mm	.394 [10.0]	1.378 [35.0]	.453 [11.5]
50 mm	.453 [11.5]	1.378 [35.0]	1.083 [27.5]

Numbers in [ ] are for metric units and are in mm.

E MAGNETS FOR PHD SOLID STATE HALL EFFECT SWITCHES

This option equips the rotary actuator with magnets on the rack for use with PHD Series 5360 Hall Effect Switches. These switches mount easily to the actuator using the "T" slot in the top of the body.

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

M MAGNETS FOR PHD REED SWITCHES

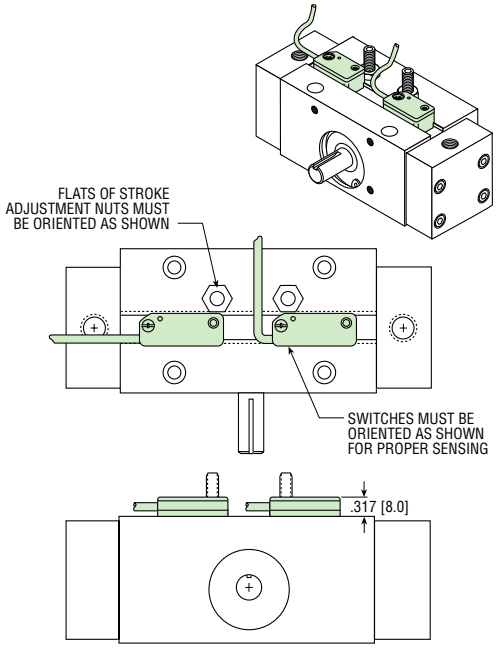
This option equips the rotary actuator with magnets on the rack for use with PHD Series 5360 Reed Switches. These switches mount easily to the actuator using the "T" slot in the top of the body.

PART NO.	COLOR	DESCRIPTION
53602-2-02	White	Sink or Source Type 4.5-24 VDC, 2 meter cable
53609-2-02	Green	AC Type 110-120 VAC with Current Limit, 2 meter cable
53622-2	White	Sink or Source Type VDC, Quick Connect
53629-2	Green	AC Type 110-120 VAC, Quick Connect with Current Limit

I MAGNETS FOR PHD SOLID STATE MAGNETORESISTIVE SWITCHES

This option equips the rotary actuator with magnets on the rack for use with PHD Magnetoresistive Switches. These switches mount easily to the actuator using the "T" slot in the top of the body.

PART NO.	COLOR	DESCRIPTION
53605-1-02	Black	NPN 6-24 VDC, 2 m cable
53606-1-02	Orange	PNP 6-24 VDC, 2 m cable
53625-1	Black	NPN 6-24 VDC, Quick Connect
53626-1	Orange	PNP 6-24 VDC, Quick Connect



PHD Series 5360 Hall Effect and Reed Switches are designed specifically to provide an input signal to various types of programmable controllers or logic systems. See Switches and Sensors section for information on the Series 5360 Switches.

NOTE: When mounting switches on the 20 mm and 25 mm bore units with rotations up to 180°, see the drawing above. Minimum rotation on a 20 mm bore unit with two switches is 45°.

RA

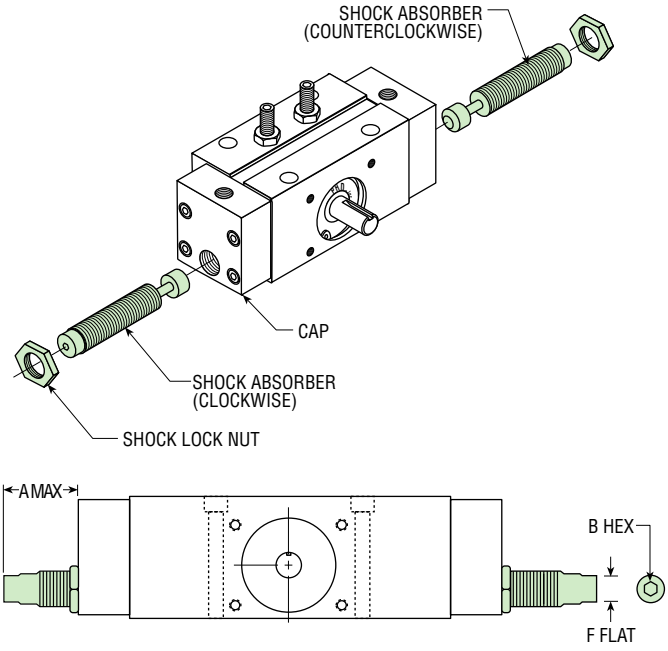
NB SHOCK ABSORBER INSTALLED BOTH DIRECTIONS

NC SHOCK ABSORBER INSTALLED COUNTERCLOCKWISE DIRECTION

NW SHOCK ABSORBER INSTALLED CLOCKWISE DIRECTION

The hydraulic shock absorber options are designed for the maximum in deceleration control and rotational stopping ability. The -NB, -NC, and -NW options provide the rotary actuator with the hydraulic shock absorber installed in the appropriate location(s). See PHD Product Sizing Catalog for details on unit stopping capacity with built-in shock absorbers. Shock absorbers are nominally effective for 45° of rotation each direction.

NOTE: The shock absorber doubles as the rotation adjustment on units with rotations greater than 180°.



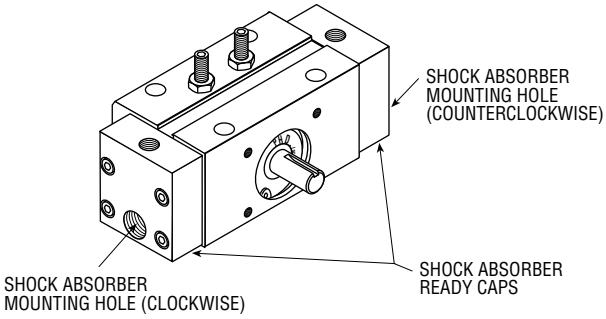
GS SHOCK ABSORBER READY BOTH DIRECTIONS

GT SHOCK ABSORBER READY COUNTERCLOCKWISE DIRECTION

GU SHOCK ABSORBER READY CLOCKWISE DIRECTION

The -GS, -GT, and -GU options should only be used if the shock absorber(s) is to be supplied separately from the rotary actuator. These options provide a unit that has provisions for installing hydraulic shock absorbers but have no shock absorbers included. See PHD Product Sizing Catalog for details on unit stopping capacity with built-in shock absorbers.

NOTE: The shock absorber doubles as the rotation adjustment on units with rotations greater than 180°. Shock absorbers **must** be installed in the rotary actuator prior to operating the unit. Operation of units with shock absorber ready options without installed shocks can damage the units and void any and all warranties. Only shock absorbers specified by PHD should be used in Series RA Rotary Actuators. The use of any other shock absorbers will affect actuator performance and life expectancy.



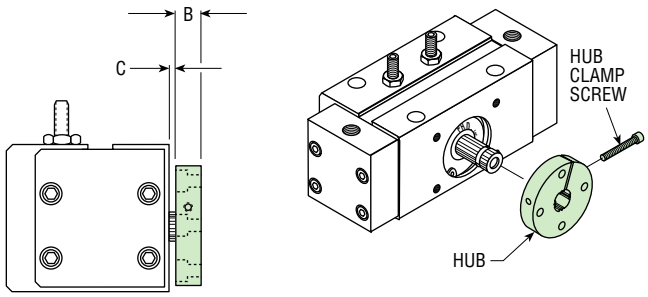
SHOCK ABSORBER SPECIFICATIONS

BORE SIZE	PHD SHOCK ABSORBER NUMBER	THREAD TYPE	STROKE		SHOCK ABSORBER WEIGHT		KINETIC ENERGY LOAD		A MAX.		B HEX		F FLATS	
			in	mm	lb	kg	in-lb	Nm	in	mm	in	mm	in	mm
20	56722-01	M12 x 1	.39	10.0	.11	.05	3.3	.36	2.25	57.2	—	—	.31	8
25	56722-02	M14 x 1.5	.42	10.7	.13	.06	9.3	1.05	2.37	60.2	—	—	.47	11.9
32	56722-03	M20 x 1.5	.25	6.35	.34	.15	21.3	1.71	2.41	61.2	.31	8.0	—	—
40	56722-04*	M25 x 1.5	.5	12.7	.67	.3	45.0	5.1	3.38	85.7	—	—	.88	22.4
50	56722-05*	M25 x 1.5	.5	12.7	.67	.3	87.9	9.94	3.44	87.4	—	—	.88	22.4

*These shock absorbers have an adjustment feature. (See PHD Product Sizing Catalog for details).

Q10 OUTPUT HUB

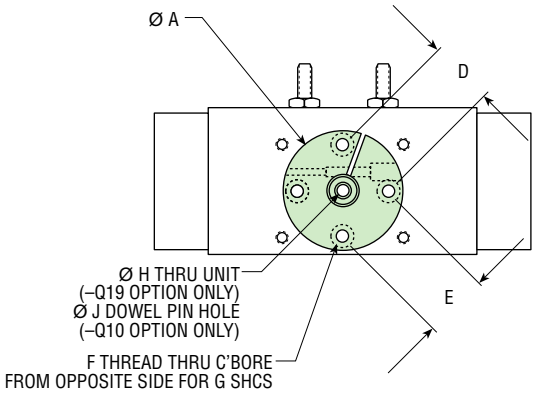
This option provides an output hub in place of the conventional pinion shaft. The hub includes four thru holes counterbored from one surface and threaded from the other, allowing easy mounting of fixturing, tooling, or other actuators requiring a flat surface area. The hub is manufactured from alloy aluminum and comes assembled to a specially designed low profile pinion shaft. The hub can be removed to allow custom machining for specific mounting needs. The hub hole pattern can be oriented in 22.5° increments. Separate hubs are available in a kit complete with all hardware. See chart below.



Q19 OUTPUT HUB WITH HOLLOW PINION SHAFT

This option provides an output hub with a hollow pinion shaft in place of the standard pinion shaft. The hub has four thru holes counterbored from one surface and threaded from the other, allowing easy mounting of fixturing, tooling, or other actuators requiring a flat surface area. The pinion shaft is hollow for feeding pneumatic or electrical lines from the back of the rotary actuator to the output hub. The hub is manufactured from alloy aluminum and comes assembled to a specially designed low profile pinion shaft. The hub can be removed to allow custom machining for specific mounting needs. It can also be rotated in 22.5° rotations. Kinetic energy ratings are reduced by 10% for this option.

NOTE: Available on 32 mm, 40 mm, and 50 mm units.

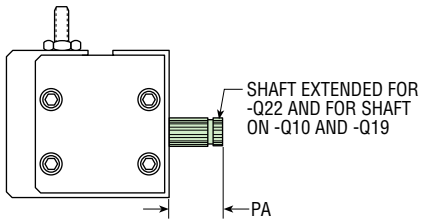


HUB REPLACEMENT KITS

BORE SIZE	FINISHED HUB KIT	
	IMPERIAL	METRIC
20 mm	57651-2721-1	57658-2771-1
25 mm	57652-2731-1	57659-2781-1
32 mm	57653-2741-1	57660-2791-1
40 mm	57654-2751-1	57661-2801-1
50 mm	57655-2761-1	57662-2811-1

Q22 SPLINED OUTPUT SHAFT ONLY

This option provides a splined pinion shaft that is ready to attach output hubs as in -Q10 option. (No hub supplied).



Q22 - Splined Output Shaft

BORE SIZE	A	B	C	D	E	F	G	H	J	PA
20 mm	1.535 [39.0]	.374 [9.5]	.100 [2.5]	.787 [20.0]	.787 [20.0]	8-32 [M4 x 0.7]	#4 [M3]	—	.1264 x .25 DP [3.21 x 6.4 DP]	.474 [12.0]
25 mm	1.772 [45.0]	.374 [9.5]	.100 [2.5]	.945 [24.0]	.945 [24.0]	10-32 [M5 x 0.8]	#6 [M4]	—	.1264 x .25 DP [3.21 x 6.4 DP]	.474 [12.0]
32 mm	2.165 [55.0]	.492 [12.5]	.100 [2.5]	1.102 [28.0]	1.102 [28.0]	1/4-28 [M6 x 1.0]	#10 [M4]	.276 [7.0]	.2514 x .50 DP [6.39 x 12.7 DP]	.592 [15.0]
40 mm	2.717 [69.0]	.492 [12.5]	.100 [2.5]	1.398 [35.5]	1.398 [35.5]	1/4-28 [M8 x 1.25]	#10 [M6]	.315 [8.0]	.2514 x .50 DP [6.39 x 12.7 DP]	.590 [15.0]
50 mm	2.953 [75.0]	.748 [19.0]	.100 [2.5]	1.575 [40.0]	1.575 [40.0]	7/16-20 [M10 x 1.5]	3/8 [M8]	.394 [10.0]	.2514 x .50 DP [6.39 x 12.7 DP]	.848 [21.5]

Numbers in [ ] are for metric units and are in mm.

RI

LOW PROFILE, HIGH FORCE

unit is standard with **integral manifold interface**

optional hollow pinion for routing and protection of electrical cables and air lines is also available

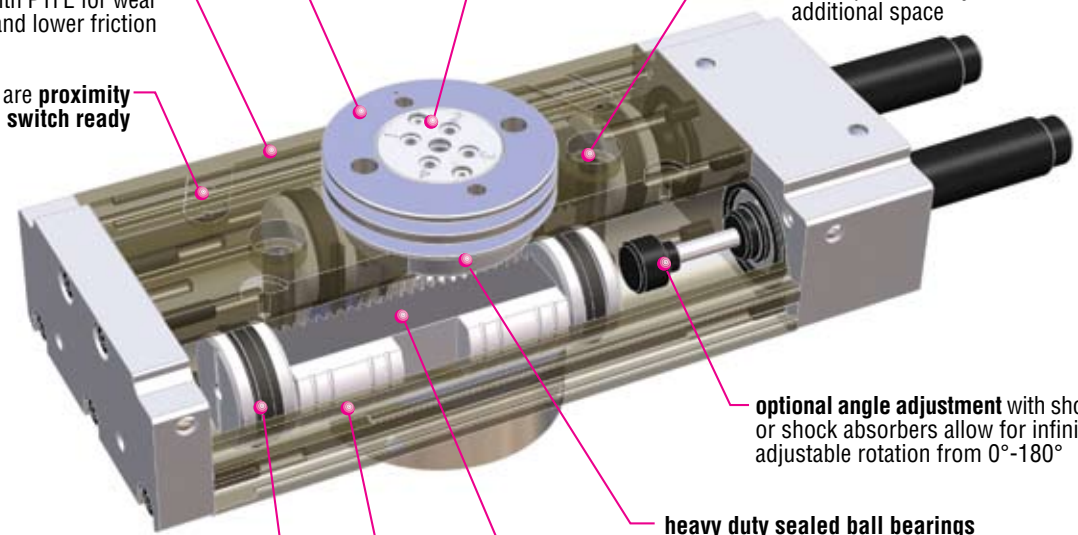
one piece high strengh **alloy steel pinion** with integral output hub for increased strength

standard **counterbored thru mounting holes** in the body are threaded to provide versatility and ease of mounting

locating rings can be added to provide dowel pin accuracy without requiring additional space

hardcoated aluminum body is impregnated with PTFE for wear resistance and lower friction

all units are **proximity switch ready**



optional angle adjustment with shock pads or shock absorbers allow for infinitely adjustable rotation from 0°-180°

heavy duty sealed ball bearings ensure shaft stability under heavy and high impact loading

double rack and pinion drive system eliminates backlash at end of rotation

free floating **acetal pistons** with pressure and wear compensating piston seals provide long life and low friction

acetal wear pads prevent metal-to-metal contact and contains lubricating reservoirs to keep piston bore well lubricated for extended life

Major Benefits

- High torque
- High axial and radial bearing load
- Thru hole shaft for built-in air communication ports

Industry Uses

- Part orientation
- General machine builders
- Electronics
- Stamping

ORDERING DATA: SERIES RI ROTARY ACTUATOR

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

PRODUCT
R - Rotary

TYPE

	BORE Ø	TORQUE AT 87 psi
S SINGLE RACK	25 mm	32 in-lb [3.6 Nm]
	32 mm	63 in-lb [7.1 Nm]
	50 mm	207 in-lb [23.4 Nm]
D DOUBLE RACK	25 mm	64 in-lb [7.2 Nm]
	32 mm	127 in-lb [14.3 Nm]
	50 mm	414 in-lb [46.8 Nm]

HOLLOW PINION
H - Hollow Pinion
Leave blank if standard

BORE Ø
25 mm
32 mm
50 mm

MID-POSITION
90°
On 3-position only
Must be specified

ANGLE ADJUSTMENT
AB - Angle adjustment with shock pad installed both ends
AC - Angle adjustment with shock pad installed counterclockwise 90°
AW - Angle adjustment with shock pad installed clockwise 90°
See note 1

3 R I D H 1 25 x 180 x 90 - NB - PB - AB - M

THREE POSITION UNITS
Only 90°
Mid-position on Double Rack Units are available.

SERIES
I - Internal Passage

DESIGN NO.

	Imperial	Metric
For RISx50	2	6
For All Others	1	5

ROTATION
180°

SHOCK ABSORBERS
NB - Shock installed both directions
NC - Shock installed counterclockwise
NW - Shock installed clockwise
See note 1

ROTATION SPEED CONTROL VALVE
PB - Rotational Speed Controls both directions
PC - Rotational Speed Controls counterclockwise
PW - Rotational Speed Controls clockwise

OPTIONS
M - Reed Magnet, Solid State

NOTES:
1) Either optional angle adjustments or shock absorbers **must** be ordered on all units. (Either option is mandatory.)
2) Switches and switch bracket kits must be ordered separately.

Options may affect unit length. See unit dimension and options pages for adders.

UNIQUE ROTARY ACTUATORS ARE AVAILABLE. SEE UNIQUE PRODUCTS AT THE END OF THIS SECTION.

UNIT SIZE	ROTATION SPEED CONTROL KIT NO.
RIxx125	70695-01
RIxx525	70696-01
RIxx132	70695-03
RIxx532	70696-03
RIDx150	70695-03
RIDx550	70696-03
RISx250	70695-03
RISx650	70696-03

NOTE: One flow control fitting per kit

UNIT SIZE	SHOCK ABSORBER KIT NO.
RISxx25	69146
RIDxx25	69153
RISxx32	69147
RIDxx32	69154
RISxx50	75423
RIDxx50	69156

UNIT SIZE	PORTING PLATE KIT NUMBER
RIx125	71972
RIx525	71997
RIx132	71973
RIx532	71998
RID150	71975
RID550	72000
RIS250	71975
RIS650	72000

Kits include: 1 Porting Plate,
2 Locating Rings,
4 Fasteners, Required O-Rings

SPECIFICATIONS	SERIES RI
OPERATING PRESSURE	20 to 100 psi [1.4 to 6.8 bar]
OPERATING TEMPERATURE	-20° to 160°F [-29° to 71°C]
RATED LIFE	5 million cycles
ROTATIONAL TOLERANCE	Nominal rotation +13° to -180° with angle adjustment
BACKLASH AT END OF ROTATION*	0°
LUBRICATION	Factory lubricated for rated life
MAINTENANCE	Field repairable

NOTE: *Angle adjustment screw must be engaged or adjusted to achieve 0° backlash

SIZE	ROTATION/ MID ROT	BASE WEIGHT lb	BASE WEIGHT kg	BORE DIAMETER in	BORE DIAMETER mm	DISPLACEMENT VOLUME/deg in^3	DISPLACEMENT VOLUME/deg cm^3	THEORETICAL TORQUE OUTPUT in-lb/psi	THEORETICAL TORQUE OUTPUT Nm/bar	ROTATIONAL VELOCITY MAX deg/sec	MAX AXIAL BEARING LOAD lb	MAX AXIAL BEARING LOAD N	MAX RADIAL BEARING LOAD lb	MAX RADIAL BEARING LOAD N
RISxx25	180°	3.0	1.36			2.24	36.71	.37	.61	180°/.13				
RIDxx25	180°	3.5	1.59	.984	25	4.48	73.41	.74	1.21	180°/.23	292	1300	572	2546
3RIDxx25	180°/90°	4.1	1.86			5.05	82.75	.37	.61	180°/.23				
RISxx32	180°	7.6	3.44			4.24	69.48	.73	1.20	180°/.11				
RIDxx32	180°	8.0	3.63	1.260	32	8.49	139.13	1.45	2.38	180°/.28	511	2275	1206	5365
3RIDxx32	180°/90°	9.6	4.36			9.42	154.37	.73	1.20	180°/.28				
RISxx50	180°	14.3	6.48			14.94	244.82	2.38	3.90	180°/.13				
RIDxx50	180°	15.0	6.80	1.969	50	29.88	489.65	4.76	7.80	180°/.28	697	3100	1850	8229
3RIDxx50	180°/90°	17.6	7.98			33.24	544.71	2.38	3.90	180°/.28				

MANIFOLD PINION SPECIFICATIONS

UNIT SIZE	NUMBER OF PASSAGES	FLOW THROUGH PASSAGES @ 87 psi [6 bar] CFM	FLOW THROUGH PASSAGES @ 87 psi [6 bar] Liter/Min	CENTER THROUGH HOLE DIAMETER in	CENTER THROUGH HOLE DIAMETER mm
RISx25	4	1	28.3	0.197	5
RIDx25	4	1	28.3	0.197	5
RISx32	6	1.3	36.8	0.276	7
RIDx32	6	1.3	36.8	0.276	7
RISx50	8	1.5	42.5	0.433	11
RIDx50	8	1.5	42.5	0.433	11

BACKLASH SPECIFICATIONS

UNIT SIZE	BACKLASH MID ROTATION +/- (degrees)	REPEATABILITY +/- (degrees)	BACKLASH THREE POSITION UNIT +/- (degrees)	REPEATABILITY THREE POSITION UNIT +/- (degrees)
RISxx25	.26	0.14	—	—
RIDxx25	.26	0.53	1.25	0.16
RISxx32	.23	0.42	—	—
RIDxx32	.23	0.94	0.65	0.10
RISxx50	.21	0.12	—	—
RIDxx50	.21	0.35	0.40	0.06

ROTATION RATE TABLE

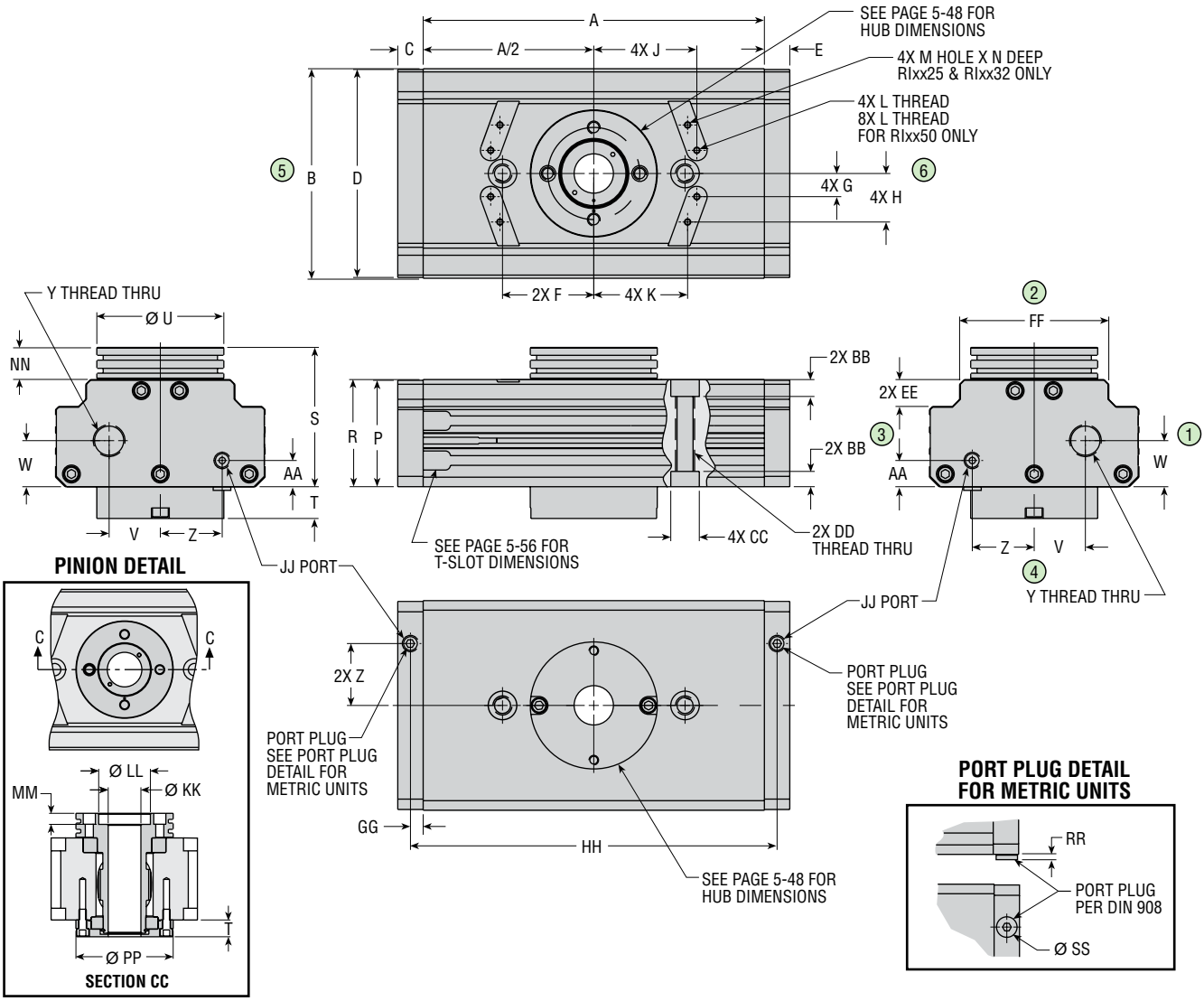
UNIT SIZE	ROTATION RATES at 87 psi (seconds maximum) SHOCK PAD	SPEED CONTROL	SHOCK
RISxx25	0.13	0.18	0.18
RIDxx25	0.23	0.41	0.23
RISxx32	0.11	0.11	0.31
RIDxx32	0.28	0.30	0.32
RISxx50	0.13	0.22	0.29
RIDxx50	0.28	0.40	0.78

(No load conditions)

SIZING AND APPLICATION ASSISTANCE

See PHD Product Sizing Catalog for specific and complete sizing information.
Online sizing assistance is available at: ***www.phdinc.com/apps/sizing***

DIMENSIONS: SERIES RISH ROTARY ACTUATOR SINGLE RACK



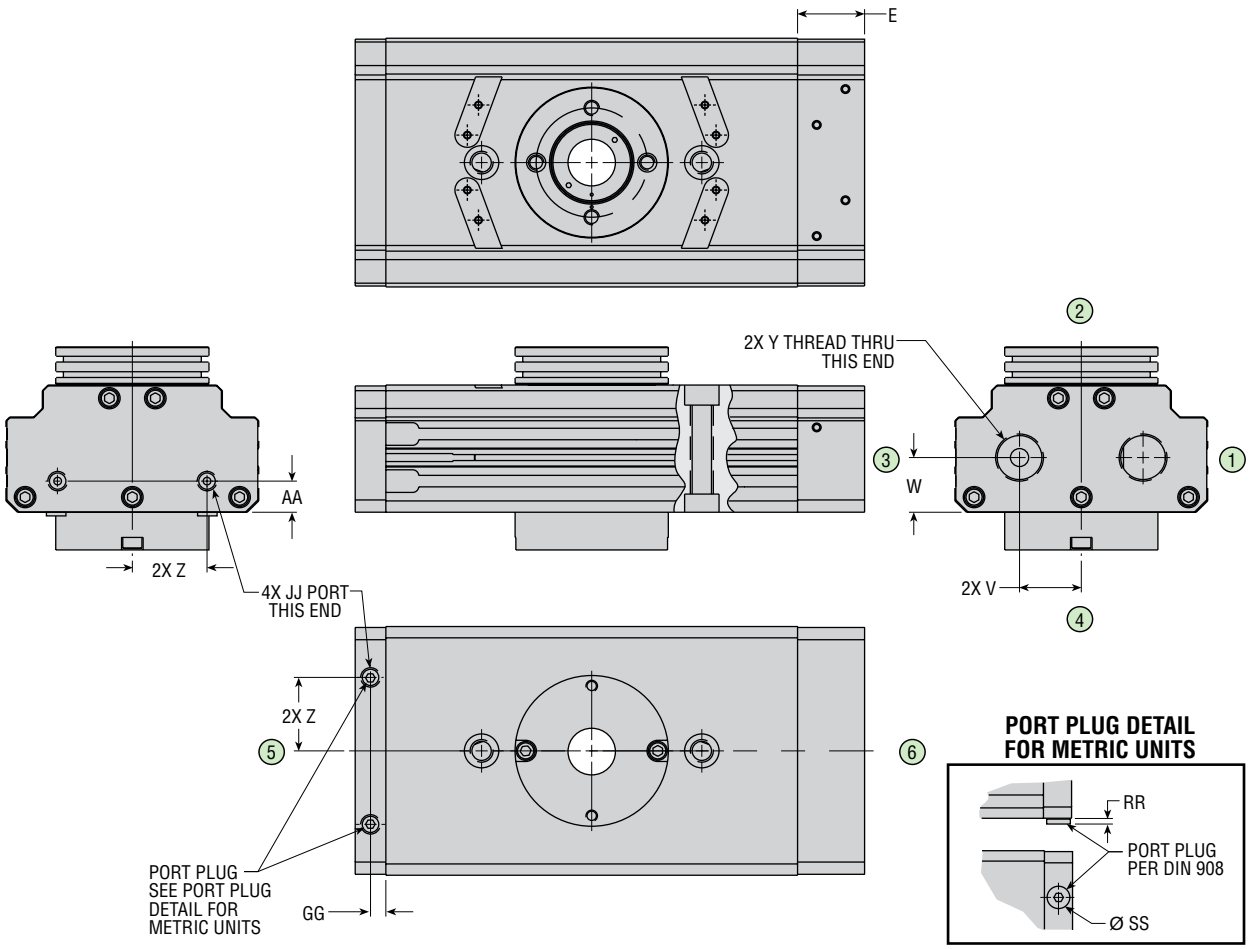
UNIT SIZE	LETTER DIMENSION																
	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T
RISH125	5.425	3.071	.472	3.031	.472	1.477	.406	.738	1.823	1.698	M3 x 0.5	.102	.098	1.398	1.417	1.889	.417
RISH525	[137.8]	[78.0]	[12.0]	[77.0]	[12.0]	[37.5]	[10.3]	[18.7]	[46.3]	[43.1]	M3 x 0.5	[2.6]	[2.5]	[35.5]	[36.0]	[48.0]	[10.6]
RISH132	6.384	3.858	.630	3.819	.630	1.969	.758	1.070	2.004	1.838	M3 x 0.5	.102	.118	1.890	1.909	2.519	.374
RISH532	[162.2]	[98.0]	[16.0]	[97.0]	[16.0]	[50.0]	[19.3]	[27.2]	[50.9]	[46.7]	M3 x 0.5	[2.6]	[3.0]	[48.0]	[48.5]	[64.0]	[9.5]
RISH250	8.464	5.197	.630	5.157	.630	2.264	.575	1.204	2.557	2.328	M4 x 0.7	—	—	2.638	2.657	3.454	.543
RISH650	[215.0]	[132.0]	[16.0]	[131.0]	[16.0]	[57.5]	[14.6]	[30.6]	[64.9]	[59.1]	M4 x 0.7	—	—	[67.0]	[67.5]	[87.7]	[13.8]

UNIT SIZE	LETTER DIMENSION													
	U	V	W	Y	Z	AA	BB	CC	CC TOL±	DD	EE	FF	GG	HH	JJ
RISH125	1.969	.731	.618	M14 x 1.5	.709	.394	.197	.4715	.0004	5/16-24	.157	2.283	.197	5.819	10-32
RISH525	[50.0]	[18.6]	[15.7]	M14 x 1.5	[18.0]	[10.0]	[5.0]	[11.98]	[.01]	M8 x 1.25	[4.0]	[58.0]	[5.0]	[147.8]	M5 x 0.8
RISH132	2.520	.888	.854	M20 x 1.5	.787	.650	.197	.4715	.0004	5/16-24	.236	2.598	.315	7.014	1/8-27 NPT
RISH532	[64.0]	[22.6]	[21.7]	M20 x 1.5	[20.0]	[16.5]	[5.0]	[11.98]	[.01]	M8 x 1.25	[6.0]	[66.0]	[8.0]	[178.2]	1/8-28 BSPP
RISH250	3.150	1.270	1.142	M25 x 1.5	1.535	.650	.419	.7077	.0004	1/2-20	.666	3.701	.315	9.094	1/8-27 NPT
RISH650	[80.0]	[32.2]	[29.0]	M25 x 1.5	[39.0]	[16.5]	[10.6]	[17.98]	[.01]	M12 x 1.75	[16.9]	[94.0]	[8.0]	[231.0]	1/8-28 BSPP

UNIT SIZE	LETTER DIMENSION						
	Ø PP	Ø KK	Ø LL	MM	NN	RR	SS
RISH125	2.244	.677	1.063	.236	.472	—	—
RISH525	[57.0]	[17.2]	[27.0]	[6.0]	[12.0]	—	—
RISH132	2.677	.846	1.339	.276	.610	—	—
RISH532	[68.0]	[21.5]	[34.0]	[7.0]	[15.5]	[2.5]	[15.0]
RISH250	3.150	1.060	1.676	.354	.797	—	—
RISH650	[80.0]	[26.9]	[42.6]	[9.0]	[20.2]	[2.5]	[15.0]

NOTES:
1) POSITIONS INDICATED BY CIRCLED NUMBERS.
2) PINION AND HUB SHOWN AT MID ROTATION.
3) METRIC INFORMATION SHOWN IN [ ].

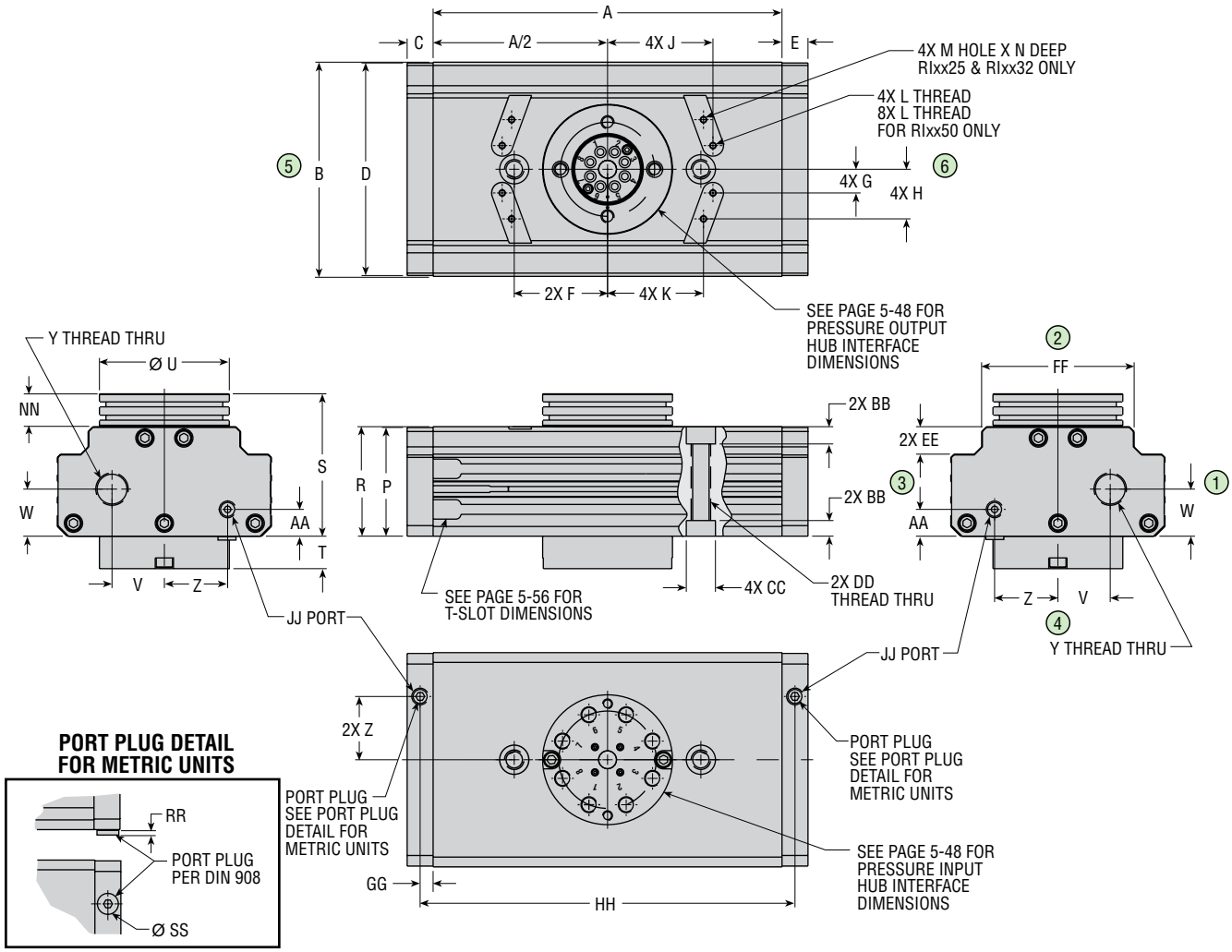
All dimensions are reference only unless specifically toleranced.



UNIT SIZE	LETTER DIMENSION									
	E	V	W	Y	Z	AA	GG	JJ	RR	SS
RIDH125	1.280	.731	.618	M14 x 1.5	.709	.394	.197	10-32	—	—
RIDH525	[32.5]	[18.6]	[15.7]	M14 x 1.5	[18.0]	[10.0]	[5.0]	M5 x 0.8	—	—
RIDH132	1.378	.888	.854	M20 x 1.5	.787	.650	.315	1/8-27 NPT	—	—
RIDH532	[35.0]	[22.6]	[21.7]	M20 x 1.5	[20.0]	[16.5]	[8.0]	1/8-28 BSPP	[2.5]	[15.0]
RIDH150	1.378	1.270	1.142	M25 x 1.5	1.535	.650	.315	1/8-27 NPT	—	—
RIDH550	[35.0]	[32.2]	[29.0]	M25 x 1.5	[39.0]	[16.5]	[8.0]	1/8-28 BSPP	[2.5]	[15.0]

NOTES:
1) POSITIONS INDICATED BY CIRCLED NUMBERS.
2) PINION AND HUB SHOWN AT MID ROTATION.
3) FOR DIMENSIONS NOT GIVEN SEE RISH SINGLE RACK DIMENSION SEE PREVIOUS PAGE.
4) METRIC INFORMATION SHOWN IN [ ].

DIMENSIONS: SERIES RIS ROTARY ACTUATOR SINGLE RACK



PORT PLUG DETAIL FOR METRIC UNITS

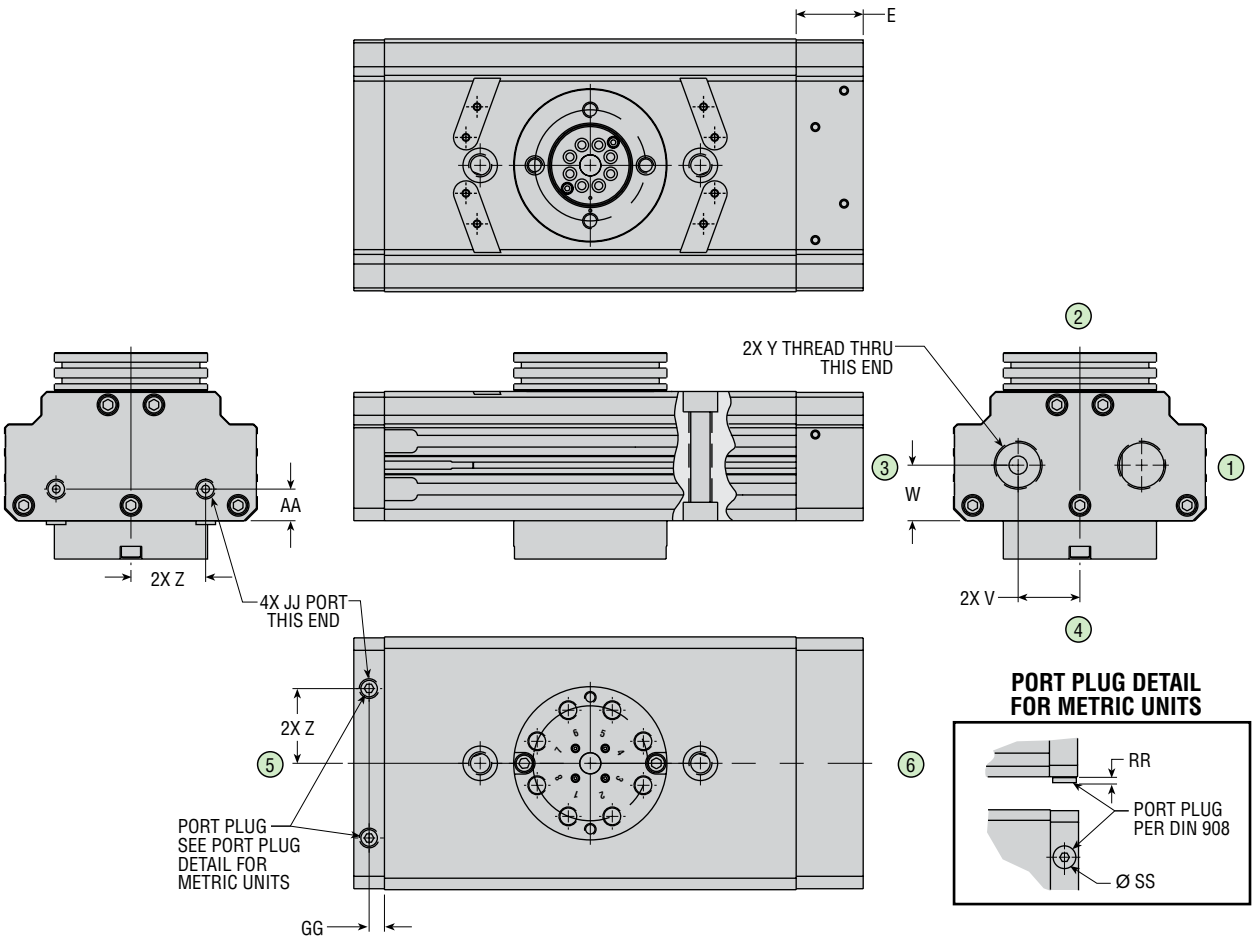
UNIT SIZE	LETTER DIMENSION																
	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T
RIS125	5.425	3.071	.472	3.031	.472	1.477	.406	.738	1.823	1.698	M3 x 0.5	.102	.098	1.417	1.398	1.889	.709
RIS525	[137.8]	[78.0]	[12.0]	[77.0]	[12.0]	[37.5]	[10.3]	[18.7]	[46.3]	[43.1]	M3 x 0.5	[2.6]	[2.5]	[36.0]	[35.5]	[48.0]	[18.0]
RIS132	6.384	3.858	.630	3.819	.630	1.969	.758	1.070	2.004	1.838	M3 x 0.5	.102	.118	1.909	1.890	2.519	.787
RIS532	[162.2]	[98.0]	[16.0]	[97.0]	[16.0]	[50.0]	[19.3]	[27.2]	[50.9]	[46.7]	M3 x 0.5	[2.6]	[3.0]	[48.5]	[48.0]	[64.0]	[20.0]
RIS250	8.464	5.197	.630	5.157	.630	2.264	.575	1.204	2.557	2.328	M4 x 0.7	—	—	2.657	2.638	3.454	.787
RIS650	[215.0]	[132.0]	[16.0]	[131.0]	[16.0]	[57.5]	[14.6]	[30.6]	[64.9]	[59.1]	M4 x 0.7	—	—	[67.5]	[67.0]	[87.7]	[20.0]

UNIT SIZE	LETTER DIMENSION														
	U	V	W	Y	Z	AA	BB	CC	CC TOL±	DD	EE	FF	GG	HH	JJ	NN
RIS125	1.969	.731	.618	M14 x 1.5	.709	.394	.197	.4715	.0004	5/16-24	.157	2.283	.197	5.819	10-32	.472
RIS525	[50.0]	[18.6]	[15.7]	M14 x 1.5	[18.0]	[10.0]	[5.0]	[11.98]	[.01]	M8 x 1.25	[4.0]	[58.0]	[5.0]	[147.8]	M5 x 0.8	[12.0]
RIS132	2.520	.888	.854	M20 x 1.5	.787	.650	.197	.4715	.0004	5/16-24	.236	2.598	.315	7.014	1/8-27 NPT	.610
RIS532	[64.0]	[22.6]	[21.7]	M20 x 1.5	[20.0]	[16.5]	[5.0]	[11.98]	[.01]	M8 x 1.25	[6.0]	[66.0]	[8.0]	[178.2]	1/8-28 BSPP	[15.5]
RIS250	3.150	1.270	1.142	M25 x 1.5	1.535	.650	.419	.7077	.0004	1/2-20	.666	3.701	.315	9.094	1/8-27 NPT	.797
RIS650	[80.0]	[32.2]	[29.0]	M25 x 1.5	[39.0]	[16.5]	[10.6]	[17.98]	[.01]	M12 x 1.75	[16.9]	[94.0]	[8.0]	[231.0]	1/8-28 BSPP	[20.2]

UNIT SIZE	LETTER DIMENSION	
	RR	SS
RIS125	—	—
RIS525	—	—
RIS132	—	—
RIS532	[2.5]	[15.0]
RIS250	—	—
RIS650	[2.5]	[15.0]

NOTES:
1) POSITIONS INDICATED BY CIRCLED NUMBERS.
2) PINION AND HUB SHOWN AT MID ROTATION.
3) METRIC INFORMATION SHOWN IN [ ].

All dimensions are reference only unless specifically toleranced.

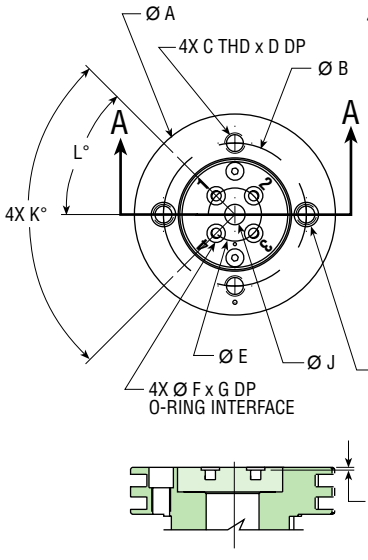


UNIT SIZE	LETTER DIMENSION									
	E	V	W	Y	Z	AA	GG	JJ	RR	SS
RID125	1.280	.731	.618	M14 x 1.5	.709	.394	.197	10-32	—	—
RID525	[32.5]	[18.6]	[15.7]	M14 x 1.5	[18.0]	[10.0]	[5.0]	M5 x 0.8	—	—
RID132	1.378	.888	.854	M20 x 1.5	.787	.650	.315	1/8-27 NPT	—	—
RID532	[35.0]	[22.6]	[21.7]	M20 x 1.5	[20.0]	[16.5]	[8.0]	1/8-28 BSPP	[2.5]	[15.0]
RID150	1.378	1.270	1.142	M25 x 1.5	1.535	.650	.315	1/8-27 NPT	—	—
RID550	[35.0]	[32.2]	[29.0]	M25 x 1.5	[39.0]	[16.5]	[8.0]	1/8-28 BSPP	[2.5]	[15.0]

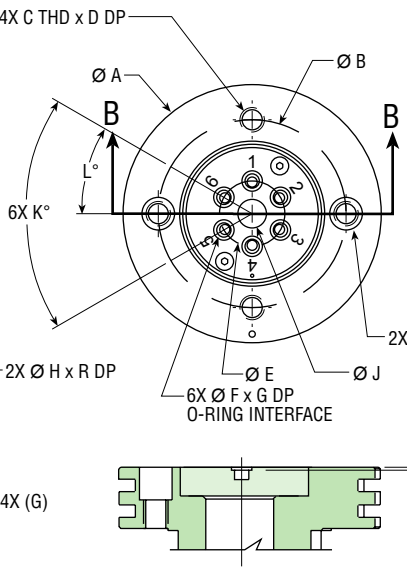
NOTES:
1) POSITIONS INDICATED BY CIRCLED NUMBERS.
2) PINION AND HUB SHOWN AT MID ROTATION.
3) FOR DIMENSIONS NOT GIVEN SEE RIS SINGLE RACK DIMENSION SEE PREVIOUS PAGE.
4) METRIC INFORMATION SHOWN IN [ ].

PRESSURE OUTPUT HUB O-RING INTERFACE

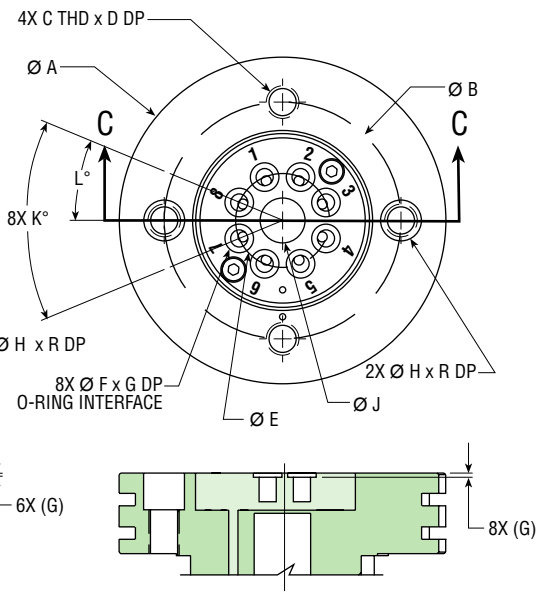
RIxx25



RIxx32

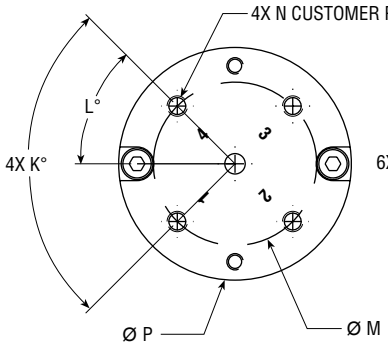


RIxx50

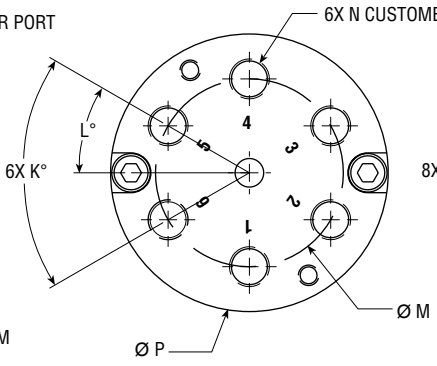


PRESSURE INPUT PORT INTERFACE

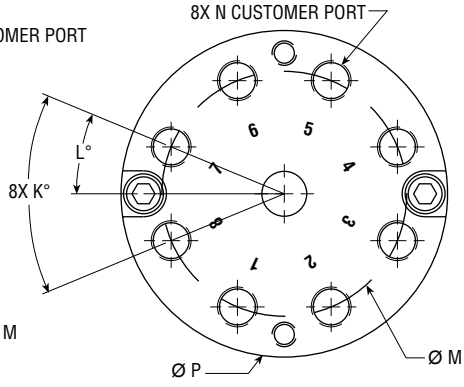
RIxx25



RIxx32



RIxx50



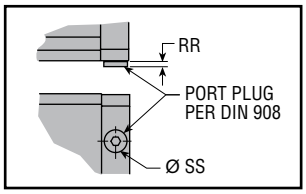
UNIT SIZE	LETTER DIMENSION																
	A	A TOL ±	B	C	D	E	F	G	H	H TOL ±	J	K°	L°	M	N	P	R
RIS125 & RID125	1.969	.002	1.378	10-32	.472	.512	.177	.026	.2355	.0003	.197	90.0	45.0	1.575	10-32	2.244	.197
RIS525 & RID525	[50]	[.05]	[35.0]	M5 x 0.8	[12.0]	[13.0]	[4.5]	[.7]	[5.98]	[.008]	[5.0]	90.0	45.0	[40.0]	M5 x 0.8	[57.0]	[5.0]
RIS132 & RID132	2.520	.002	1.811	1/4-28	.610	.630	.197	.026	.3147	.0003	.276	60.0	30.0	1.811	1/8-27 NPT	2.677	.315
RIS532 & RID532	[64.0]	[.05]	[46.0]	M6 x 1.0	[15.5]	[16.0]	[5.0]	[.7]	[7.99]	[.008]	[7.0]	60.0	30.0	[46.0]	1/8-28 BSPP	[68.0]	[8.0]
RIS250 & RID150	3.150	.002	2.283	5/16-24	.797	.906	.276	.039	.3940	.0003	.433	45.0	22.5	2.362	1/8-27 NPT	3.150	.354
RIS650 & RID550	[80.0]	[.05]	[58.0]	M8 x 1.25	[20.2]	[23.0]	[7.0]	[1.0]	[10.01]	[.008]	[11.0]	45.0	22.5	[60.0]	1/8-28 BSPP	[80.0]	[9.0]

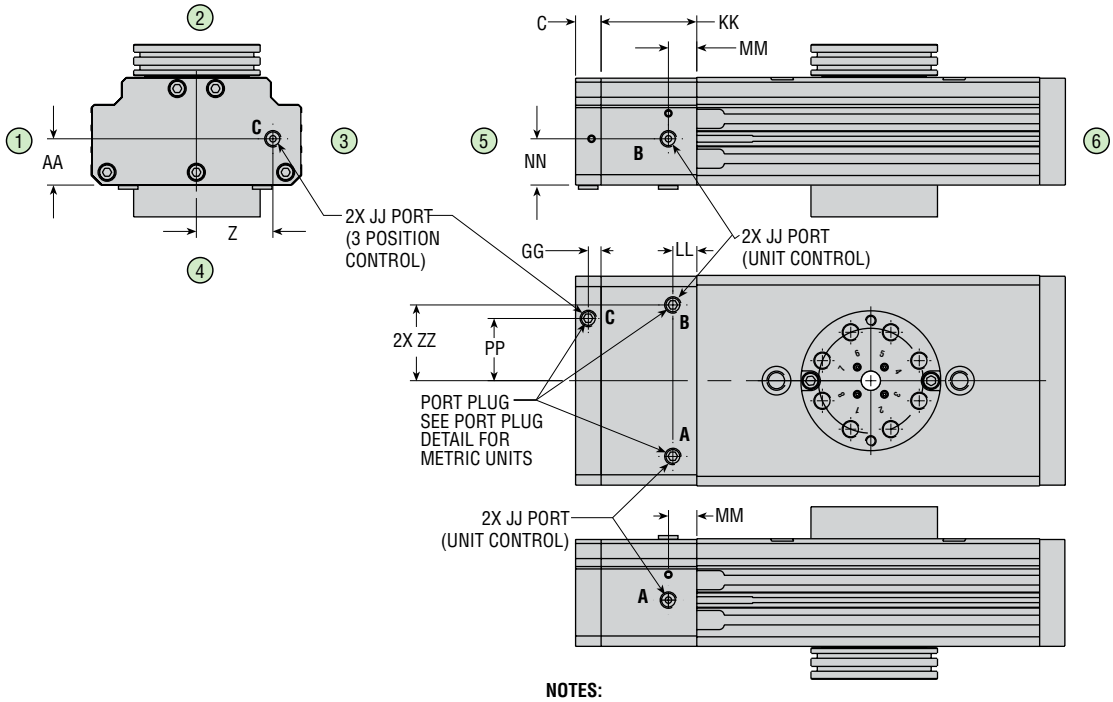
NOTES:
1) PINION AND HUB SHOWN AT MID ROTATION.
2) METRIC INFORMATION SHOWN IN [ ].

DOUBLE RACK
SIZE 25, 32, & 50

FOR DIMENSIONS NOT SHOWN HERE:
SERIES RIxH SEE PAGES 5-44 AND 5-45
SERIES RIx SEE PAGES 5-46 AND 5-47

PORT PLUG DETAIL FOR METRIC UNITS





NOTES:
1) PORT POSITIONS INDICATED BY CIRCLED NUMBERS.
2) PINION AND HUB SHOWN AT MID ROTATION.
3) PORTS "A" AND "B" MUST BE PRESSURIZED IMMEDIATELY BEFORE MOVING TO OR FROM THE MID-POSITION TO ALLOW CORRECT FLOW CONTROL AND FUNCTION.

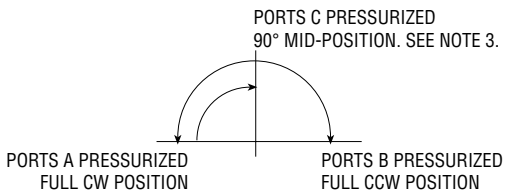
UNIT SIZE	LETTER DIMENSION								
	AA	JJ	KK	LL	MM	NN	RR	SS	ZZ
3RID125	.618	10-32	1.496	.354	.354	.618	—	—	.807
3RID525	[15.7]	M5 x 0.8	[38.0]	[9.0]	[9.0]	[15.7]	—	—	[20.5]
3RID132	.854	1/8-27 NPT	1.965	.492	.571	.854	—	—	1.161
3RID532	[21.7]	1/8-28 BSPP	[49.9]	[12.5]	[14.5]	[21.7]	[2.5]	[15.0]	[29.5]
3RID150	1.142	1/8-27 NPT	2.362	.591	.701	1.142	—	—	1.870
3RID550	[29.0]	1/8-28 BSPP	[60.0]	[15.0]	[17.8]	[29.0]	[2.5]	[15.0]	[47.5]

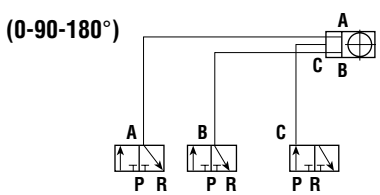
METRIC INFORMATION SHOWN IN [ ].

DOUBLE RACK DIMENSIONS

UNIT SIZE	LETTER DIMENSION			
	C	Z	GG	PP
3RID125	.472	.709	.197	.295
3RID525	[12.0]	[18.0]	[5.0]	[7.5]
3RID132	.630	1.496	.315	.472
3RID532	[16.0]	[38.0]	[8.0]	[12.0]
3RID150	.630	1.890	.315	1.535
3RID550	[16.0]	[48.0]	[8.0]	[39.0]

METRIC INFORMATION SHOWN IN [ ].





AB ANGLE ADJUSTMENTS WITH SHOCK PAD INSTALLED BOTH ENDS

AC ANGLE ADJUSTMENTS WITH SHOCK PAD INSTALLED COUNTERCLOCKWISE 90°

AW ANGLE ADJUSTMENTS WITH SHOCK PAD INSTALLED CLOCKWISE 90°

Angle adjustment options and/or shock absorber options must be ordered on each unit. Both provide mechanical stops and angle adjustment of -90° from both ends of rotation.

The standard rotation for Series RI is 180°. The ability to adjust over a wide range eliminates the need to order special units for specific angles of rotation.

The angle adjustment screw has a shock pad as standard providing quiet actuator operation in less demanding applications. In more demanding applications, the optional shock absorbers should be specified to handle the higher energy dissipation.

UNIT SIZE	LETTER DIMENSION			
	A	B	C	D
RISx125	.200	2.578	.551	.770
RISx525	[5.1]	[65.5]	[14.0]	[19.6]
RISx132	.240	3.392	.787	1.100
RISx532	[6.1]	[86.2]	[20.0]	[27.9]
RISx250	.310	3.373	.984	1.360
RISx650	[7.9]	[85.7]	[25.0]	[34.5]

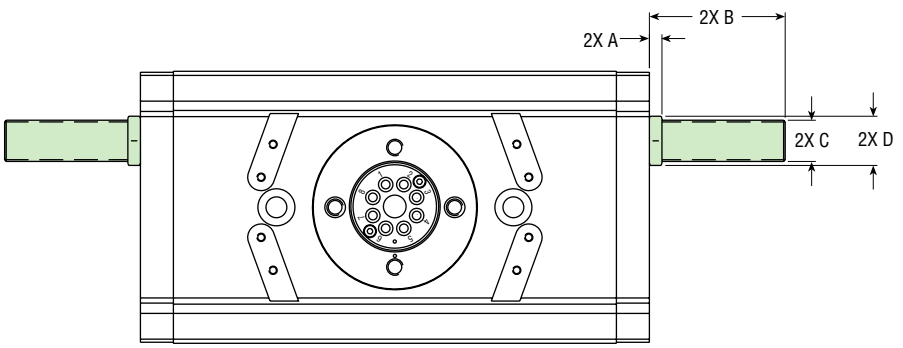
METRIC INFORMATION SHOWN IN [ ].

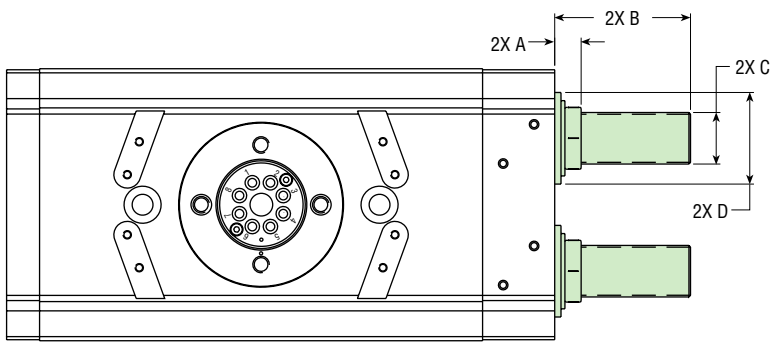
UNIT SIZE	LETTER DIMENSION			
	A	B	C	D
RIDx125	.369	1.770	.551	1.094
RIDx525	[9.4]	[45.0]	[14.0]	[27.8]
RIDx132	.424	2.644	.787	1.375
RIDx532	[10.8]	[67.2]	[20.0]	[34.9]
RIDx150	.505	2.625	.984	1.750
RIDx550	[12.8]	[66.7]	[25.0]	[44.5]

METRIC INFORMATION SHOWN IN [ ].

UNIT SIZE	ANGLE ADJUSTMENT KIT NO.*
RISxx25	69223-01
RIDxx25	69230-01
RISxx32	69226-01
RIDxx32	69231-01
RISxx50	75424-01
RIDxx50	69233-01

*ANGLE ADJUSTMENT KITS INCLUDE:
FOR RISxx UNITS - 1 ANGLE ADJUSTMENT SCREW AND 1 NUT
FOR RIDxx UNITS - 1 ANGLE ADJUSTMENT SCREW, 1 NUT, 1 THREAD SEAL AND 1 SEAL WASHER
1 KIT REQUIRED PER END OF ADJUSTMENT DESIRED.





All dimensions are reference only unless specifically toleranced.

NB SHOCK ABSORBER INSTALLED BOTH DIRECTIONS

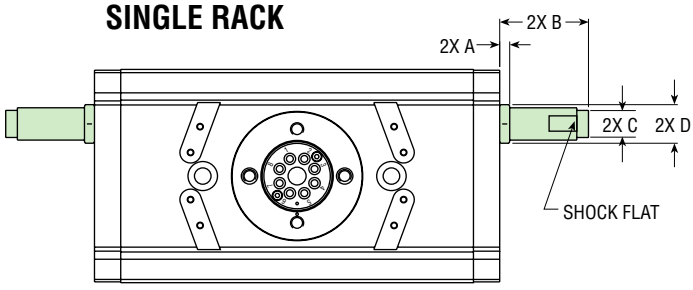
NC SHOCK ABSORBER INSTALLED COUNTERCLOCKWISE DIRECTION

NW SHOCK ABSORBER INSTALLED CLOCKWISE DIRECTION

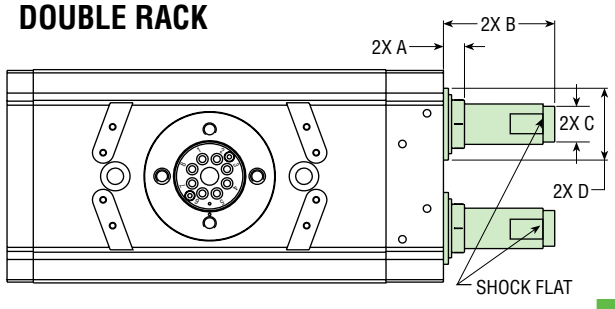
Either angle adjustment options and/or shock absorber options must be ordered on each unit. Both provide mechanical stops and angle adjustment of -90° from both ends of rotation.

The shock absorber options provide maximum deceleration control and rotational stopping ability. The -NB, -NC, and -NW options provide the Rotary Actuator with the shock absorber factory installed in the Series RI Rotary Actuator. See PHD Sizing Catalog for details on unit stopping capacity with installed shock absorbers. Reference the Shock Absorber Specifications Chart for nominal effective angle of rotation in each direction.

SINGLE RACK



DOUBLE RACK



UNIT	LETTER DIMENSION A	B	C	D
RIS125	.200	2.847	.470	.770
RIS525	[5.1]	[72.3]	[11.9]	[19.6]
RIS132	.240	3.263	.660	1.100
RIS532	[6.1]	[82.9]	[16.8]	[27.9]
RIS250	.310	3.924	.870	1.360
RIS650	[7.9]	[99.7]	[22.1]	[34.5]

METRIC INFORMATION SHOWN IN [ ].

UNIT	LETTER DIMENSION A	B	C	D
RID125	.369	2.039	.470	1.094
RID525	[9.4]	[51.8]	[11.9]	[27.8]
RID132	.424	2.515	.660	1.375
RID532	[10.8]	[63.9]	[16.8]	[34.9]
RID150	.505	3.176	.870	1.750
RID550	[12.8]	[80.7]	[22.1]	[44.5]

METRIC INFORMATION SHOWN IN [ ].

SHOCK ABSORBER SPECIFICATIONS

UNIT SIZE	SHOCK ABSORBER KIT NO.	THREAD TYPE mm	STROKE in	STROKE mm	SHOCK ABSORBER WEIGHT lb	SHOCK ABSORBER WEIGHT kg	KINETIC ENERGY LOAD in-lb	KINETIC ENERGY LOAD Nm	SHOCK ABSORBER LENGTH in	SHOCK ABSORBER LENGTH mm	ACROSS SHOCK FLATS in	ACROSS SHOCK FLATS mm	SHOCK ABSORBER EFFECTIVE ANGLE
RISxx25	69146	M14 x 1.5	.42	10.7	.12	.05	150	17	4.00	101.6	.47	11.9	50
RIDxx25	69153	M14 x 1.5	.42	10.7	.12	.05	150	17	4.00	101.6	.47	11.9	50
RISxx32	69147	M20 x 1.5	.625	15.9	.28	.13	225	25	4.67	118.6	.69	17.5	60
RIDxx32	69154	M20 x 1.5	.625	15.9	.28	.13	360	40	4.67	118.6	.69	17.5	60
RISxx50	75423	M25 x 1.5	.91	23.1	.76	.34	600	68	5.51	140.0	.88	22.4	70
RIDxx50	69156	M25 x 1.5	.91	23.1	.76	.34	1200	136	5.51	140.0	.88	22.4	70

SHOCK ABSORBERS KITS INCLUDE:
FOR RISxx UNITS - 1 SHOCK AND 1 NUT
FOR RIDxx UNITS - 1 SHOCK, 1 NUT, 1 THREAD SEAL, AND 1 SEAL WASHER
1 KIT REQUIRED PER END OF ADJUSTMENT DESIRED

NOTE: The shock absorber doubles as the rotation adjustment. Shock absorbers or angle adjustment option **must** be installed in the rotary actuator prior to operating the unit. Operation of units without installed shocks or angle adjustment can damage the units and void any and all warranties. Only shock absorbers specified by PHD should be used in Series RI Rotary Actuators. The use of any other shock absorbers will affect actuator performance and life expectancy.

PHD recommends replacing shocks every 1,000,000 cycles to maintain peak actuator performance and life.

PB ROTATION SPEED CONTROL BOTH DIRECTIONS

PC ROTATION SPEED CONTROL COUNTERCLOCKWISE DIRECTION

PW ROTATION SPEED CONTROL CLOCKWISE DIRECTION

The PHD Series RI offers optional external compact flow control fittings for adjusting output hub rotation speed. The speed of the hub is controlled by regulating the cylinder exhaust. The control fittings are unidirectional flow control valves where intake air flows freely through the flow control and exhaust is metered out through an adjustment screw. Intake capacity is slightly greater than the full open exhaust capacity, enabling maximum variation of hub rotation speed.

The PHD Series RI flow control fittings are mounted directly to the caps and provide an integral tube fitting connection. They also swivel 360° around the ports, easing tube routing installation. Rotational velocities are adjusted and maintained by the captivated fine adjustment screw with a locking nut to ensure precise velocity control and repeatability in output hub rotation speed.

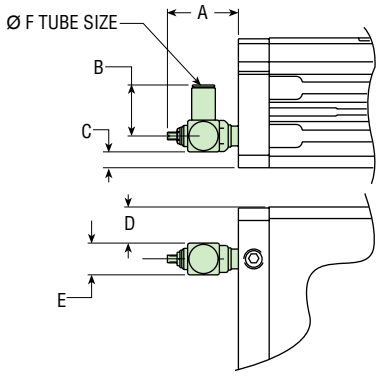
NOTE: Flow control fitting is effective between 15 to 100 psi [1.0 to 7.0 bar] and from 5° to 160°F [-15° to 71.1°C].

UNIT SIZE	LETTER DIMENSION					
	A	B	C	D	E	F
RIxx125	.984	.827	.197	.630	.394	.156
RIxx525	[25.0]	[21.0]	[5.0]	[16.0]	[10.0]	[4.0]
RIxx132	1.614	1.043	.069	.817	.650	.250
RIxx532	[41.0]	[26.5]	[1.8]	[20.8]	[16.5]	[6.4]
RIxx150	1.693	1.043	.069	.743	.650	.250
RIxx550	[43.0]	[26.5]	[1.8]	[18.9]	[16.5]	[6.4]

METRIC INFORMATION SHOWN IN [ ].

UNIT SIZE	ROTATION SPEED CONTROL KIT NO.
RIxx125	70695-01
RIxx525	70696-01
RIxx132	70695-03
RIxx532	70696-03
RIxx150	70695-03
RIxx550	70696-03

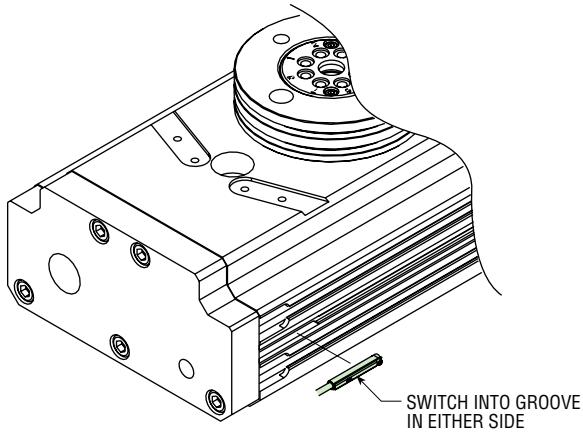
1 KIT REQUIRED PER END OF ADJUSTMENT DESIRED
NOTE: ONE FLOW CONTROL FITTING PER KIT



M MAGNETS FOR PHD 6790 SOLID STATE AND REED SWITCHES

This option equips the rotary actuator with magnets on the rack for use with PHD Series 6790 Solid State Switches. These switches mount easily to the actuator using the switch slots in the sides of the body.

PHD Series 6790 Solid State and Reed Switches are designed specifically to provide an input signal to various types of programmable controllers or logic systems. See Switches and Sensors section for ordering information on the Series 6790 Switches.



SERIES 6790 SWITCHES

PART NO.	DESCRIPTION
67902-1-02	NPN (Sink) or PNP (Source) DC Reed, 2 m cable
67902-1-05	NPN (Sink) or PNP (Source) DC Reed, 5 m cable
67903-1-02	NPN (Sink) DC Solid State, 2 m cable
67903-1-05	NPN (Sink) DC Solid State, 5 m cable
67904-1-02	PNP (Source) DC Solid State, 2 m cable
67904-1-05	PNP (Source) DC Solid State, 5 m cable
67922-1	NPN (Sink) or PNP (Source) DC Reed, Quick Connect
67923-1	NPN (Sink) DC Solid State, Quick Connect
67924-1	PNP (Source) DC Solid State, Quick Connect
67929-2	AC Reed, Current Limited, Quick Connect
63549-02	2 m Cordset with Quick Connect
63549-05	5 m Cordset with Quick Connect

NOTES:
1) Switch set screw torque to 16 in-oz [.11 Nm] max.
2) See Switches and Sensors section for additional switch information and complete specification.

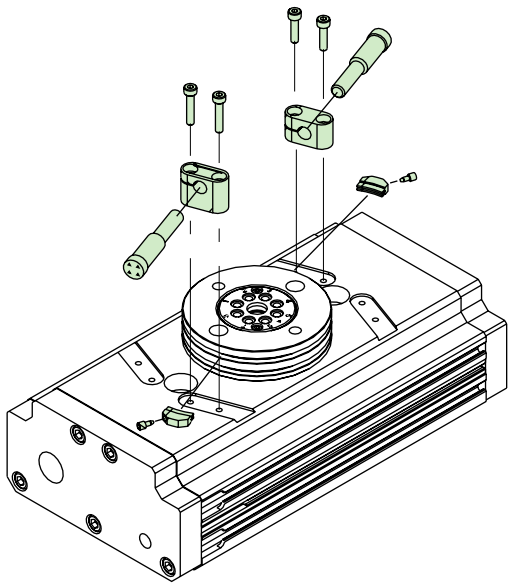
All dimensions are reference only unless specifically toleranced.

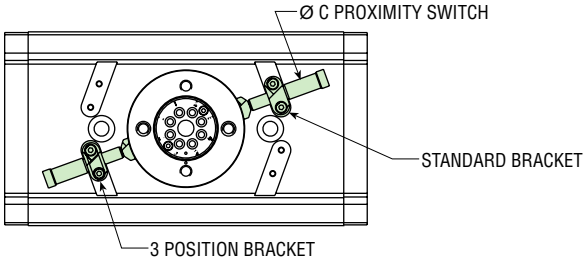
EXTERNAL PROXIMITY SWITCHES

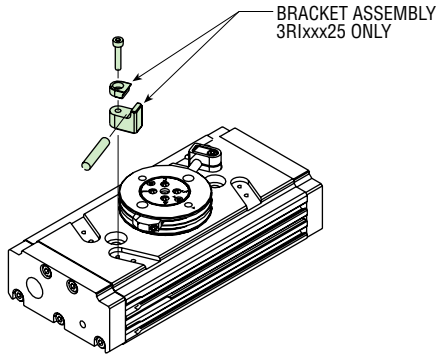
This accessory provides for the external mounting of round metal sensing proximity switches. One switch mounting kit is required per switch and includes the plastic bracket with the required mounting hardware. A steel switch target is also included in each external proximity switch mounting kit.

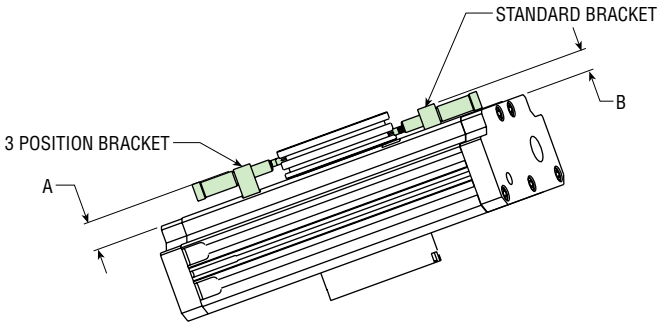
The Series RI body accepts up to four external proximity switches. The typical application requires two switch mounting kits, however, if the three position model has been ordered, the three position switch bracket kit must also be ordered. This kit utilizes the top target groove in the hub and therefore positions the proximity switch higher from the body.

Proximity switches are supplied by the customer, see chart below for switch diameter specifications, dimension C.









VIEW AA

UNIT SIZE	LETTER DIMENSION A	B	C
RIxx125	.456	.413	.197
RIxx525	[11.6]	[10.5]	[5.0]
RIxx132	.571	.452	.197
RIxx532	[14.5]	[11.5]	[5.0]
RIxx150	.748	.571	.315
RIxx550	[19.0]	[14.5]	[8.0]

METRIC INFORMATION SHOWN IN [ ].

UNIT SIZE	STANDARD PROXIMITY KIT NO.
RIxxx25	69181
RIxxx32	69182
RIxxx50	69184

STANDARD PROXIMITY KITS INCLUDE:
1 TARGET ASSEMBLY
- 1 CAM PIN
- 1 TARGET

1 BRACKET OR BRACKET ASSEMBLY WITH REQUIRED MOUNTING HARDWARE

UNIT SIZE	3 POSITION PROXIMITY KIT NO.
3 RIDxx25	70207
3 RIDxx32	70208
3 RIDxx50	70209

3 POSITION PROXIMITY KITS INCLUDE:
1 TARGET ASSEMBLY
- 1 CAM PIN
- 1 TARGET

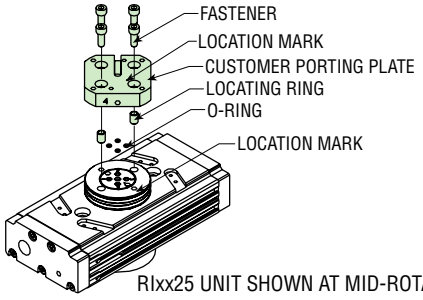
1 BRACKET OR BRACKET ASSEMBLY WITH REQUIRED MOUNTING HARDWARE

PORTING PLATE

This accessory provides a convenient conversion from the manifold output hub interface to a threaded port interface. It allows the use of the manifold hub feature of the Series RI Rotary Actuator, without the need to drill communication holes through the attached tooling. It also allows the plumbing of secondary actuators using the fittings and tubing of your choice.

The Porting Plate is made from 6061-T6 aluminum and is machined on all sides ensuring flat and parallel mounting surfaces. Four drilled and tapped holes are provided to attach your tooling. Location accuracy is maintained through the use of locating rings and dowel pin holes.

The Porting Plate also features numbered ports corresponding to the rotary actuator input ports. A location mark keeps proper port alignment simple during assembly.

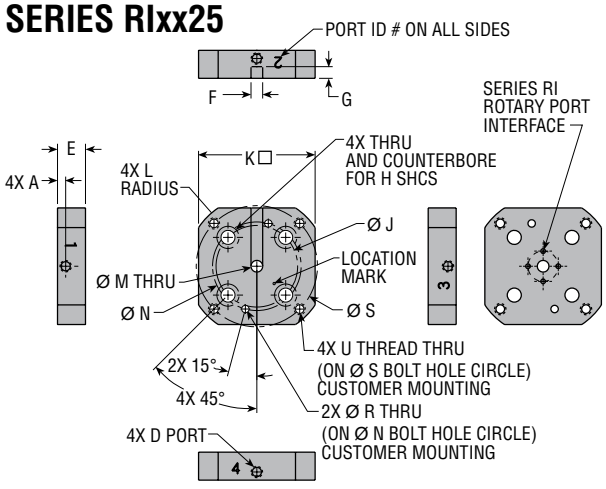


RIxx25 UNIT SHOWN AT MID-ROTATION

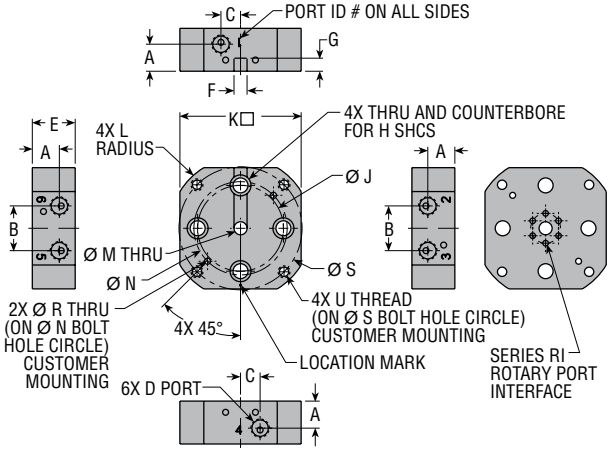
UNIT	KIT NUMBER	SCREW SIZE (SHCS)	REQUIRED SCREW TORQUE in-lb	Nm
RIS125 & RID125	71972	10-32 x .5	75	8.5
RIS525 & RID525	71997	M5 x 0.8 x 12	75	8.5
RIS132 & RID132	71973	1/4-28 x .75	150	16.9
RIS532 & RID532	71998	M6 x 1.0 x 22	150	16.9
RIS250 & RID150	71975	5/16-24 x .875	250	28.2
RIS650 & RID550	72000	M8 x 1.25 x 25	250	28.2

KITS INCLUDE: 1 PORTING PLATE, 2 LOCATING RINGS, 4 FASTENERS, REQUIRED O-RINGS

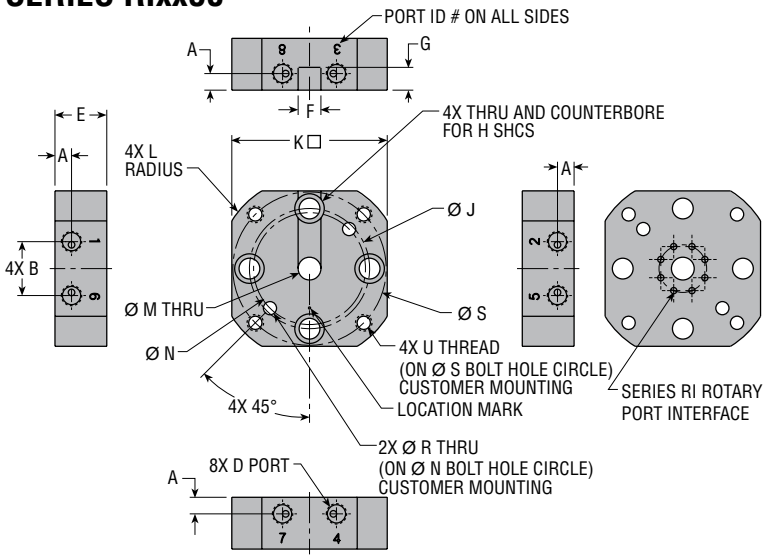
SERIES RIxx25



SERIES RIxx32



SERIES RIxx50



UNIT SIZE	LETTER DIMENSION A	B	C	D	E	F
RIS125 & RID125	.138	—	—	10-32	.472	.197
RIS525 & RID525	[3.5]	—	—	[M5 x 0.8]	[12.0]	[5.0]
RIS132 & RID132	.571	.945	.413	1/8 NPT	.906	.276
RIS532 & RID532	[14.5]	[24.0]	[10.5]	[1/8 BSPP]	[23.0]	[7.0]
RIS250 & RID150	.315	1.024	—	1/8 NPT	.984	.433
RIS650 & RID550	[8.0]	[26.0]	—	[1/8 BSPP]	[25.0]	[11.0]

UNIT SIZE	LETTER DIMENSION G	H	J	K	L	M
RIS125 & RID125	.197	10-32	1.378	1.969	1.181	.197
RIS525 & RID525	[5.0]	[M5 x 0.8]	[35.0]	[50.0]	[30.0]	[5.0]
RIS132 & RID132	.276	1/4-28	1.811	2.559	1.496	.276
RIS532 & RID532	[7.0]	[M6 x 1.0]	[46.0]	[65.0]	[38.0]	[7.0]
RIS250 & RID150	.433	5/16-24	2.283	2.953	1.732	.433
RIS650 & RID550	[11.0]	[M8 x 1.25]	[58.0]	[75.0]	[44.0]	[11.0]

UNIT SIZE	LETTER DIMENSION N	R	S	U
RIS125 & RID125	1.496	.1252	2.047	10-24
RIS525 & RID525	[38.0]	[3.005]	[52.0]	[M5 x 0.8]
RIS132 & RID132	1.969	.1252	2.598	1/4-20
RIS532 & RID532	[50.0]	[3.005]	[66.0]	[M6 x 1.0]
RIS250 & RID150	2.126	.2503	2.913	5/16-18
RIS650 & RID550	[54.0]	[6.007]	[74.0]	[M8 x 1.25]

METRIC INFORMATION SHOWN IN [ ].

All dimensions are reference only unless specifically toleranced.

MANIFOLD O-RING SEAL KIT

This accessory provides the necessary o-rings to fit the manifold hub of the Series RI Rotary Actuator. This allows the rotary actuator to easily interface to customer supplied tooling. The o-rings are 70 durometer, Buna-N rubber.

MANIFOLD O-RING SEAL KIT SPECIFICATIONS

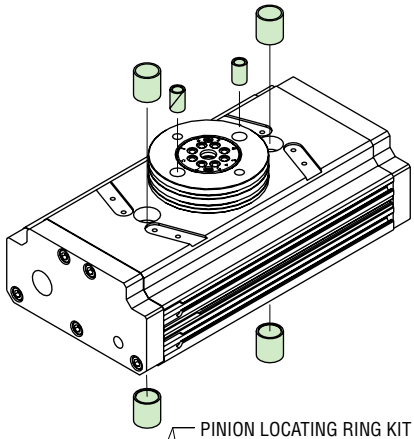
UNIT SIZE	O-RING MANIFOLD KIT NO.	NUMBER OF O-RINGS IN KIT	O-RING SIZE
RIxx25	69202	10	2 mm I.D. x 1 mm C.S.
RIxx32	69203	10	3 mm I.D. x 1 mm C.S.
RIxx50	69205	10	4 mm I.D. x 1.5 mm C.S.

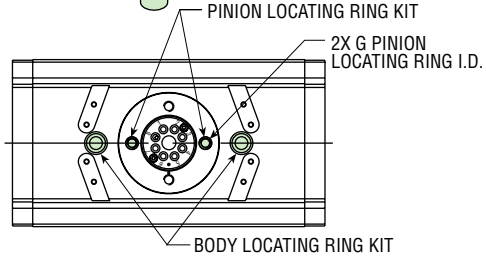
LOCATION RINGS

These accessories provide accurate body and hub positioning. The location sleeve fits into either the top or bottom H7 tolerance counter bore holes on the PHD Series RI body or hub. They provide dowel pin accuracy without requiring the additional space for a dowel. Location rings allow either through bolt or tapped body mounting to be used. The mounting bolt is placed through the location ring, simultaneously securing and locating the mating parts.

The body locating ring kit consist of two hardened and ground steel sleeves sized to press into the H7 tolerance counter bored holes on either the top or bottom of the Series RIS body.

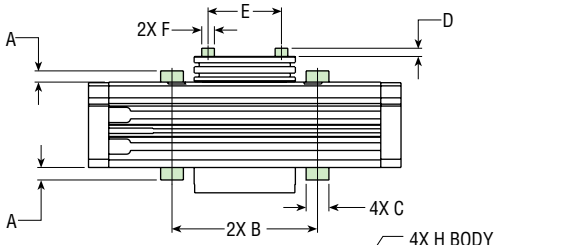
The hub locating ring kit consists of two hardened and ground steel sleeves, sized to press into the hub counter bores located on the top of the Series RI hub.





UNIT SIZE	LETTER DIMENSION									
	A	B	Ø C	C TOL.	D	E	Ø F	F TOL.	Ø G	Ø H
RIxx125	.236	2.953	.472	+.0002/-.0005	.118	1.378	.236	+.0001/-.0007	.197	.354
RIxx525	[6.0]	[75.0]	[12.0]	+[.005]/-[.013]	[3.0]	[35.0]	[6.0]	+[.003]/-[.018]	[5.0]	[9.0]
RIxx132	.236	3.937	.472	+.0002/-.0005	.079	1.811	.315	+.0001/-.0007	.252	.354
RIxx532	[6.0]	[100.0]	[12.0]	+[.005]/-[.013]	[2.0]	[46.0]	[8.0]	+[.003]/-[.018]	[6.4]	[9.0]
RIxx150	.349	4.528	.709	-.0002/-.0006	.276	2.283	.394	+.0001/-.0007	.315	.591
RIxx550	[8.9]	[115.0]	[18.0]	-[.005]/-[.015]	[7.0]	[58.0]	[10.0]	+[.003]/-[.018]	[8.0]	[15.0]

METRIC INFORMATION SHOWN IN [ ].
NOTE: LOCATING RINGS ARE TO BE PRESSED INTO BODY AND PINION

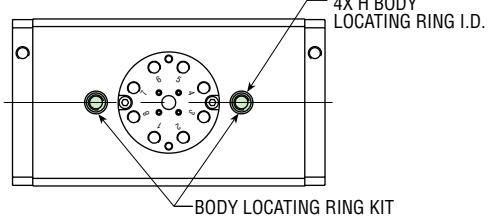


UNIT SIZE	BODY LOCATING RING KIT NO.
RIxxx25	69210
RIxxx32	69210
RIxxx50	69212

BODY LOCATING RING KITS INCLUDE 2 LOCATING RINGS

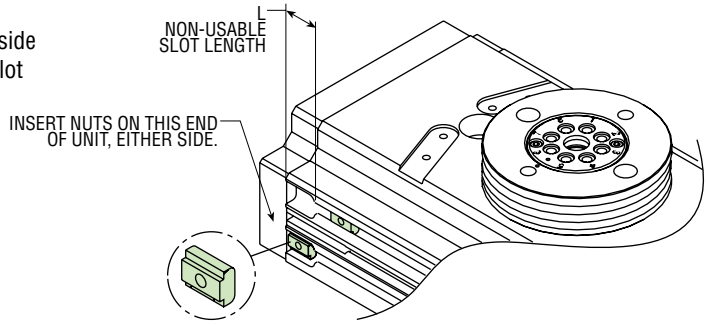
UNIT SIZE	PINION LOCATING RING KIT NO.
RIxxx25	69216
RIxxx32	69217
RIxxx50	69219

PINION LOCATING RING KITS INCLUDE 2 LOCATING RINGS



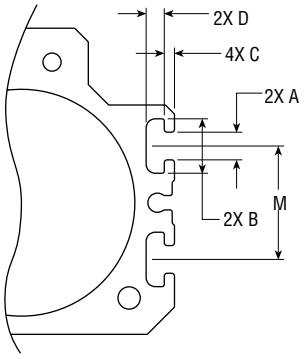
T-NUTS

T-nuts allow the rotary actuator to be mounted from the side of the unit. T-nuts can be positioned at any point along the t-slot grooves which are 90° to the pinion hub.

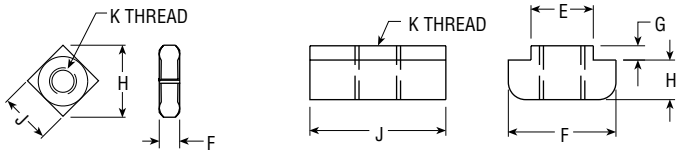


SLOT DIMENSIONS

TYPICAL BOTH SIDES (POSITION 1 & 3)



NUT DIMENSIONS



Size 25 **Sizes 32 & 50**

UNIT SIZE	SLOT DIMENSION				NUT DIMENSIONS								NUT PART NO.
	A	B	C	D	E	F	G	H	J	K	L	M	
RIxx125	.177	.315	.079	.138	—	.125	—	.389	.275	M4 x 0.7	.472	.630	3204-051-01
RIxx525	[4.5]	[8.0]	[2.0]	[3.5]	—	[3.2]	—	[9.8]	[7]		[12.0]	[16.0]	
RIxx132	.240	.472	.088	.157	.216	.374	.050	.137	.472	M4 x 0.7	.669	.787	63759-xx
RIxx532	[6.1]	[12.0]	[2.2]	[4.0]	[5.5]	[9.5]	[1.3]	[3.5]	[12.0]		[17.0]	[20.0]	
RIxx150	.240	.472	.088	.157	.216	.374	.050	.137	.472	M4 x 0.7	.669	.984	63759-xx
RIxx550	[6.1]	[12.0]	[2.2]	[4.0]	[5.5]	[9.5]	[1.3]	[3.5]	[12.0]		[17.0]	[25.0]	

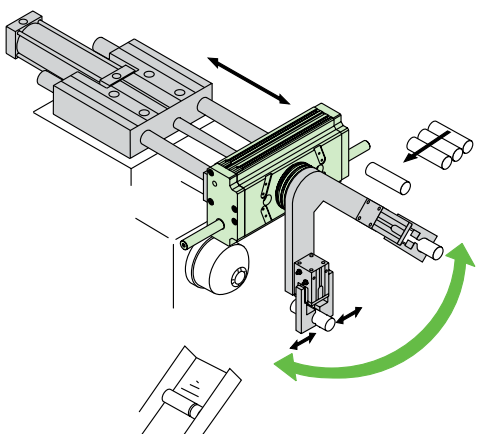
METRIC INFORMATION SHOWN IN [ ].
-xx = -00 INDICATES STANDARD PLATING -03 INDICATES -Z1 PLATING

RI

APPLICATION EXAMPLES

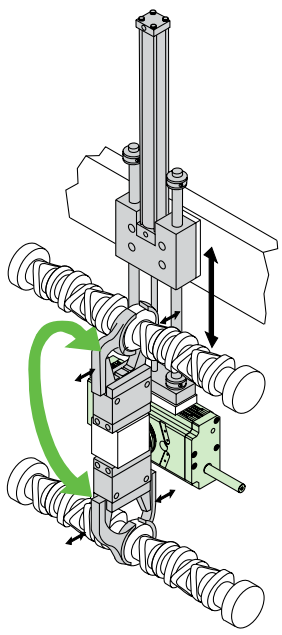
LATHE LOADER

In this application, a combination of a slide, two grippers, and a rotary actuator load and unload parts from a lathe. One Series 190 Gripper grasps a blank part on a holding rack while another Series 190 Gripper grasps a finished part in the lathe. A Series SK Slide extends out, and the finished part is removed from the lathe while the blank part is removed from the holding rack. A Series RI Rotary Actuator then rotates clockwise. The slide retracts, the blank part is loaded into the lathe, and the finished part is released into a holding bin. The Series RI Rotary Actuator is beneficial for this application due to its high torque output and the capability of routing airlines and switch cables through the pinion. This feature eliminates any external airlines, which could wear or sever causing catastrophic damage.



CAM SHAFT FINISHING PROCESS

In this application, two grippers are combined with a Series RI Rotary Actuator to load and unload cam shafts into a grinding machine for finishing. First a Series SK Slide, mounted to a gantry, will provide the reaching motion as a Series 5300 Gripper picks up the unfinished cam shaft. The Series RI Rotary Actuator rotates the grasped cam to the top position. The gantry then cycles back to the grinding machine, the second gripper is extended down into the machine to pick up the finished cam shaft, the slide retracts, the rotary actuator rotates the grippers and shafts, and the unfinished cam is loaded into the machine. Finally the finished cam shaft is moved and placed in a completion tray on a conveyor. The Series RI Rotary Actuator is ideal for this application due to its high torque output and the capability of routing airlines and switch cables through the pinion.

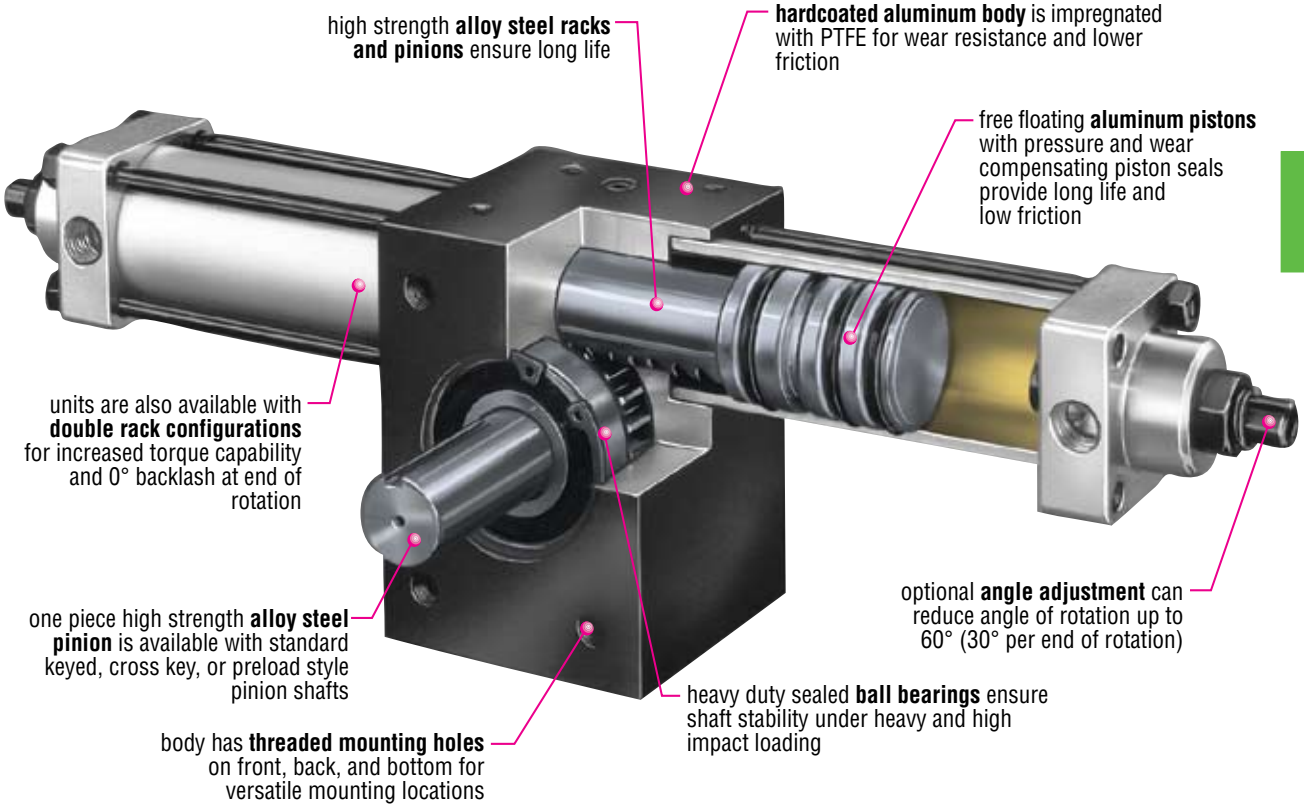


All dimensions are reference only unless specifically toleranced.

1000-8000

HEAVY DUTY
HIGH TORQUE

OUTPUT TORQUES TO 31,800 in-lb [3595 Nm]



Major Benefits

- Heavy duty
- Wide variety of options and accessories
- Versatile design
- High torque

Industry Uses

- Automotive
- General machine builders

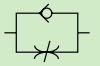
UNITS WITH IMPERIAL SHAFTS AND KEYWAY

TO ORDER SPECIFY:
Type, Design No., Series, Angle of Rotation, and Options.

DESIGN NO.
1 - Imperial
5 - Metric - Ports and mounting are metric. Pinion shafts and keyway are imperial.
6 - Metric Complete

SERIES
1 (000) 1" Bore Single Rack
2 (000) 1" Bore Double Rack
3 (000) 1-3/8" Bore Single Rack
4 (000) 1-3/8" Bore Double Rack
5 (000) 2" Bore Single Rack
6 (000) 2" Bore Double Rack
7 (000) 3" Bore Single Rack
8 (000) 3" Bore Double Rack

PORT CONTROL©



BUILT-IN METER OUT FLOW CONTROL VALVE
P - Flow control both directions
P1 - Flow control clockwise
P2 - Flow control counterclockwise

ANGLE ADJUSTMENT
A - Angle adjustment both ends
A1 - Angle adjustment clockwise 30°
A2 - Angle adjustment counterclockwise 30° (20° for Series 8000)

R1 1 A 2 180 - P - D - A - K-M-V

TYPE
R1 - Single Shaft
R2 - Double Shaft

FLUID MEDIA
A - Pneumatic
H - Hydraulic

ANGLE OF ROTATION STANDARD ANGLES
45°, 90°, 180°, 270°, 360°, and 450°
For other available rotations, consult PHD.

CUSHION OR SHOCK PAD
D - Cushions both directions
D1 - Cushion clockwise
D2 - Cushion counterclockwise
B - Shock Pads both directions
B1 - Shock Pad clockwise
B2 - Shock Pad counterclockwise
(Cushions and Shock Pads are not available on the same end of actuator. Shock Pads are not available for Hydraulic use.)

STANDARD OPTIONS
E - Magnetic Piston for Solid State Switch
I - Port Position 1 on top rack
Port Position 3 on bottom rack
(Available on Series 2000, 4000, 6000, and 8000 only.)
M - Magnetic Piston for Reed Switch
O - Ports in Position 1
(Available on Series 1000, 3000, 5000, and 7000 only.)
Q - Ports in Position 3
(Available on Series 1000, 3000, 5000, and 7000 only.)
T - Ports in Position 4
V - Fluoro-Elastomer Seals
W - Close Tolerance Rotation, +30 minutes, -0
Z1 - Electroless Nickel Plate

DESIGN NO 1 AND 5 OPTIONS ONLY
C - Cross Key Pinion Shaft
G - Shaft Seal both sides
H - Hollow Pinion Shaft (not available on type R2 units)
J - Hall Sensor for rotations not exceeding 180° (Set Point Module is ordered separately)
K - Preload Keyway Pinion Shaft (required for use with hub adaptor)
L - Counterclockwise Unidirectional Clutch (Not available on 7000/8000 units)
N - Pilot Valve Actuator (PVA)
R - Clockwise Unidirectional Clutch (Not available on 7000/8000 units)
S - SAE Ports (Hydraulic Units Only)

NOTES:
1) Sensor must be used with a PHD Set Point Module. See Switches and Sensors section for information and ordering data.
2) Mounting flanges must be ordered separately.
3) SAE Ports available. Consult PHD for sizes.

Options may affect unit length. See unit dimension and options pages for adders.

PROXIMITY SWITCH MOUNTING BRACKETS

SERIES	SIZE NO.
1000 & 2000	32
3000 & 4000	34
5000 & 6000	38
7000 & 8000	39

See Switches and Sensors section for complete ordering information.

UNIQUE ROTARY ACTUATORS ARE AVAILABLE. SEE UNIQUE PRODUCTS AT THE END OF THIS SECTION.

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° to -0°
BACKLASH AT ANY MID-ROTATION POINT AND AT END OF ROTATION WITHOUT -A (DOUBLE RACK)	1° (2000), 0°30' (4000, 6000), 0°15' (8000)
BACKLASH AT END OF ROTATION WITH -A* (DOUBLE RACK)	0° (2000, 4000, 6000, 8000)
BACKLASH ON ALL SINGLE RACK UNITS (END AND ANY MID-ROTATION)	1° (1000), 0°30' (3000, 5000), 0° 15' (7000)
LUBRICATION	Factory lubricated for rated life
MAINTENANCE	Field repairable

NOTE: *-A angle adjustment screw must be engaged or adjusted to achieve 0° backlash

	WEIGHT				BORE		DISPLACEMENT		THEORETICAL		ROTATIONAL	MAX AXIAL BEARING		MAX RADIAL BEARING		DISTANCE BETWEEN SHAFT BEARINGS	
	BASE		ADDER		DIAMETER		VOLUME/DEG		TORQUE OUTPUT		VELOCITY MAX	LOAD		LOAD			
SIZE	lb	kg	lb/°	kg/°	in	mm	in^3/°	cm^3/°	in-lb/psi	Nm/bar	deg/sec	lb	N	lb	N	in	mm
1(000)	2.3	1.0	.0022	.0010	1.000	25.4	.007	.115	.39	.64	180°	120	534	300	1334	1.375	34.9
2(000)	3.3	1.5	.0043	.0020	1.000	25.4	.014	.229	.78	1.28	180°						
3(000)	6.9	3.1	.0064	.0029	1.375	34.9	.019	.312	1.11	1.21	180°	240	1068	600	2669	2.188	55.6
4(000)	9.7	4.4	.0127	.0058	1.375	34.9	.038	.623	2.22	3.64	180°						
5(000)	10.7	4.8	.0093	.0042	2.000	50.8	.041	.672	2.36	3.87	180°	370	1646	925	4114	2.235	56.8
6(000)	15.7	7.1	.0185	.0084	2.000	50.8	.082	1.344	4.72	7.74	180°						
7(000)	34.4	15.6	.0289	.0131	3.000	76.2	.185	3.032	10.60	17.37	180°	800	3558	2000	8896	3.750	95.3
8(000)	42.2	19.1	.0578	.0262	3.000	76.2	.370	6.064	21.20	34.75	180°						

HYD SERIES	OPTION psi [bar]							
	PLAIN		-P		-D		-E OR -M	
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]

NOTE: **All hydraulic ratings are based on non-shock hydraulic service.

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.

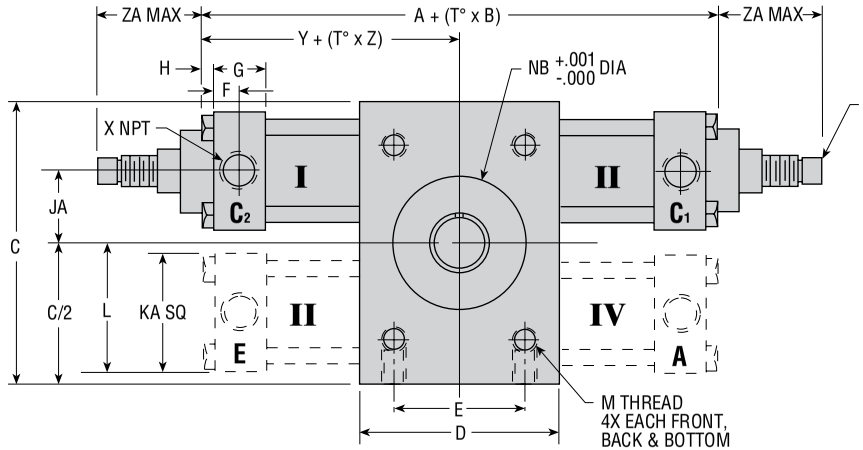
Minimum factor of safety at maximum rated hydraulic pressure for output shaft is 2:1, and for hydraulic chambers is 3:1. Consult PHD for proof pressure data. Hydraulic ratings based on non-shock, hydraulic service.

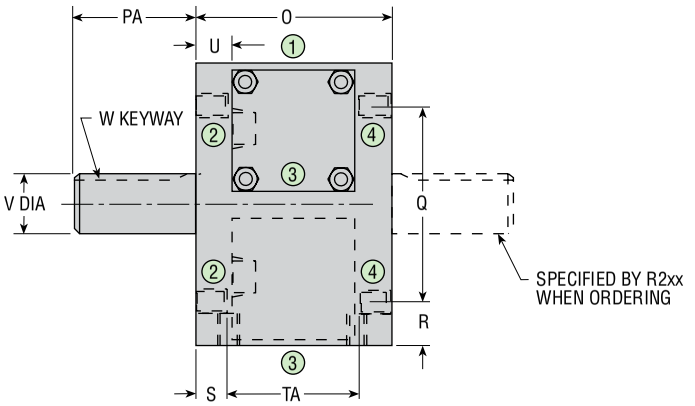
SIZING AND APPLICATION ASSISTANCE

See PHD Product Sizing Catalog for specific and complete sizing information.
Online sizing assistance is available at: ***www.phdinc.com/apps/sizing***

DIMENSIONS: SERIES 1000-8000 ROTARY ACTUATORS

IMPERIAL





CAP STYLE	SERIES	LETTER DIMENSION																									
		A	B	C	D	E	F	G	H	JA	KA	L	M	NB	O	PA	Q	R	S	TA	U	V	W	X	Y	Z	ZA
PLAIN	1000 & 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	1.125 x .056 DP	2.000	.875	2.000	.500	.250	1.500	.312	.4998/.5003	1/8 x 1/16 x .625	1/8	2.849	.0087	0.00
-A	1000 & 2000	6.198	.0174	3.000	2.000	1.500	.500	.750	0.00	.750	1.375	1.437	1/4-20 x .312 DP	1.125 x .056 DP	5.000	.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	2.000 x .039 DP	3.000	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	2.1654 x .052 DP	3.000	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	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	3.3465 x .120 DP	5.000	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

OPTION LOCATION REFERENCE

ACTUATOR TYPE	LETTER OPTION REFERENCED BY TUBE NUMBER											PORT & NEEDLE LOCATIONS REFERENCED BY CIRCLED NUMBERS														
	-A		-B		-D		-P					STANDARD			-O			-Q			-T			-I		
	-A1	-A2	-B1	-B2	-D1	-D2	-P1	-P2	-M	-E	-N	PORT	-P	-D	PORT	-P	-D	PORT	-P	-D	PORT	-P	-D	PORT	-P	-D
R1xA & R2xA	II	I	II	I	II	I	II	I	I & II	I & II	I & II	2	1	1	1	2	2	3	2	2	4	1	1	1, 3	4	4
R1xH & R2xH	II	I	N/A	N/A	II	I	II	I	I & II	I & II	N/A	2	1	1	1	2	2	3	2	2	4	1	1	1, 3	4	4

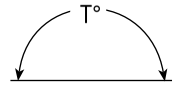
QUICK REFERENCE FOR: A + (T° x B)

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

*Dimensions calculated using plain cap style. Add .250 to dimension for each -A style cap used on Series 1000/2000 only.

SHAFT KEYWAY: SHOWN AT MID-ROTATION
PORT POSITION: INDICATED BY CIRCLED NUMBERS
-O & -Q AVAILABLE ON SERIES 1000, 3000, 5000, & 7000 ONLY
TUBES III & IV: INCLUDED ON SERIES 2000, 4000, 6000, & 8000 UNITS ONLY
MTG. HOLES: CENTERED ON CENTERLINE OF ACTUATOR BODY
CUSHIONS: SERIES 1000 & 2000 ACTUATORS
ADD 1/2" TO RESPECTIVE "A" AND "Y" DIMENSIONS FOR EACH CUSHION

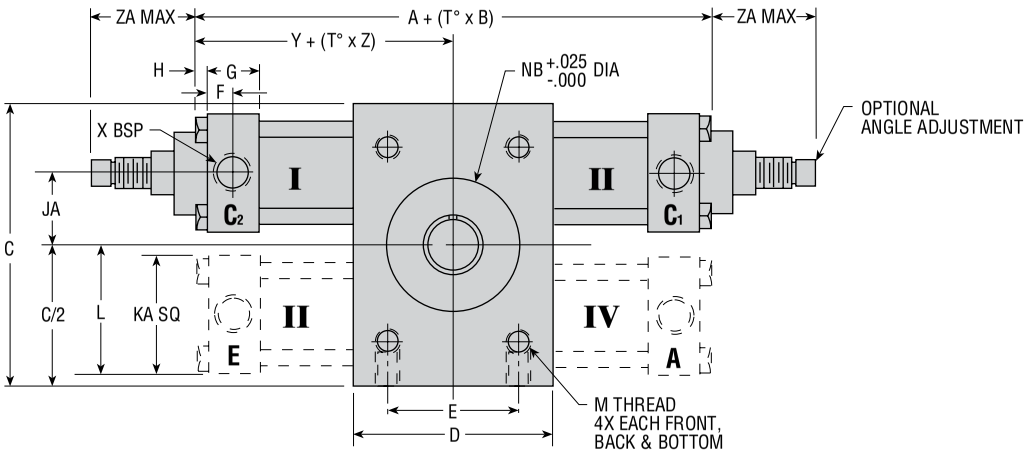
PORT PRESSURIZED - FULL CCW POSITION
C_1 ON SERIES 1000, 3000, 5000, & 7000
OR C_1 & E ON SERIES 2000, 4000, 6000, & 8000
I

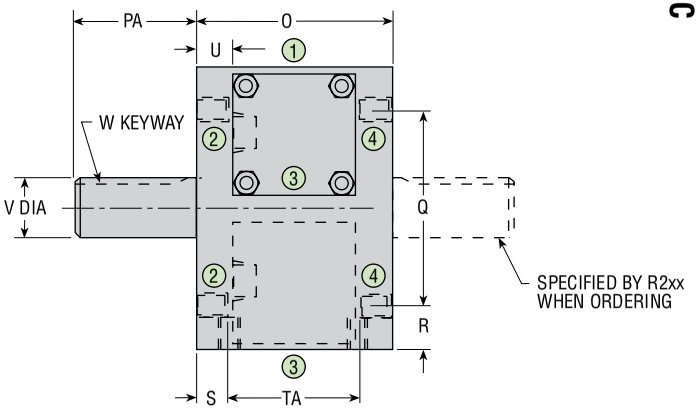


II
PORT PRESSURIZED - FULL CW POSITION
C_2 ON SERIES 1000, 3000, 5000, & 7000
OR C_2 & A ON SERIES 2000, 4000, 6000, & 8000

All dimensions are reference only unless specifically toleranced.

DIMENSIONS: SERIES 1000-8000 ROTARY ACTUATORS





CAP STYLE	SERIES	LETTER DIMENSION																			IMPERIAL SHAFTS*		METRIC SHAFTS*				
		A	B	C	D	E	F	G	H	JA	KA	L	M	NB	O	PA	Q	R	S	TA	U	V	W	V	W	X	Y	Z	ZA.
PLAIN	1000 & 2000	145	0.44	76	51	38.1	6	13	0	19	35	36	M6 x 1.0 x 8	28.58 x 1.4 DP	50.8	22	50.8	13	6	38.1	8	12.69/12.71	3.15 x 1.59 x 16	12.00/11.97	4 x 2.5 x 15	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	28.58 x 1.4 DP	50.8	22	50.8	13	6	38.1	8	12.69/12.71	3.15 x 1.59 x 16	12.99/11.97	4 x 2.5 x 15	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	50.80 x 1.0 DP	76.2	48	76.2	16	13	50.8	14	22.22/22.23	4.75 x 2.36 x 38	22.00/21.96	6 x 3.5 x 32	1/4	100	0.33	38
BOTH	5000 & 6000	232	0.66	127	102	63.5	10	19	5	29	57	58	M10 x 1.5 x 16	55.00 x 1.3 DP	76.2	48	88.9	19	13	50.8	10	28.55/28.58	6.35 x 3.18 x 38	28.00/27.96	8 x 5 x 40	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	85.00 x 3.0 DP	127.0	89	127.0	38	32	63.5	19	44.42/44.45	9.53 x 2.36 x 78	44.00/43.96	12 x 5 x 56	3/8	154	0.66	73

OPTION LOCATION REFERENCE

ACTUATOR TYPE	LETTER OPTION REFERENCED BY TUBE NUMBER											PORT & NEEDLE LOCATIONS REFERENCED BY CIRCLED NUMBERS														
	-A		-B		-D		-P		-M	-E	-N	STANDARD			-O			-Q			-T			-I		
	-A1	-A2	-B1	-B2	-D1	-D2	-P1	-P2				PORT	-P	-D	PORT	-P	-D	PORT	-P	-D	PORT	-P	-D	PORT	-P	-D
R1xA & R2xA	II	I	II	I	II	I	II	I	I & II	I & II	I & II	2	1	1	1	2	2	3	2	2	4	1	1	1, 3	4	4
R1xH & R2xH	II	I	—	—	II	I	II	I	I & II	I & II	N/A	2	1	1	1	2	2	3	2	2	4	1	1	1, 3	4	4

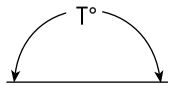
* BOTH IMPERIAL AND METRIC SHAFT OPTIONS AVAILABLE ON METRIC BODY (IMPERIAL SHAFT = DESIGN 5, AND METRIC SHAFT = DESIGN 6). NUMBERS ARE FOR METRIC UNITS AND ARE IN mm.

SHAFT KEYWAY: SHOWN AT MID-ROTATION
PORT POSITION: INDICATED BY CIRCLED NUMBERS
-O & -Q AVAILABLE ON SERIES 1000, 3000, 5000, & 7000 ONLY
TUBES III & IV: INCLUDED ON SERIES 2000, 4000, 6000, & 8000 UNITS ONLY
MTG. HOLES: CENTERED ON CENTERLINE OF ACTUATOR BODY
CUSHIONS: SERIES 1000 & 2000 ACTUATORS
ADD 13 mm TO RESPECTIVE "A" AND "Y" DIMENSIONS FOR EACH CUSHION

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	410.1	469.5	529.0
7000 & 8000	368.3	427.7	548.0	665.5	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**

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

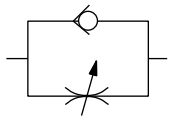
All dimensions are reference only unless specifically toleranced.

P — PORT CONTROL® BOTH DIRECTIONS

P1 — PORT CONTROL® CLOCKWISE

P2 — PORT CONTROL® COUNTERCLOCKWISE

The exclusive PHD Port Control®, "built-in" speed control valve based on the "meter-out" principle, features an adjustable needle and a separate ball check. Both are built into the rotary actuator end cap and are used to control the speed of the actuator over its entire rotation.



The self-locking needle has micrometer threads and is adjustable under pressure. It determines the orifice size which controls the exhaust volume only of the actuator proper. 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 rotary actuators. It saves space and eliminates the cost of fittings and installation for external flow control valves.

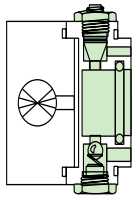
D — ADJUSTABLE CUSHIONS BOTH DIRECTIONS

D1 — ADJUSTABLE CUSHIONS CLOCKWISE

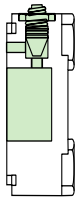
D2 — ADJUSTABLE CUSHIONS COUNTERCLOCKWISE

PHD Cushions are designed for smooth deceleration at the end of rotation. When the cushion is activated, the remaining volume in the cylinder must exhaust past an adjustable needle which controls the amount of deceleration. Effective cushion length is approximately 30° of rotation.

Cushions on Series 2000, 4000, 6000, and 8000 are furnished on one of two racks only.



1/2000 Cushion Block Style



3/8000 Poppet Style

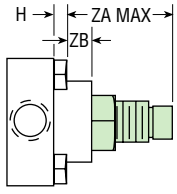
A — ANGLE ADJUSTMENT BOTH DIRECTIONS

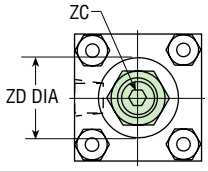
A1 — ANGLE ADJUSTMENT CLOCKWISE

A2 — ANGLE ADJUSTMENT COUNTERCLOCKWISE

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°.





SERIES	LETTER DIMENSION				
	H	ZA	ZB	ZC	ZD
1000 & 2000	0.00 [0]	1.125 [29]	.312 [8]	3/16 HEX —	.875 [22]
3000 & 4000	.250 [6]	1.500 [38]	.375 [10]	1/4 HEX —	1.250 [32]
5000 & 6000	.203 [5]	1.875 [48]	.750 [19]	1/4 HEX —	1.250 [32]
7000 & 8000	.437 [11]	2.875 [73]	.937 [24]	3/4 FLAT [19 mm]	1.750 [45]

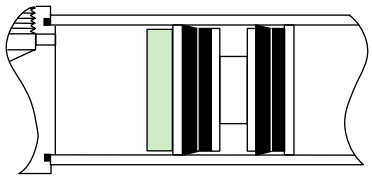
NUMBERS IN [ ] ARE FOR METRIC UNITS AND ARE IN mm.

All dimensions are reference only unless specifically toleranced.

B SHOCK PADS BOTH DIRECTIONS

B1 SHOCK PADS CLOCKWISE

B2 SHOCK PADS COUNTERCLOCKWISE

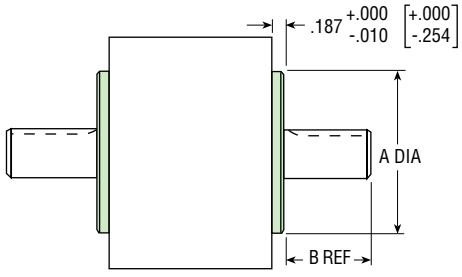


Polyurethane pads for absorption of shock and noise are available on each end of Series 1000-8000 Rotary Actuators. Reducing shock permits higher piston velocities for shorter cycle times. Reducing noise levels provides improved environment for increased productivity. Pads eliminate metal-to-metal contact between piston and end caps. **NOTE:** Air application only.

G SHAFT SEAL COVERS

Not available on Rx6x models

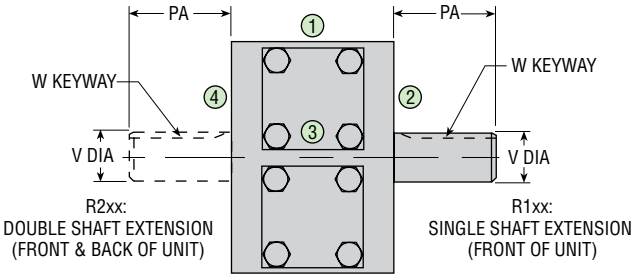
Fits all PHD Series 1000-8000, except when ordering hollow shafts. Isolates internal or external pressures. Maximum pressure differential is 500 psi [34.4 bar]. Furnished installed on actuator only (both sides). Covers are made of hard anodized aluminum. Not to be used as a pilot.



SERIES	LETTER A	LETTER B
2000	1.875 [47.63]	.688 [17.5]
4000	3.000 [76.20]	1.688 [42.9]
6000	3.250 [82.55]	1.688 [42.9]
8000	4.480 [113.79]	3.312 [84.1]

NUMBERS IN [ ] ARE FOR METRIC UNITS AND ARE IN mm.

BASIC SHAFT DIMENSIONS: R1xx and R2xx



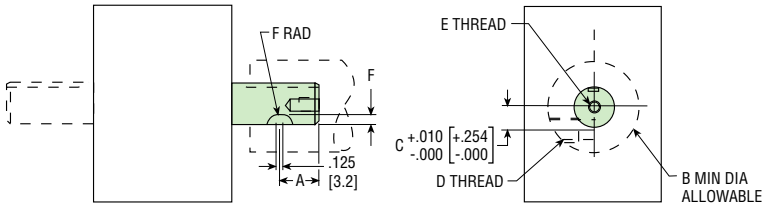
SERIES	LETTER DIMENSION				
		IMPERIAL*		METRIC**	
	PA	V	W	V	W
1000 & 2000	.875 [22]	.4998/.5003 [12.69/12.71]	1/8 x 1/16 x .625 [3.18 x 1.56 x 16]	— [12.00/11.97]	— [4 x 2.5 x 15]
3000 & 4000	1.875 [48]	.8748/.8753 [22.22/22.23]	3/16 x 3/32 x 1.500 [4.75 x 2.36 x 38]	— [22.00/21.96]	— [6 x 3.5 x 32]
5000 & 6000	1.875 [48]	1.124/1.125 [28.55/28.58]	1/4 x 1/8 x 1.500 [6.35 x 3.18 x 38]	— [28.00/27.96]	— [8 x 5 x 40]
7000 & 8000	3.500 [89]	1.749/1.750 [44.42/44.45]	3/8 x 3/16 x 3.000 [9.53 x 2.36 x 76]	— [44.00/43.96]	— [12 x 5 x 56]

NOTES:
1) **SHAFT KEYWAY:** SHOWN AT MID-ROTATION
2) *IMPERIAL SHAFT UNITS (Rx1x, Rx5x)
3) **METRIC SHAFT UNITS (Rx6x)

K PRELOADED KEYWAY SHAFT

Not available on Rx6x

Required when use with hub adaptor is desired.



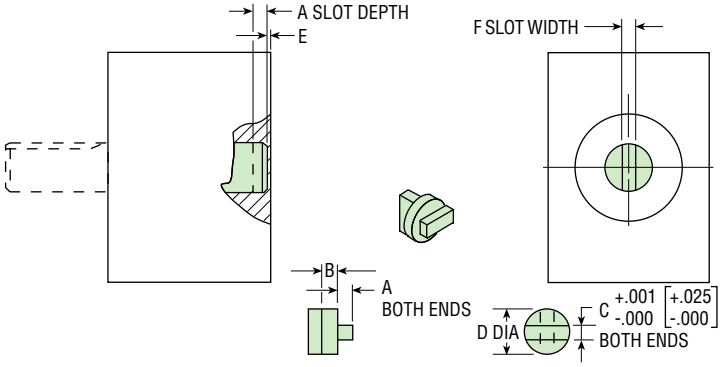
SERIES	LETTER DIMENSION					
	A	B	C	D	E	F
1000 & 2000	.375 [9.5]	1.500 [38.1]	.250 [6.35]	3/8-24 [M10]	10-32 x .312 DP [M5 x 8]	.156 [4]
3000 & 4000	.812 [20.6]	2.000 [50.8]	.437 [11.11]	1/2-20 [M12]	5/16-24 x .440 DP [M8 x 11]	.220 [6]
5000 & 6000	.812 [20.6]	3.000 [76.2]	.563 [14.28]	5/8-11 [M16]	3/8-24 x .560 DP [M10 x 14]	.251 [6]
7000 & 8000	1.500 [38.1]	4.000 [101.6]	.875 [22.22]	1-8 [M24]	1/2-20 x .687 DP [M12 x 17.5]	.438 [11]

SHAFT KEYWAY: SHOWN AT MID-ROTATION
R2xx UNITS: WHEN ORDERING SPECIFY -K-K FOR PRELOAD ON BOTH SHAFT EXTENSIONS. PRELOAD WILL BE ON OPPOSITE SIDES OF SHAFT.
SET SCREW: INCLUDED WITH UNIT

1000-8000

C CROSS KEY SHAFT

Not available on Rx6x

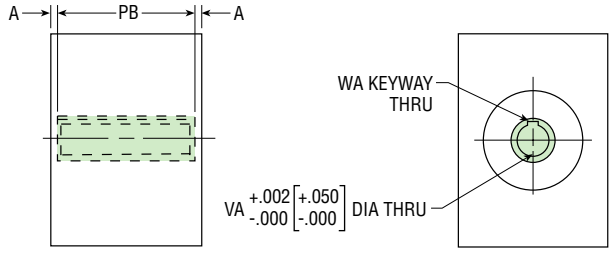


SERIES	LETTER DIMENSION					
	A	B	C	D	E	F
1000 & 2000	.250 [6.4]	.215 [5.5]	.230 [5.8]	.500 [12.7]	.118 [3]	.250 [6.3]
3000 & 4000	.250 [6.4]	.265 [6.7]	.248 [6.3]	.875 [22.2]	.120 [3]	.248 [6.3]
5000 & 6000	.437 [11]	.485 [12.3]	.500 [12.7]	1.125 [28.6]	.150 [3.8]	.5002 [12.7]
7000 & 8000	.437 [11]	.805 [20.4]	.875 [22.2]	1.750 [44.5]	.245 [6.2]	.8752 [22.2]

SHAFT KEYWAY: SHOWN AT MID-ROTATION
R2xx UNITS: WHEN ORDERING SPECIFY -C-C FOR CROSSKEY ON BOTH SHAFT EXTENSIONS
CROSSKEY: INCLUDED WITH UNIT

H HOLLOW SHAFT

Not available on Rx6x



SERIES	LETTER DIMENSION			
	A	PB	VA	WA
1000 & 2000	.042 [1.1]	1.920 [48.76]	.250 [6.35]	— —
3000 & 4000	.042 [1.1]	2.917 [74.09]	.500 [12.7]	1/8 x 1/16 [3.18 x 1.58]
5000 & 6000	.135 [3.4]	2.730 [69.34]	.687 [17.46]	3/16 x 3/32 [4.76 x 2.38]
7000 & 8000	.240 [6.1]	4.520 [114.80]	1.125 [28.57]	1/4 x 1/8 [6.35 x 3.18]

SHAFT KEYWAY: SHOWN AT MID-ROTATION

All dimensions are reference only unless specifically toleranced.

MAGNETIC PISTON FOR USE WITH PHD PROXIMITY SWITCHES

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

E SOLID STATE SWITCHES

Series 1000-8000 Rotary Actuators may be equipped with a magnetic band (specify -E) on the pistons which activates externally mounted Solid State Switches. These switches allow the interfacing of the PHD Actuators to various logic systems. This option is for use with the following switches.

SERIES 1750 SOLID STATE SWITCHES

PART NO.	COLOR	DESCRIPTION
17503-2-06	Yellow	NPN (Sink) Type 4.5-24 VDC, 6 foot cable
17504-2-06	Red	PNP (Source) Type 4.5-24 VDC, 6 foot cable
17523-2	Yellow	NPN (Sink) Type 4.5-24 VDC, Quick Connect
17524-2	Red	PNP (Source) Type 4.5-24 VDC, Quick Connect

SWITCH BRACKETS

SERIES	PART NO. SERIES 1750 SWITCH
1000 & 2000	17000-32-5
3000 & 4000	17000-34-5
5000 & 6000	17000-38-0
7000 & 8000	17000-39-0

M REED SWITCHES

The PHD Magnetic Reed Switches may be used in situations where the Solid State Switches are not applicable. As with the Solid State 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.

SERIES 1750 REED SWITCHES

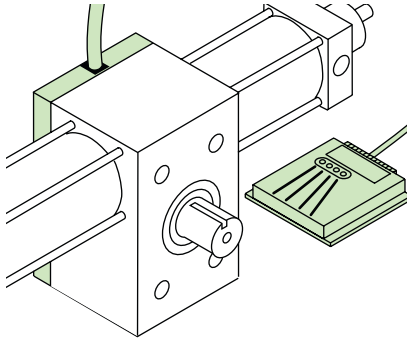
PART NO.	DESCRIPTION	
17502-2-06	White	NPN (Sink) or PNP (Source) 4.5-24 VDC, 6 foot cable
17509-3-06	Green	AC Type 110-120 VAC with Current Limit, 6 foot cable
17522-2	White	NPN (Sink) or PNP (Source) 4.5-24 VDC, Quick Connect
17529-3	Green	AC Type 110-120 VAC, Quick Connect with Current Limit

J SENSOR/SET POINT MODULE

Not available on Rx6x

PHD offers a solid state sensor transducer along with a Set Point Module which provides up to four adjustable sensing positions throughout the 180° maximum sensing range. These signals can be used as inputs to a programmable controller to signal ends of rotation in addition to multiple signals during rotation for indication of arc traveled.

The Set Point Module allows independent adjustment of each sensing position and is available for 4.5 to 24 VDC current sinking or current sourcing.



SET POINT MODULE

PART NO.	DESCRIPTION
9800-01-0300	NPN (Sink) 4.5-24 VDC
9800-01-0400	PNP (Source) 4.5-24 VDC

See Switches and Sensors section for information.

L COUNTERCLOCKWISE UNIDIRECTIONAL CLUTCH

Not available on Rx6x or 7/8000 units
Output hub will only rotate in counterclockwise direction at specific rotation ordered.

R CLOCKWISE UNIDIRECTIONAL CLUTCH

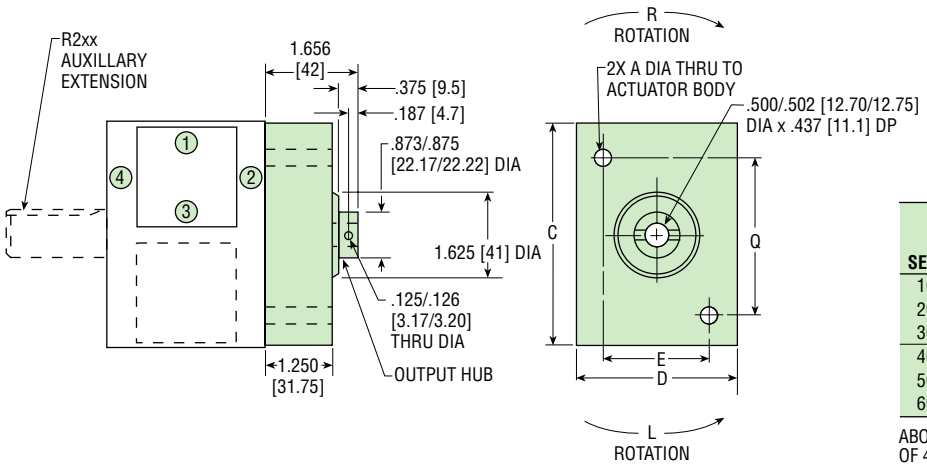
Not available on Rx6x or 7/8000 units
Output hub will only rotate in clockwise direction at specific rotation ordered.

Overrun clutch for intermittent unidirectional shaft output, available for Series 1000 through 6000.

Output hub rotates in one direction only. It remains motionless while rack and pinion reverse. Clutch repeats within ±1/2°.

Assembly features a Torrington roller clutch. Spring loaded brake shoes limit output shaft free wheeling, but are not intended for stopping external loads.

CAUTION: Any angular error will accumulate; therefore, shot pins or similar locators are necessary on index applications. Maintain shot pin location during reversal of Rotary Actuator to guarantee that clutch shaft does not move due to external forces or slight internal friction in clutch.



SERIES	LETTER DIMENSION				
	A	C	D	E	Q
1000 & 2000	.281 [7.2]	2.938 [74.6]	2.000 [51]	1.500 [38]	2.000 [50.8]
3000 & 4000	.344 [8.7]	4.188 [106.3]	3.000 [76]	2.000 [50.8]	3.000 [76.2]
5000 & 6000	.406 [10.3]	4.938 [125.4]	4.000 [102]	2.500 [63.5]	3.500 [88.9]

SERIES	LIMITING FACTORS			
	MAX. INLET PRESSURE(psi)[bar]		MAX. RADIAL OR AXIAL LOAD (lb) [N]	
1000	1052	[72]	5	[22]
2000	526	[36]	5	[22]
3000	372	[25]	10	[44]
4000	186	[13]	10	[44]
5000	174	[12]	15	[66]
6000	87	[6]	15	[66]

ABOVE INLET PRESSURES PROVIDE A MAXIMUM TORQUE OF 414 in-lb [46.8 Nm] ALLOWED BY THE CLUTCH

N PILOT VALVE ACTUATOR

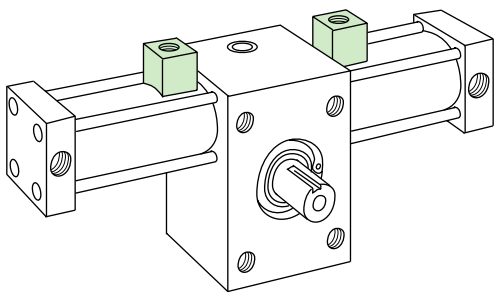
Not available on Rx6x

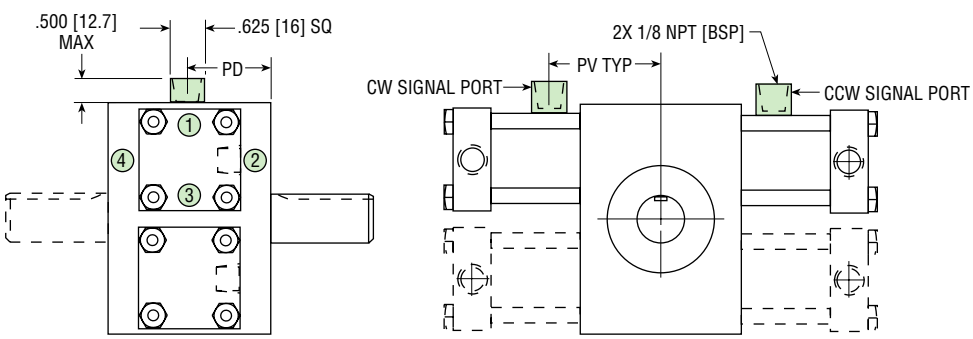
The PVA functions as a built-in pneumatic limit switch. An air pressure signal is provided at the end-of-piston travel as the piston seal uncovers an orifice in the block. Upon reversal of piston travel, the pilot pressure is shut off and the pilot line is vented through the rotary actuator housing.

Air pilot signal is provided approximately .03 inch [1 mm] prior to end of piston travel (or 10 to 15 degrees prior to end of rotation). For pneumatic use only.

PVA ports are located in position 1 unless otherwise specified.

Not available in conjunction with angle adjustment -A option.





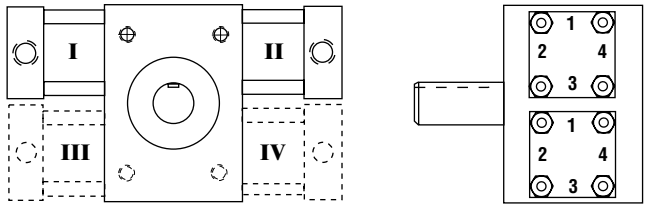
SERIES	LETTER DIMENSION		
	PD	PV STANDARD	PV W/-B
1000 & 2000	1.000 [25.4]	2.191 [55.7]	1.848 [46.9]
3000 & 4000	1.500 [38.1]	2.847 [72.3]	2.410 [61.2]
5000 & 6000	1.500 [38.1]	3.436 [87.3]	2.978 [75.6]
7000 & 8000	2.500 [63.5]	4.409 [112]	3.770 [95.8]

PVA UNITS WILL REQUIRE A MINIMUM ROTATION OF 45°

PORT & PORT CONTROL® LOCATIONS

Standard port location on all Series 1000-8000 Actuators is position 2. Standard PVA (-N) Locations are tubes I and II in position 1. Standard Port Control® and cushion adjustment needles are located in end caps I and II in position 1. Other port and adjusting needle locations are available as specified.

Needles may not be located in same position as ports.



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.

O PORTS POSITION 1 (N/A on 2, 4, 6, and 8000 units)

This option positions the ports in position 1.

Q PORTS POSITION 3 (N/A on 2, 4, 6, and 8000 units)

This option positions the ports in position 3 on tubes I and II.

T PORTS POSITION 4

This option positions the ports in position 4. This allows access to ports from the back.

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.

W CLOSE TOLERANCE ROTATION

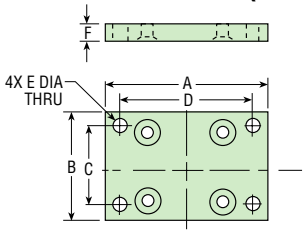
This option may be specified when a precise rotation is required and angle adjustment (see page 5-62) is not acceptable. By specifying this option, rotation will be within a tolerance of +30, -0 minutes. Standard tolerance is -0°, +10° of rotation.

Z1 ELECTROLESS NICKEL PLATING

Electroless nickel plating is done on all externally exposed ferrous parts except the pinion shaft. This optional plating treatment gives an alternative method of protecting the unit from severe environments.

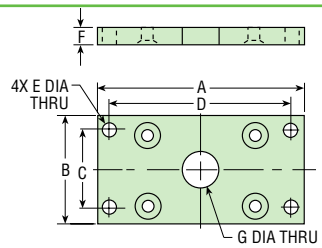
NOTE: Standard plating is Zinc and Black Oxide.

MOUNTING FLANGE (HARDWARE INCLUDED)



BOTTOM MOUNTING FLANGE

SERIES	KIT NO. IMPERIAL	KIT NO. METRIC	LETTER DIMENSION A	B	C	D	E	F
1000 & 2000	13756	14320	4.250 [108]	2.000 [51]	1.625 [41.3]	2.625 [66.7]	.281 [7.1]	.250 [6.3]
3000 & 4000	13757	14321	4.500 [114]	3.000 [76]	2.375 [60.3]	3.875 [98.4]	.406 [10.3]	.437 [11.1]
5000 & 6000	13758	14322	4.500 [114]	4.000 [102]	3.375 [85.7]	3.875 [98.4]	.406 [10.3]	.437 [11.1]



SIDE MOUNTING FLANGE

SERIES	KIT NO. IMPERIAL	KIT NO. METRIC	LETTER DIMENSION A	B	C	D	E	F	G
1000 & 2000	13759	14316	4.250 [108]	2.000 [51]	1.375 [34.9]	3.625 [92.1]	.281 [7.1]	.250 [6.3]	.625 [15.9]
3000 & 4000	13760	14317	5.750 [146]	3.000 [76]	2.125 [54.0]	5.125 [130.2]	.406 [10.3]	.437 [11.1]	1.000 [25.4]
5000 & 6000	13761	14318	6.500 [165]	4.000 [102]	3.375 [85.7]	5.875 [149.2]	.406 [10.3]	.437 [11.1]	1.250 [31.8]
7000 & 8000	13762	14319	12.000 [305]	5.000 [127]	3.000 [76.2]	10.000 [254.0]	.781 [19.8]	.750 [19.1]	1.875 [47.6]

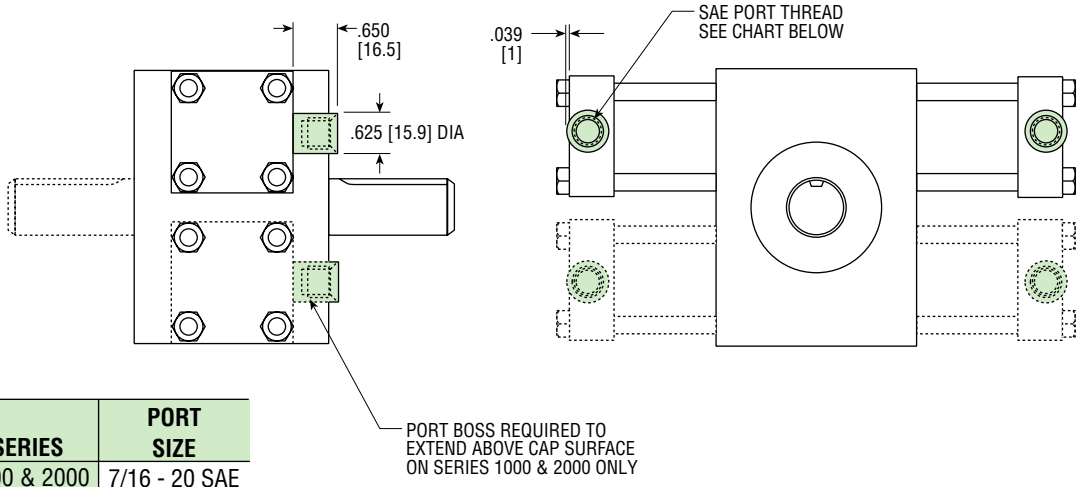
All dimensions are reference only unless specifically toleranced.

S SAE PORTS FOR HYDRAULIC FLUID

Not available on Rx6x or RxxA

SAE Ports are available on most PHD hydraulic Rotary Actuators. The Series 1000 and 2000 Rotary Actuators require a boss which is brazed to the caps.

Dimensions for this boss are shown below. 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

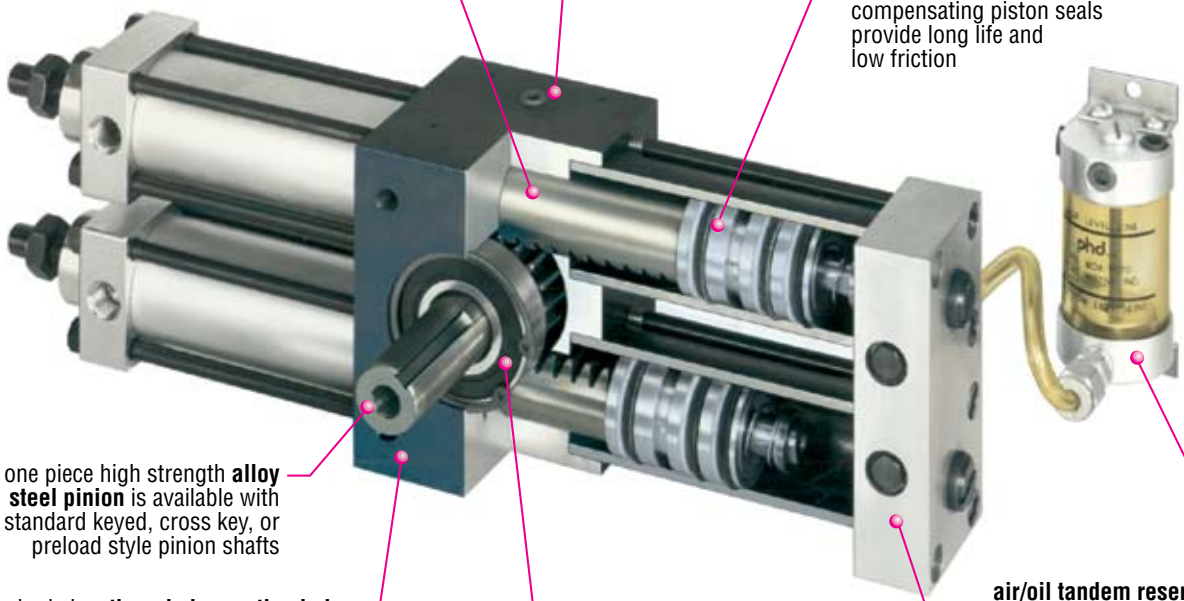
All dimensions are reference only unless specifically toleranced.

2000-8000
air/oil tandem

SMOOTH ROTATION AND CONTROLLED VELOCITY

OUTPUT TORQUES TO 1,590 in-lb [179 Nm]

Unit shown with -Y option
(Tandem cap rotated 180°)



high strength **alloy steel racks and pinions** ensure long life

hardcoated aluminum body is impregnated with PTFE for wear resistance and lower friction

free floating **aluminum pistons** with pressure and wear compensating piston seals provide long life and low friction

one piece high strength **alloy steel pinion** is available with standard keyed, cross key, or preload style pinion shafts

body has **threaded mounting holes** on the front, back, and bottom for versatile mounting locations

heavy duty **sealed ball bearings** ensure shaft stability under heavy and high impact loading

one piece **tandem cap** provides internal oil crossover with standard integrated velocity controls and optional integrated cushion controls

air/oil tandem reservoir ensures positive pressure within the oil-filled rotary section

Major Benefits

- Smooth rotation throughout rotation
- Controlled velocity

Industry Uses

- Automotive
- General industrial machines

UNITS WITH IMPERIAL SHAFTS AND KEYWAY

TO ORDER SPECIFY:
Type, Design No., Series,
Angle of Rotation, and Options.

DESIGN NO.
3 - Imperial - Ports and mounting holes are imperial
8 - Metric - Ports and mounting holes are metric. Pinion shaft and keyways are imperial.
9 - Metric Complete

SERIES
2 (000) 1" Bore Double Rack
4 (000) 1-3/8" Bore Double Rack
6 (000) 2" Bore Double Rack
8 (000) 3" Bore Double Rack
(Oil Section is 2" Bore)

CUSHION
D - Cushions both directions
D1 - Cushion clockwise
D2 - Cushion counterclockwise

ANGLE ADJUSTMENT
A - Angle adjustment both ends
A1 - Angle adjustment clockwise 30°
A2 - Angle adjustment counterclockwise 30°

3 | R1 | 3 | R | 2 | 180 | - | 90 | - | D | - | A | - | M-V

3 ROTARY POSITIONS
Use this digit for 3 Position Tandems only.

TYPE
R1 - Single Shaft
R2 - Double Shaft

FLUID MEDIA
R - Air/Oil Tandem

ANGLE OF ROTATION STANDARD ANGLES
45°, 90°, 180°, 270°, 360°, and 450°
For other available rotations, consult PHD.

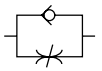
ANGLE OF ROTATION FROM POSITION I TO POSITION II
Use this digit for 3 Position Tandems only.

OPTIONS
E - Magnetic Piston for Solid State Switch
I - Port Position 1 top rack
Port Position 3 bottom rack
M - Magnetic Piston for Reed Switch
T - Port in Position 4
V - Fluoro-Elastomer Seals
W - Close Tolerance Rotation, +30 minutes, -0 (Not available on 3 positions 3RxxR units.)
Y - Tandem Cap rotated 180°
Z1 - Electroless Nickel Plate

DESIGN NO. 3 AND 8 OPTIONS ONLY
C - Cross Key Pinion Shaft
G - Shaft Seal both sides
H - Hollow Pinion Shaft
(not available on type R2xR)
J - Hall Sensor for rotations not exceeding 180° (Set Point Module is ordered separately)
K - Preload Keyway Pinion Shaft (Required for use with hub adaptors)
L - Counterclockwise Unidirectional Clutch
(Not available on 8000 units)
N - Pilot Valve Actuator (PVA)
R - Clockwise Unidirectional Clutch
(Not available on 8000 units)

NOTE: Sensor must be used with a PHD Set Point Module. See Switches and Sensors section for information and ordering data.

PORT CONTROL©



BUILT-IN METER OUT FLOW CONTROL VALVE
Port Control is standard on all Air/Oil Tandem Actuators.

PROXIMITY SWITCH MOUNTING BRACKETS

SERIES	SIZE NO.
2000	-32
4000	-34
6000	-38
8000	-39

See Switches and Sensors section for complete ordering information.

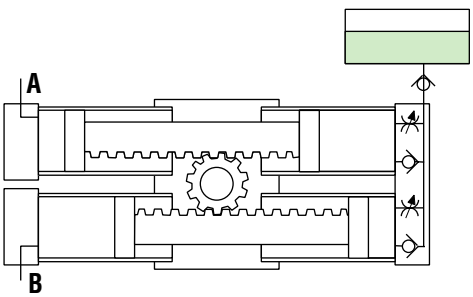
Options may affect unit length. See unit dimension and options pages for adders.

UNIQUE ROTARY ACTUATORS ARE AVAILABLE. SEE UNIQUE PRODUCTS AT THE END OF THIS SECTION.

SPECIFICATIONS	TANDEM SERIES 2000-8000
PNEUMATIC OPERATING PRESSURE	20 to 150 psi [1.4 to 10 bar]
OPERATING TEMPERATURE	-20° to 180°F [-29° to 82°C]
FULL (TOTAL) ROTATIONAL TOLERANCE	Nominal rotation +10°/-0°
MID-ROTATIONAL TOLERANCES (3-POSITION UNIT)	(see chart below for mid-position tolerance)
BACKLASH AT ANY MID-ROTATION POINT AND AT END OF ROTATION WITHOUT -A OPTION	1° (2000), 0° 30' (4000, 6000) 0° 15' (8000)
AT END OF ROTATION WITH -A OPTION* (DOUBLE RACK)	0° (2000, 4000, 6000, 8000)
AT MID-POSITION LOCATION (3 POSITION UNIT)	(see chart below for mid-position backlash)
LUBRICATION	Factory lubricated for rated life
MAINTENANCE	Field repairable

NOTE: *Angle adjustment screw must be engaged or adjusted to achieve 0° backlash. (-A standard on 3-position units)

	WEIGHT				BORE		DISPLACEMENT		THEORETICAL TORQUE OUTPUT		MAX SPEED	MAX AXIAL BEARING LOAD		MAX RADIAL BEARING LOAD		DISTANCE BETWEEN SHAFT BEARINGS	
	BASE		ADDER		DIAMETER		VOLUME/DEG				AT 80 psi						
SIZE	lb	kg	lb/°	kg/°	in	mm	in^3/°	cm^3/°	in-lb/psi	Nm/bar	deg/sec	lb	N	lb	N	in	mm
2(000)	4.5	2.0	.0059	.0027	1.000	25.4	.007	.115	.39	.64	366°	120	534	300	1334	1.375	34.9
4(000)	11.5	5.2	.0161	.0073	1.375	34.9	.019	.312	1.11	1.82	348°	240	1068	600	2669	2.188	55.6
6(000)	18.1	8.2	.0244	.0111	2.000	50.8	.041	.672	2.36	3.87	216°	370	1646	925	4114	2.235	56.8
8(000)	41.0	18.6	.0581	.0264	3.000	76.2	.185	3.032	10.60	17.37	156°	800	3558	2000	8896	3.750	95.3



3-POSITION MID-POSITION TOLERANCES & BACKLASH

SERIES	TOLERANCE	BACKLASH
2000	±1°	±1° 30'
4000 & 6000	±0° 30'	±1° 15'
8000	±0° 15'	1°

OPERATING PRINCIPLE

This feature is available on Series 2000, 4000, 6000, and 8000. One end functions as a control member only, reducing the effective output torque to match 1000, 3000, 5000, and 7000 respectively.

The illustration shows a tandem actuator with built-in Port Controls®, crossover manifold and oil reservoir. The latter 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.

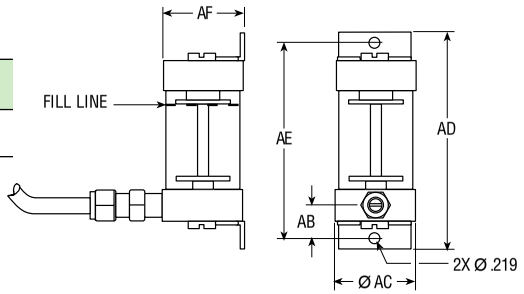
SIZING AND APPLICATION ASSISTANCE
See PHD Product Sizing Catalog for specific and complete sizing information. Online sizing assistance is available at:
www.phdinc.com/apps/sizing

DIMENSIONS: AIR/OIL TANDEM ROTARY ACTUATORS

IMPERIAL

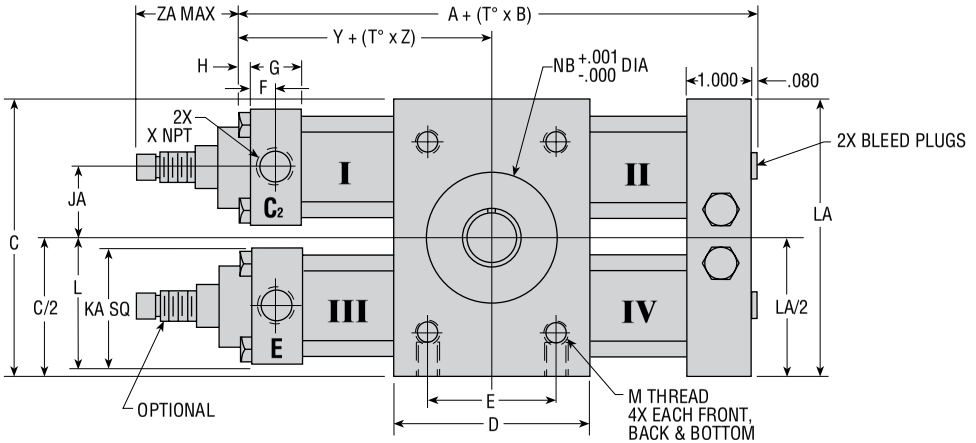
TANK DIMENSIONS

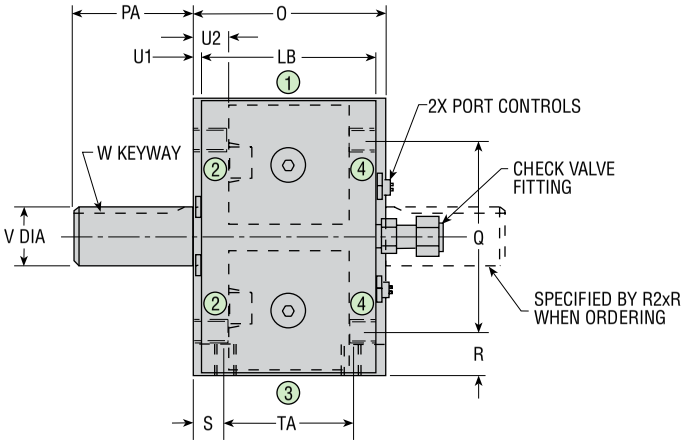
RESERVOIR PART NO.	AB	AC	AD	AE	AF
13459-02-2	.647	2.500	5.500	5.125	2.531
13459-03-2	.545	1.500	3.875	3.500	1.531



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 20 PSI PRESSURE AT ALL TIMES TO ENSURE THE SYSTEM REMAINS PURGED.



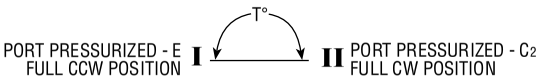


CAP STYLE	SERIES	LETTER DIMENSION																												
		A	B	C	D	E	F	G	H	JA	KA	L	LA	LB	M	NB	O	PA	Q	R	S	TA	U1	U2	V	W	X	Y	Z	ZA
PLAIN	2000	6.215	.0174	3.000	2.000	1.500	.250	.500	0.00	.750	1.375	1.437	2.875	1.750	1/4-20 x .312 DP	1.125 x .056 DP	2.000	.875	2.000	.500	.250	1.500	.125	.312	.4998/.5003	1/8 x 1/16 x .625	1/8	2.849	.0087	0
-A	2000	6.465	.0174	3.000	2.000	1.500	.500	.750	0.00	.750	1.375	1.437	2.875	1.750	1/4-20 x .312 DP	1.125 x .056 DP	2.000	.875	2.000	.500	.250	1.500	.125	.312	.4998/.5003	1/8 x 1/16 x .625	1/8	3.099	.0087	1.125
BOTH	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	2.000 x .039 DP	3.000	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
BOTH	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	2.1654 x .052 DP	3.000	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
BOTH	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	3.3465 x .120 DP	5.000	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

OPTION LOCATION REFERENCE

ACTUATOR TYPE	LETTER OPTION REFERENCED BY TUBE NUMBER							PORT & NEEDLE LOCATIONS REFERENCED BY CIRCLED NUMBERS								
	-A		-D		-P			STANDARD			-T			-I		
	-A1	-A2	-D1	-D2	-P1	-P2	-M	-E	PORT	-P	-D	PORT	-P	-D	PORT	-P	-D
R1xR & R2xR	III	I	II	IV	STANDARD		I & III	I & III	2	4	4	4	4	4	1 & 3	4	4

SHAFT KEYWAY: SHOWN AT MID-ROTATION
PORT POSITION: INDICATED BY CIRCLED NUMBERS
MTG. HOLES: CENTERED ON CENTERLINE OF ACTUATOR BODY



QUICK REFERENCE FOR: A + (T° x B)

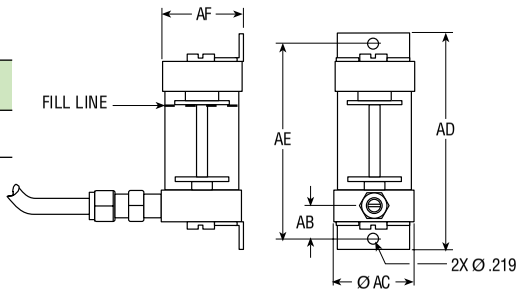
SERIES	DEGREE OF ROTATION					
	45	90	180	270	360	450
*2000	6.998	7.781	9.347	10.913	12.479	14.045
4000	9.156	10.326	12.666	15.006	17.346	19.686
6000	10.360	11.530	13.870	16.210	18.550	20.890
8000	13.468	15.808	20.488	25.168	29.848	34.528

*Dimensions calculated using plain cap style. Add .250 to dimension for each -A style cap used on Series 2000 only.

All dimensions are reference only unless specifically toleranced.

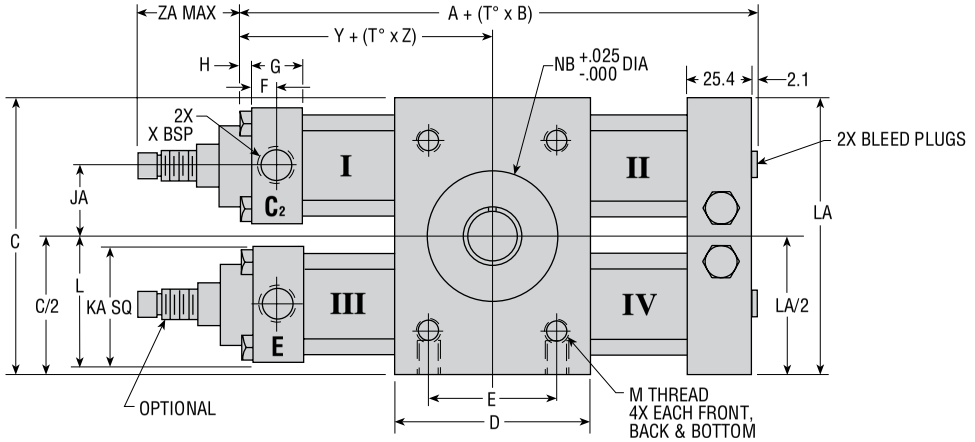
TANK DIMENSIONS

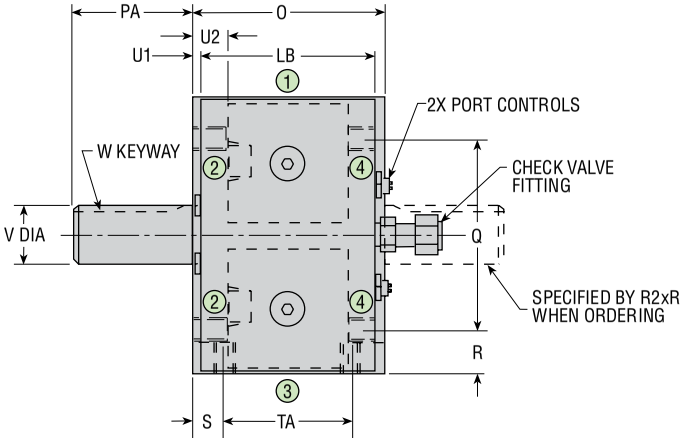
RESERVOIR PART NO.	AB	AC	AD	AE	AF
13459-02-2	16.4	63.5	139.7	130.2	64.3
13459-03-2	13.8	38.1	98.4	88.9	38.9



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.





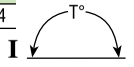
CAP STYLE	SERIES	LETTER DIMENSION																			IMPERIAL SHAFTS*		METRIC SHAFTS*						
		A	B	C	D	E	F	G	H	JA	KA	L	LA	LB	M	NB	O	PA	Q	R	S	TA	V	W	V	W	U1	U2	X	Y	Z	ZA
PLAIN	2000	158	0.44	76	51	38.1	6	13	0	19	35	36	73	44	M6 x 1.0 x 8	28.58 x 1.4	50.8	22	50.8	13	6	38.1	12.69/12.71	3.15 x 1.59 x 16	12.00/11.97	4 x 2.5 x 15	3	8	G1/8	72	0.22	0
-A	2000	165	0.44	76	51	38.1	13	19	0	19	35	36	73	44	M6 x 1.0 x 8	28.58 x 1.4	50.8	22	50.8	13	6	38.1	12.69/12.71	3.15 x 1.59 x 16	12.00/11.97	4 x 2.5 x 15	3	8	G1/8	78	0.22	29
BOTH	4000	203	0.66	108	76	50.8	9	17	6	29	48	53	106	70	M8 x 1.25 x 13	50.80 x 1.0	76.2	48	76.2	16	13	50.8	22.22/22.23	4.75 x 2.36 x 38	22.00/21.96	6 x 3.5 x 32	3	14	G1/4	100	0.33	38
BOTH	6000	233	0.66	127	102	63.5	10	19	5	29	57	58	119	70	M10 x 1.5 x 16	55.00 x 1.3	76.2	48	88.9	19	13	50.8	28.55/28.58	6.35 x 3.18 x 38	28.00/27.96	8 x 5 x 40	3	10	G1/4	116	0.33	48
BOTH	8000	283	1.32	203	127	76.2	12	27	11	48	89	92	156	76	M20 x 2.5 x 32	85.00 x 3.0	127.0	89	127	38	32	63.5	44.42/44.45	9.53 x 2.36 x 78	44.00/43.96	12 x 5 x 56	25	19	G3/8	154	0.66	73

* BOTH IMPERIAL AND METRIC SHAFT OPTIONS AVAILABLE ON METRIC BODY
(IMPERIAL SHAFT = DESIGN 8, AND METRIC SHAFT = DESIGN 9).
NUMBERS FOR METRIC UNITS AND ARE IN mm.

OPTION LOCATION REFERENCE

ACTUATOR TYPE	LETTER OPTION REFERENCED BY TUBE NUMBER								PORT & NEEDLE LOCATIONS REFERENCED BY CIRCLED NUMBERS								
	-A		-D		-P				STANDARD			-T			-I		
	-A1	-A2	-D1	-D2	-P1	-P2	-M	-E	PORT	-P	-D	PORT	-P	-D	PORT	-P	-D
R1xR & R2xR	III	I	II	IV	STANDARD		I & III	I & III	2	4	4	4	4	4	1 & 3	4	4

SHAFT KEYWAY: SHOWN AT MID-ROTATION
PORT POSITION: INDICATED BY CIRCLED NUMBERS
MTG. HOLES: CENTERED ON CENTERLINE OF ACTUATOR BODY



PORT PRESSURIZED - E I FULL CCW POSITION

II PORT PRESSURIZED - C2 FULL CW POSITION

QUICK REFERENCE FOR: A + (T° x B)

SERIES	DEGREE OF ROTATION					
	45	90	180	270	360	450
**2000	177.7	197.6	237.4	277.2	317.0	356.7
4000	232.6	262.2	321.7	381.2	440.6	500.0
6000	263.1	292.9	352.3	411.7	471.2	530.9
8000	342.1	401.5	520.4	639.3	758.1	877.0

**Dimensions calculated using plain cap style. Add 6.3 to dimension for each -A style cap used on Series 2000 only.

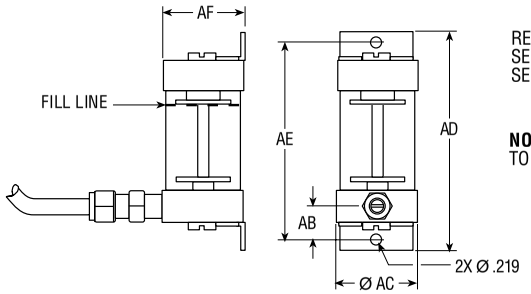
All dimensions are reference only unless specifically toleranced.

DIMENSIONS: 3-POSITION AIR/OIL TANDEM

IMPERIAL

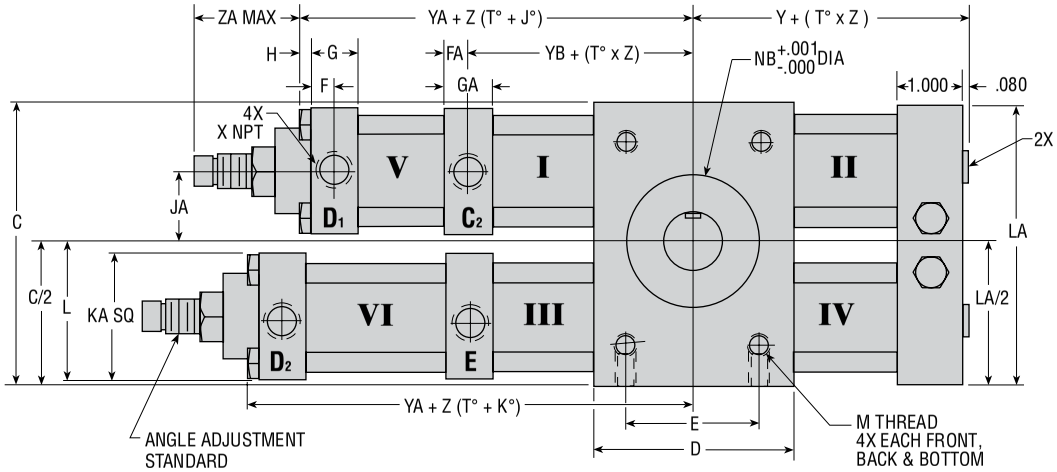
TANK DIMENSIONS

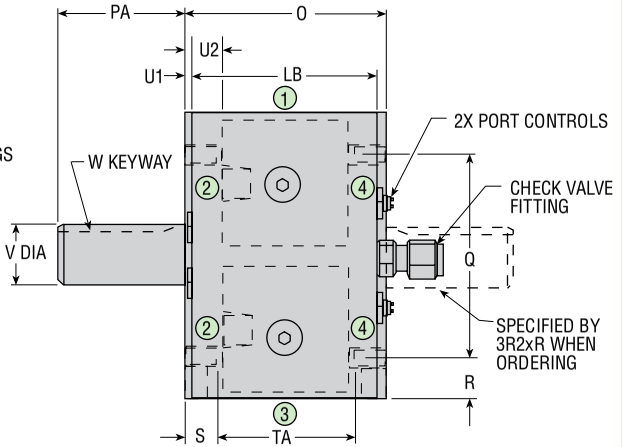
RESERVOIR PART NO.	AB	AC	AD	AE	AF
13459-02-2	.647	2.500	5.500	5.125	2.531
13459-03-2	.545	1.500	3.875	3.500	1.531



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 20 PSI PRESSURE AT ALL TIMES TO ENSURE THE SYSTEM REMAINS PURGED.



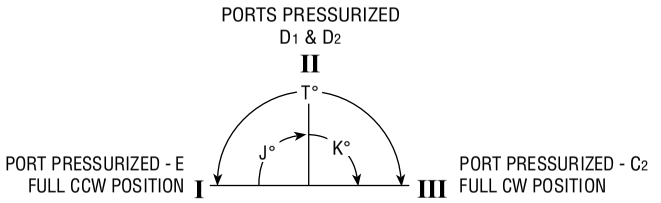


SERIES	LETTER DIMENSION																													
	C	D	E	F	FA	G	GA	H	JA	KA	L	LA	LB	M	NB	O	PA	Q	R	S	TA	U1	U2	V	W	X	Y	YA	YB	Z	ZA
2000	3.000	2.000	1.500	.500	.500	.750	.750	0.00	.750	1.375	1.437	2.875	1.750	1/4-20 x .312 DP	1.125 x .056 DP	2.000	.875	2.000	.500	.250	1.500	.125	.312	.4998/.5003	1/8 x 1/16 x .625	1/8	3.366	5.983	2.599	.0087	1.125
4000	4.250	3.000	2.000	.344	.375	.688	.719	.250	1.156	1.875	2.094	4.187	2.750	5/16-18 x .500 DP	2.000 x .039 DP	3.000	1.875	3.000	.625	.500	2.000	.125	.562	.8748/.8753	3/16 x 3/32 x 1.500	1/4	4.033	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	4.687	2.750	3/8-16 x .625 DP	2.1654 x .052 DP	3.000	1.875	3.500	.750	.500	2.000	.125	.375	1.124/1.125	1/4 x 1/8 x 1.500	1/4	4.627	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	6.125	3.000	3/4-10 x 1.250 DP	3.3465 x .120 DP	5.000	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	5.048	9.865	5.236	.026	2.875

OPTION LOCATION REFERENCE

ACTUATOR TYPE	LETTER OPTION REFERENCED BY TUBE NUMBER							PORT & NEEDLE LOCATIONS REFERENCED BY CIRCLED NUMBERS								
		-D		-P		-M	-E	STANDARD			-T			-I		
	-A	-D1	-D2	-P1	-P2	I & III	I & III	PORT	-P	-D	PORT	-P	-D	PORT	-P	-D
3R1xR & 3R2xR	STANDARD	II	IV	STANDARD		V & VI	V & VI	2	4	4	4	4	4	1 & 3	4	4

SHAFT KEYWAY: SHOWN AT MID-ROTATION
PORT POSITIONS: INDICATED BY CIRCLED NUMBERS
MTG. HOLES: CENTERED ON CENTERLINE OF ACTUATOR BODY
PLUMBING SCHEMATIC: LOCATED IN ENGINEERING DATA SECTION

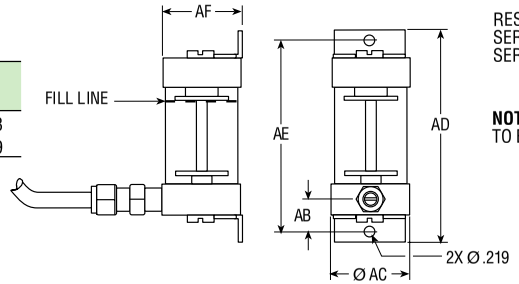


All dimensions are reference only unless specifically toleranced.

DIMENSIONS: 3-POSITION AIR/OIL TANDEM

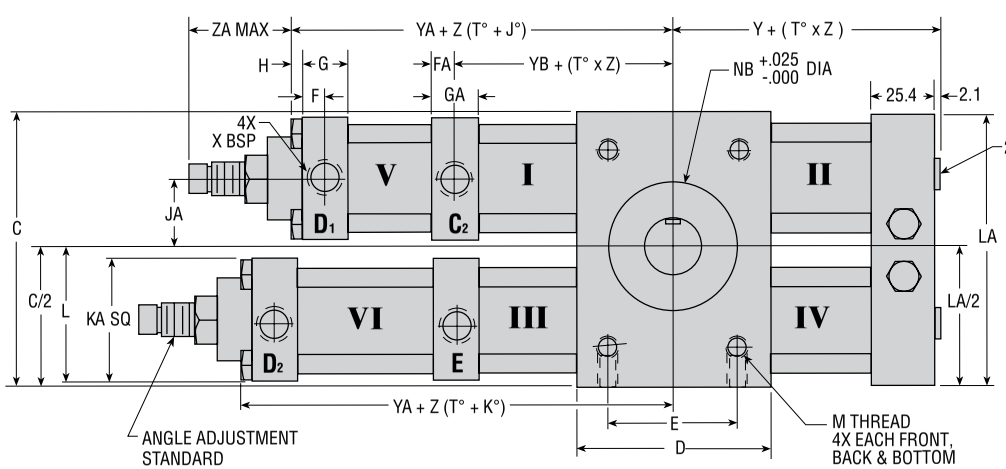
TANK DIMENSIONS

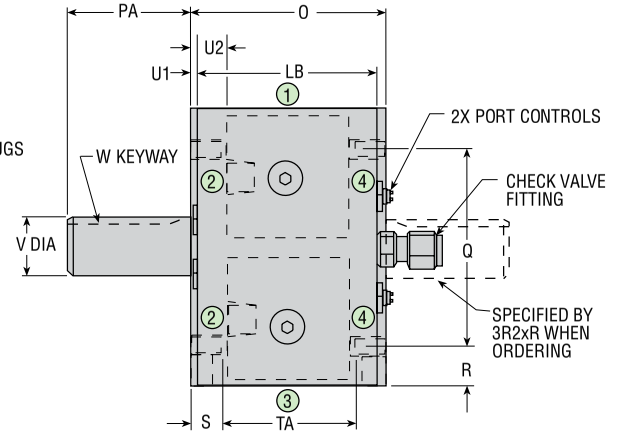
RESERVOIR PART NO.	AB	AC	AD	AE	AF
13459-02-2	16.4	63.5	139.7	130.2	64.3
13459-03-2	13.8	38.1	98.4	88.9	38.9



RESERVIOR 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.





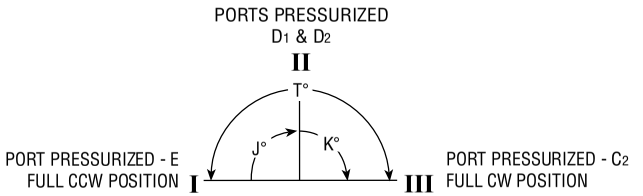
SERIES	LETTER DIMENSION																															
																								IMPERIAL SHAFTS*		METRIC SHAFTS*							
	C	D	E	F	FA	G	GA	H	JA	KA	L	LA	LB	M	NB	O	PA	Q	R	S	TA	U1	U2	V	W	V	W	X	Y	YA	YB	Z	ZA
2000	76	51	38.1	13	13	19	19	0	19	35	36	73.0	44.5	M6 x 1.0 x 8	28.58 x 1.4 DP	50.8	22	50.8	13	6	38.1	3	8	12.69/12.71	3.15 x 1.59 x 16	12.00/11.97	4 x 2.5 x 15	G1/8	85	152	66	0.22	29
4000	108	76	50.8	9	10	17	18	6	29	48	53	106.4	69.9	M8 x 1.25 x 13	50.80 x 1.0 DP	76.2	48	76.2	16	13	50.8	3	14	22.22/22.23	4.75 x 2.36 x 38	22.00/21.96	6 x 3.5 x 32	G1/4	102	171	85	0.33	38
6000	127	102	63.5	10	9	19	18	5	29	57	58	119.1	69.9	M10 x 1.5 x 16	55.00 x 1.3 DP	76.2	48	88.9	19	13	50.8	3	10	28.55/28.58	6.35 x 3.18 x 38	28.00/27.96	8 x 5 x 40	G1/4	118	186	101	0.33	48
8000	203	127	76.2	12	12	27	27	11	48	89	92	155.6	76.2	M20 x 2.5 x 32	85.00 x 3.0 DP	127.0	89	127.0	38	32	63.5	25	19	44.42/44.45	9.53 x 2.36 x 78	44.00/43.96	12 x 5 x 56	G3/8	128	251	133	0.66	73

* BOTH IMPERIAL AND METRIC SHAFT OPTIONS AVAILABLE ON METRIC BODY
(IMPERIAL SHAFT = DESIGN 8, AND METRIC SHAFT = DESIGN 9).
NUMBERS FOR METRIC UNITS AND ARE IN mm.

OPTION LOCATION REFERENCE

ACTUATOR TYPE	LETTER OPTION REFERENCED BY TUBE NUMBER						PORT & NEEDLE LOCATIONS REFERENCED BY CIRCLED NUMBERS								
		-D		-P		-M	-E	STANDARD			-T			-I		
	-A	-D1	-D2	-P1	-P2	I & III	I & III	PORT	-P	-D	PORT	-P	-D	PORT	-P	-D
3R1xR & 3R2xR	STANDARD	II	IV	STANDARD		V & VI	V & VI	2	4	4	4	4	4	1 & 3	4	4

SHAFT KEYWAY: SHOWN AT MID-ROTATION
PORT POSITIONS: INDICATED BY CIRCLED NUMBERS
MTG. HOLES: CENTERED ON CENTERLINE OF ACTUATOR BODY
PLUMBING SCHEMATIC: LOCATED IN ENGINEERING DATA SECTION



All dimensions are reference only unless specifically toleranced.

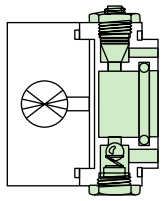
D ADJUSTABLE CUSHIONS BOTH DIRECTIONS

D1 ADJUSTABLE CUSHIONS CLOCKWISE

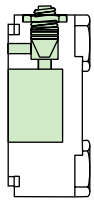
D2 ADJUSTABLE CUSHIONS COUNTERCLOCKWISE

PHD Cushions are designed for smooth deceleration at the end of rotation. When the cushion is activated, the remaining volume in the cylinder must exhaust past an adjustable needle which controls the amount of deceleration. Effective cushion length is approximately 30° of rotation, except on the 8000 Tandem which has 20° of cushion length.

Cushions on Series 2000, 4000, 6000, and 8000 are furnished on one of two racks only.



2000 Cushion Block Style



4000-8000 Poppet Style

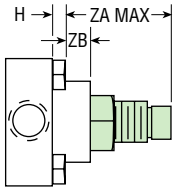
A ANGLE ADJUSTMENT BOTH DIRECTIONS
(Standard on 3-position units)

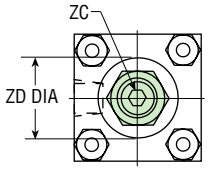
A1 ANGLE ADJUSTMENT CLOCKWISE

A2 ANGLE ADJUSTMENT COUNTERCLOCKWISE

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°.



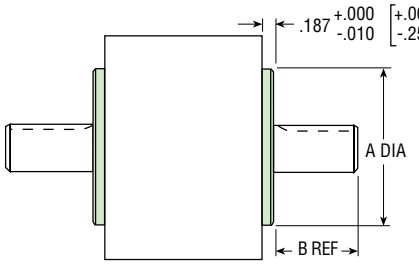


SERIES	LETTER DIMENSION				
	H	ZA	ZB	ZC	ZD
2000	0.00 [0]	1.125 [29]	.312 [8]	3/16 HEX —	.875 [22]
4000	.250 [6]	1.500 [38]	.375 [10]	1/4 HEX —	1.250 [32]
6000	.203 [5]	1.875 [48]	.750 [19]	1/4 HEX —	1.250 [32]
8000	.437 [11]	2.875 [73]	.937 [24]	3/4 FLAT [19 mm]	1.750 [45]

NUMBERS IN [ ] ARE FOR METRIC UNITS AND ARE IN mm.

G SHAFT SEAL COVERS
Not available on Rx9R

Fits all PHD Series 2000-8000, except when ordering hollow shafts. Isolates internal or external pressures. Maximum pressure differential is 500 psi [34.4 bar]. Furnished installed on actuator only (both sides). Covers are made of hard anodized aluminum. Not to be used as a pilot.

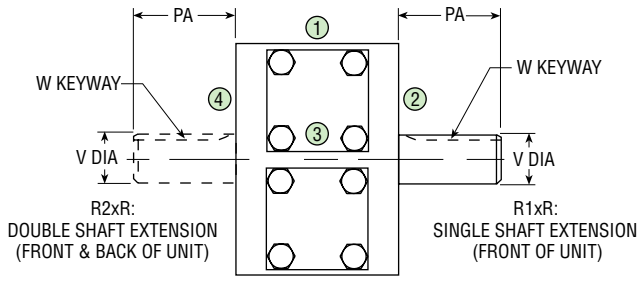


SERIES	LETTER	
	A	B
2000	1.875 [47.63]	.688 [17.5]
4000	3.000 [76.20]	1.688 [42.9]
6000	3.250 [82.55]	1.688 [42.9]
8000	4.480 [113.79]	3.312 [84.1]

NUMBERS IN [ ] ARE FOR METRIC UNITS AND ARE IN mm.

All dimensions are reference only unless specifically toleranced.

BASIC SHAFT DIMENSIONS: R1xR and R2xR



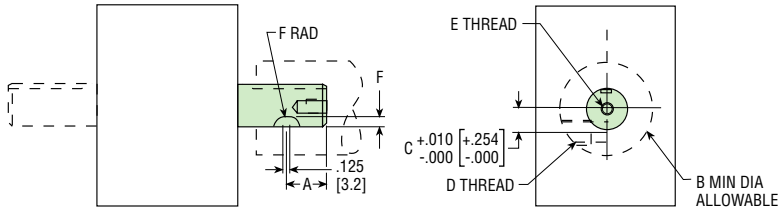
SERIES	LETTER DIMENSION				
		IMPERIAL*		METRIC**	
	PA	V	W	V	W
2000	.875 [22]	.4998/.5003 [12.69/12.71]	1/8 x 1/16 x .625 [3.18 x 1.56 x 16]	— [12.00/11.97]	— [4 x 2.5 x 15]
4000	1.875 [48]	.8748/.8753 [22.22/22.23]	3/16 x 3/32 x 1.500 [4.75 x 2.36 x 38]	— [22.00/21.96]	— [6 x 3.5 x 32]
6000	1.875 [48]	1.124/1.125 [28.55/28.58]	1/4 x 1/8 x 1.500 [6.35 x 3.18 x 38]	— [28.00/27.96]	— [8 x 5 x 40]
8000	3.500 [89]	1.749/1.750 [44.42/44.45]	3/8 x 3/16 x 3.000 [9.53 x 2.36 x 76]	— [44.00/43.96]	— [12 x 5 x 56]

NOTES:
1) **SHAFT KEYWAY:** SHOWN AT MID-ROTATION
2) *IMPERIAL SHAFT UNITS (Rx3R, Rx8R)
3) **METRIC SHAFT UNITS (Rx9R)

K PRELOADED KEYWAY SHAFT

Not available on Rx9R

Required when use of hub adaptor is desired.

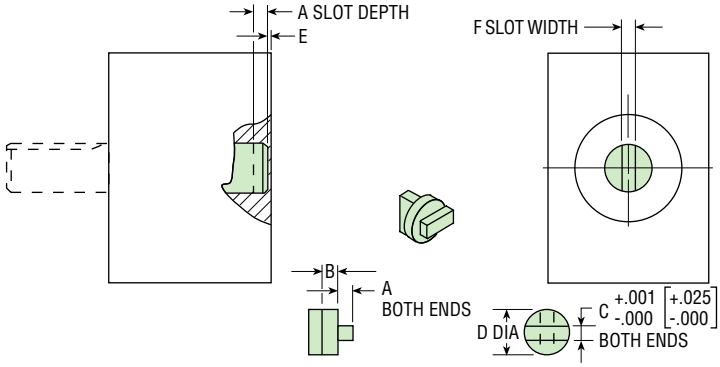


SHAFT KEYWAY: SHOWN AT MID-ROTATION
R2xx UNITS: WHEN ORDERING SPECIFY -K-K FOR PRELOAD ON BOTH SHAFT EXTENSIONS. PRELOAD WILL BE ON OPPOSITE SIDES OF SHAFT.
SET SCREW: INCLUDED WITH UNIT

SERIES	LETTER DIMENSION					
	A	B	C	D	E	F
2000	.375 [9.5]	1.500 [38.1]	.250 [6.35]	3/8-24 [M10]	10-32 x .312 DP [M5 x 8]	.156 [4]
4000	.812 [20.6]	2.000 [50.8]	.437 [11.11]	1/2-20 [M12]	5/16-24 x .440 DP [M8 x 11]	.220 [6]
6000	.812 [20.6]	3.000 [76.2]	.563 [14.28]	5/8-11 [M16]	3/8-24 x .560 DP [M10 x 14]	.251 [6]
8000	1.500 [38.1]	4.000 [101.6]	.875 [22.22]	1-8 [M24]	1/2-20 x .687 DP [M12 x 17.5]	.438 [11]

C CROSS KEY SHAFT

Not available on Rx9R

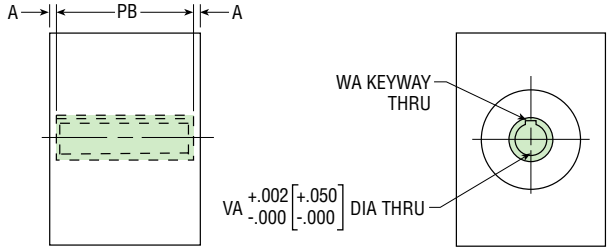


SERIES	LETTER DIMENSION					
	A	B	C	D	E	F
2000	.250 [6.4]	.215 [5.5]	.230 [5.8]	.500 [12.7]	.118 [3]	.250 [6.3]
4000	.250 [6.4]	.265 [6.7]	.248 [6.3]	.875 [22.2]	.120 [3]	.248 [6.3]
6000	.437 [11]	.485 [12.3]	.500 [12.7]	1.125 [28.6]	.150 [3.8]	.5002 [12.7]
8000	.437 [11]	.805 [20.4]	.875 [22.2]	1.750 [44.5]	.245 [6.2]	.8752 [22.2]

SHAFT KEYWAY: SHOWN AT MID-ROTATION
R2xx UNITS: WHEN ORDERING SPECIFY -C-C FOR CROSSKEY ON BOTH SHAFT EXTENSIONS
CROSSKEY: INCLUDED WITH UNIT

H HOLLOW SHAFT

Not available on Rx9R



SERIES	LETTER DIMENSION			
	A	PB	VA	WA
2000	.042 [1.1]	1.920 [48.76]	.250 [6.35]	— —
4000	.042 [1.1]	2.917 [74.09]	.500 [12.7]	1/8 x 1/16 [3.18 x 1.58]
6000	.135 [3.4]	2.730 [69.34]	.687 [17.46]	3/16 x 3/32 [4.76 x 2.38]
8000	.240 [6.1]	4.520 [114.80]	1.125 [28.57]	1/4 x 1/8 [6.35 x 3.18]

SHAFT KEYWAY: SHOWN AT MID-ROTATION

MAGNETIC PISTON FOR USE WITH PHD PROXIMITY SWITCHES

See each data for magnetic piston ordering information.
Switches and brackets must be ordered separately.
See Switches and Sensors section for complete switch information.

E SOLID STATE SWITCHES

Series 2000-8000 Rotary Actuators may be equipped with a magnetic band (specify -E) on the pistons which activates externally mounted PHD Solid State Switches. These switches allow the interfacing of the PHD Actuators to various logic systems. This option is for use with the following switches.

SERIES 1750 SOLID STATE SWITCHES

PART NO.	COLOR	DESCRIPTION
17503-2-06	Yellow	NPN (Sink) Type 4.5-24 VDC, 6 foot cable
17504-2-06	Red	PNP (Source) Type 4.5-24 VDC, 6 foot cable
17523-2	Yellow	NPN (Sink) Type 4.5-24 VDC, Quick Connect
17524-2	Red	PNP (Source) Type 4.5-24 VDC, Quick Connect

SWITCH BRACKETS

SERIES	PART NO. SERIES 1750 SWITCH
2000	17000-32-5
4000	17000-34-5
6000	17000-38-0
8000	17000-39-0

M REED SWITCHES

The PHD Magnetic Reed Switches may be used in situations where the Solid State Switches are not applicable. As with the Solid State 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.

SERIES 1750 REED SWITCHES

PART NO.	DESCRIPTION	
17502-2-06	White	NPN (Sink) or PNP (Source) 4.5-24 VDC, 6 foot cable
17509-3-06	Green	AC Type 110-120 VAC with Current Limit, 6 foot cable
17522-2	White	NPN (Sink) or PNP (Source) 4.5-24 VDC, Quick Connect
17529-3	Green	AC Type 110-120 VAC, Quick Connect with Current Limit

J SENSOR/SET POINT MODULE

Not available on Rx9R

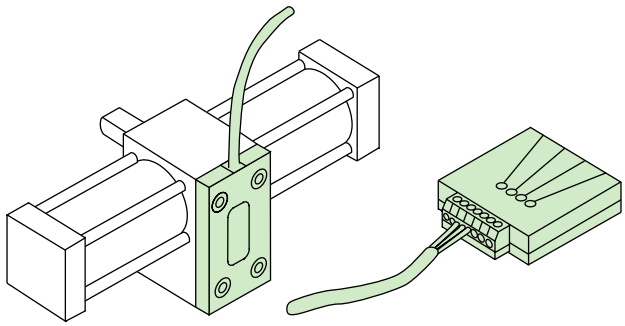
PHD offers a solid state sensor transducer along with a Set Point Module which provides up to four adjustable sensing positions throughout the 180° maximum sensing range. These signals can be used as inputs to a programmable controller to signal ends of rotation in addition to multiple signals during rotation for indication of arc traveled.

The Set Point Module allows independent adjustment of each sensing position and is available for 4.5 to 24 VDC current sinking or current sourcing.

SET POINT MODULE

PART NO.	DESCRIPTION
9800-01-0300	NPN (Sink) 4.5-24 VDC
9800-01-0400	PNP (Source) 4.5-24 VDC

See Switches and Sensors section for information.



All dimensions are reference only unless specifically toleranced.

L COUNTERCLOCKWISE UNIDIRECTIONAL CLUTCH

Not available on Rx9R or 7/8000
Output hub will only rotate in counterclockwise direction at specific rotation ordered.

R CLOCKWISE UNIDIRECTIONAL CLUTCH

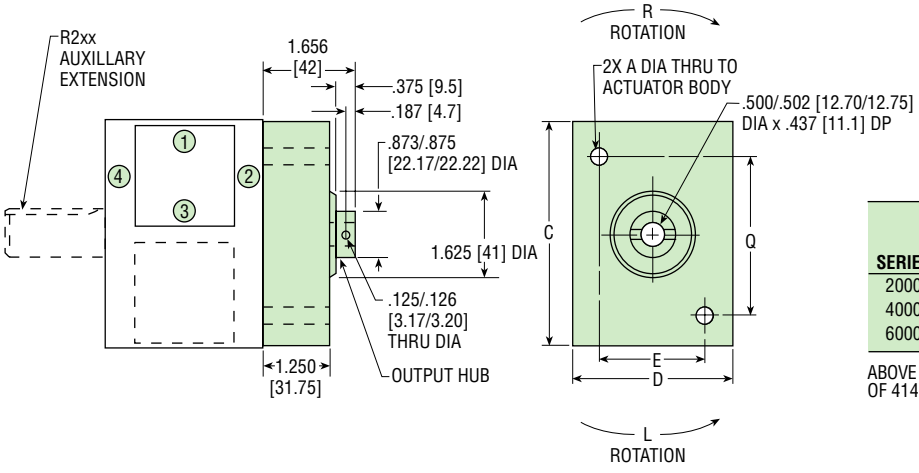
Not available on Rx9R or 7/8000
Output hub will only rotate in clockwise direction at specific rotation ordered.

Overrun clutch for intermittent unidirectional shaft output, available for Series 2000 through 6000.

Output hub rotates in one direction only. It remains motionless while rack and pinion reverse. Clutch repeats within ±1/2°.

Assembly features a Torrington roller clutch. Spring loaded brake shoes limit output shaft free wheeling, but are not intended for stopping external loads.

CAUTION: Any angular error will accumulate; therefore, shot pins or similar locators are necessary on index applications. Maintain shot pin location during reversal of Rotary Actuator to guarantee that clutch shaft does not move due to external forces or slight internal friction in clutch.



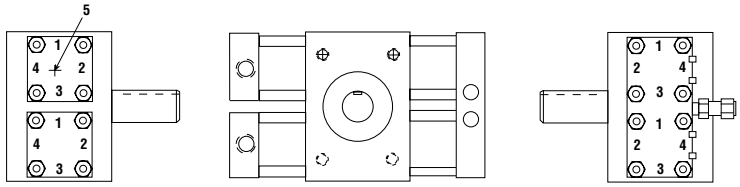
SERIES	LETTER DIMENSION				
	A	C	D	E	Q
2000	.281 [7.2]	2.938 [74.6]	2.000 [51]	1.500 [38]	2.000 [50.8]
4000	.344 [8.7]	4.188 [106.3]	3.000 [76]	2.000 [50.8]	3.000 [76.2]
6000	.406 [10.3]	4.938 [125.4]	4.000 [102]	2.500 [63.5]	3.500 [88.9]

SERIES	LIMITING FACTORS			
	MAX. INLET PRESSURE(psi)[bar]		MAX. RADIAL OR AXIAL LOAD (lb) [N]	
2000	526	[36]	5	[22]
4000	186	[13]	10	[44]
6000	87	[6]	15	[66]

ABOVE INLET PRESSURES PROVIDE A MAXIMUM TORQUE OF 414 in-lb [46.8 Nm] ALLOWED BY THE CLUTCH

PORT & PORT CONTROL® LOCATIONS

Standard port location on all Series 2000-8000 Actuators is position 2. Standard Port Control® and cushion adjustment needles are located in position 4.



I PORT POSITION 1 TOP RACK PORT POSITION 3 BOTTOM RACK

This option positions the ports in position 1 on tube I and in position 3 on rack III. This allows access to the ports on the "Top" and "Bottom" sides of the actuator.

T PORT POSITION 4

This option positions the ports in position 4 on tubes I and III.

Y TANDEM CAP ROTATED 180°

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

V FLUORO-ELASTOMER SEALS

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

W CLOSE TOLERANCE ROTATION

Not available on 3 position 3RxxR units

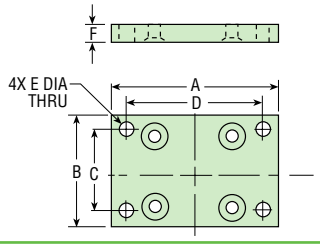
This option may be specified when a precise rotation is required and angle adjustment (see page 5-76) is not acceptable. By specifying this option, rotation will be within a tolerance of +30, -0 minutes. Standard tolerance is -0°, +10° of rotation.

Z1 ELECTROLESS NICKEL PLATING

Electroless nickel plating is done on all externally exposed ferrous parts except the pinion shaft. This optional plating treatment gives an alternative method of protecting the unit from severe environments.

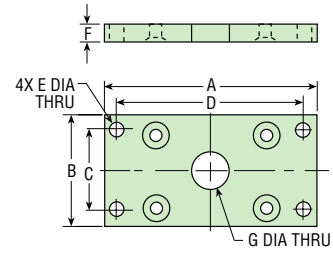
NOTE: Standard plating is Zinc and Black Oxide.

MOUNTING FLANGE (HARDWARE INCLUDED)



BOTTOM MOUNTING FLANGE

SERIES	KIT NO. IMPERIAL	KIT NO. METRIC	LETTER DIMENSION A	B	C	D	E	F
2000	13756	14320	4.250 [108]	2.000 [51]	1.625 [41.3]	2.625 [66.7]	.281 [7.1]	.250 [6.3]
4000	13757	14321	4.500 [114]	3.000 [76]	2.375 [60.3]	3.875 [98.4]	.406 [10.3]	.437 [11.1]
6000	13758	14322	4.500 [114]	4.000 [102]	3.375 [85.7]	3.875 [98.4]	.406 [10.3]	.437 [11.1]



SIDE MOUNTING FLANGE

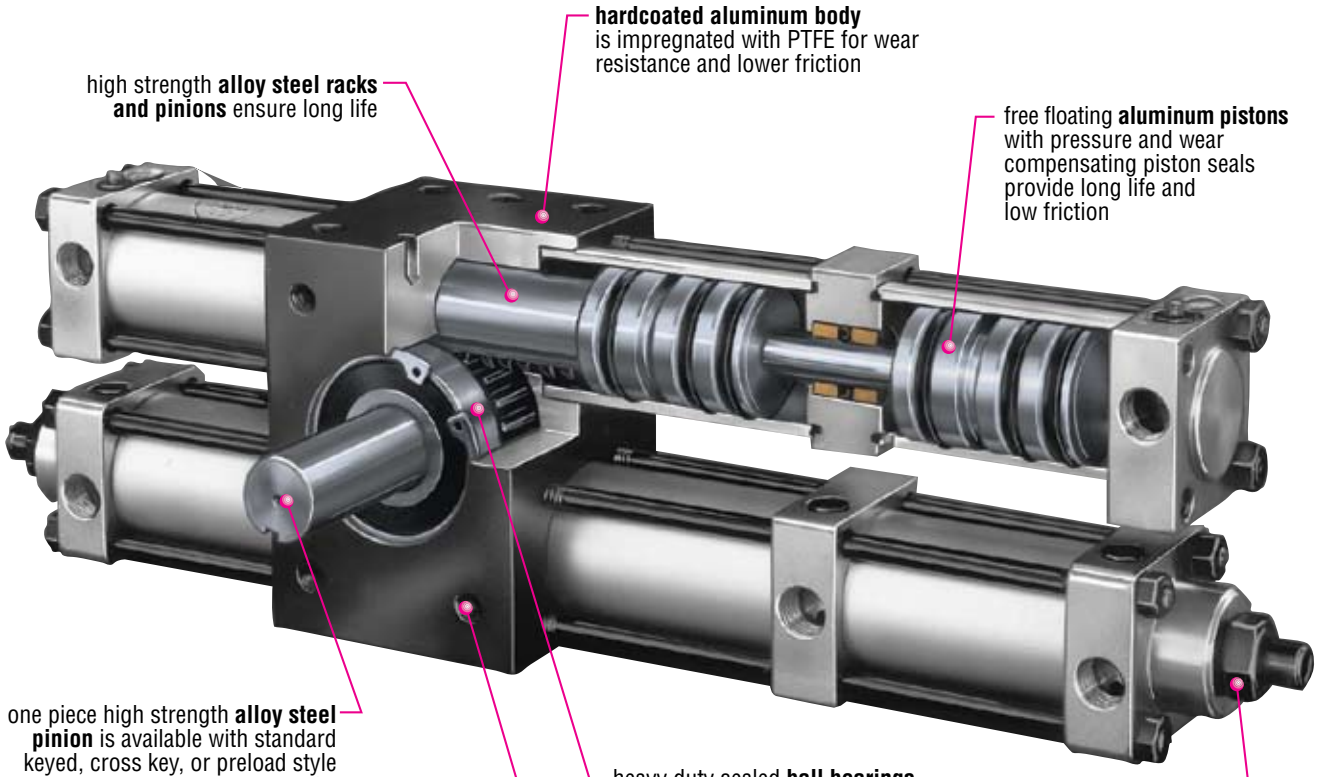
SERIES	KIT NO. IMPERIAL	KIT NO. METRIC	LETTER DIMENSION A	B	C	D	E	F	G
2000	13759	14316	4.250 [108]	2.000 [51]	1.375 [34.9]	3.625 [92.1]	.281 [7.1]	.250 [6.3]	.625 [15.9]
4000	13760	14317	5.750 [146]	3.000 [76]	2.125 [54.0]	5.125 [130.2]	.406 [10.3]	.437 [11.1]	1.000 [25.4]
6000	13761	14318	6.500 [165]	4.000 [102]	3.375 [85.7]	5.875 [149.2]	.406 [10.3]	.437 [11.1]	1.250 [31.8]
8000	13762	14319	12.000 [305]	5.000 [127]	3.000 [76.2]	10.000 [254.0]	.781 [19.8]	.750 [19.1]	1.875 [47.6]

All dimensions are reference only unless specifically toleranced.

2000-8000 multi-position

THREE, FOUR, OR FIVE ROTARY POSITIONS

4 POSITION UNIT



Cutaway unit shown above does not represent a standard 4 position unit. (No stop tubes are shown, -A caps are not located on proper caps and out tubes are on wrong side of unit)

Major Benefits

- Three, four, or five rotary positions

Industry Uses

- Automotive
- General industrial machines

ORDERING DATA: MULTI-POSITION ROTARY ACTUATORS

TO ORDER SPECIFY:
No. of Rotary Positions, Type, Design No., Fluid Media, Series, and Options.

NO. OF ROTARY POSITIONS
3 - 3 Position
4 - 4 Position
5 - 5 Position

DESIGN NO.
1 - Imperial
5 - Metric - Port and mounting metric. Pinion and keyways are imperial.
6 - Metric Complete

SERIES
2 (000) 1" Bore Double Rack
4 (000) 1-3/8" Bore Double Rack
6 (000) 2" Bore Double Rack
8 (000) 3" Bore Double Rack
NOTE: 2000 Series available in 3 Position only.

ANGLE OF ROTATION FROM POSITION I TO POSITION II

ANGLE OF ROTATION FROM POSITION I TO POSITION IV. USED ON 5 POSITION ONLY.

5	R1	1	A	4	180	-	45	-	90	-	135	-	P-D

TYPE
R1 - Single Shaft
R2 - Double Shaft

FLUID MEDIA
A - Pneumatic
H - Hydraulic

TOTAL ANGLE OF ROTATION STANDARD ANGLES

ANGLE OF ROTATION FROM POSITION I TO POSITION III. USED ON 4 & 5 POSITION ONLY.

STANDARD OPTIONS
B - Shock Pads on extreme positions (not available on hydraulic units)
D - Cushions on extreme positions
E - Magnetic Piston for Solid State Switch
I - Port Position 1 on top rack
Port Position 3 on bottom rack
M - Magnetic Piston for Reed Switch
P - Port Controls® on all caps
T - Port in Position 4
V - Fluoro-Elastomer Seals
Z1 - Electroless Nickel Plate

DESIGN NO. 1 AND 5 OPTIONS ONLY
C - Cross Key Pinion Shaft
G - Shaft Seal both sides
H - Hollow Pinion Shaft (not available on type R2 units)
J - Hall Sensor for rotations not exceeding 180° (Set Point Module is ordered separately)
K - Preload Keyway Pinion Shaft (required for use with hub adaptors)

NOTES:
1) Angle Adjustments are standard on all Multi-Position Rotary Actuators.
2) Sensor must be used with a PHD Set Point Module. See Switches and Sensors section for information and ordering data.

Options may affect unit length. See unit dimension and options pages for adders.

PROXIMITY SWITCH MOUNTING BRACKETS

SERIES	SIZE NO.
2000	32
4000	34
6000	38
8000	39

See Switches and Sensors section for complete ordering information.

UNIQUE ROTARY ACTUATORS ARE AVAILABLE. SEE UNIQUE PRODUCTS AT THE END OF THIS SECTION.

SPECIFICATIONS	MULTI-POSITION 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] (see option table below)
OPERATING TEMPERATURE	-20° to 180° F [-29° to 82° C]
FULL (TOTAL) ROTATIONAL TOLERANCE	Nominal rotation +10°/-0°
MID-POSITION ROTATIONAL TOLERANCES (ALL MID-POSITIONS 2, 3, 4)	(see chart below for mid-position tolerance)
BACKLASH	
AT ANY MID-ROTATION POINT, ALL UNITS AND 4 POSITION, END OF ROTATIONS	1° (2000), 0° 30' (4000, 6000), 0° 15' (8000)
AT END OF ROTATIONS ON 3 AND 5 POSITIONS*	0° (2000, 4000, 6000, 8000)
AT MID-POSITION LOCATIONS (ALL MID-POSITIONS 2, 3, 4)	(see chart below for mid-position backlash)
LUBRICATION	Factory lubricated for rated life
MAINTENANCE	Field repairable

NOTE: *Angle adjustment screw must be engaged or adjusted to achieve 0° backlash.

SIZE	BORE DIAMETER in	BORE DIAMETER mm	DISPLACEMENT VOLUME/DEG in^3/°	DISPLACEMENT VOLUME/DEG cm^3/°	THEORETICAL TORQUE OUTPUT in-lb/psi	THEORETICAL TORQUE OUTPUT Nm/bar	MAX AXIAL BEARING LOAD lb	MAX AXIAL BEARING LOAD N	MAX RADIAL BEARING LOAD lb	MAX RADIAL BEARING LOAD N	DISTANCE BETWEEN SHAFT BEARINGS in	DISTANCE BETWEEN SHAFT BEARINGS mm
2000	1.000	25.4	.014	.229	.39	.64	120	534	300	1334	1.375	34.9
4000	1.375	34.9	.038	.623	1.11	1.82	240	1068	600	2669	2.188	55.6
6000	2.000	50.8	.082	13.44	2.36	3.87	370	1646	925	4114	2.235	56.8
8000	3.000	76.2	.370	6.06	10.60	17.37	800	3558	2000	8896	3.750	95.3

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 chart below.

Minimum factor of safety at maximum rated hydraulic pressure for output shaft is 2:1, and for hydraulic chambers is 3:1. Consult PHD for proof of pressure data. All ratings based on non-shock hydraulic service and with full rotation tubes not being double powered.

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

NOTE: All hydraulic ratings are based on non-shock hydraulic service.

BACKLASH & INTERMEDIATE POSITION TOLERANCES

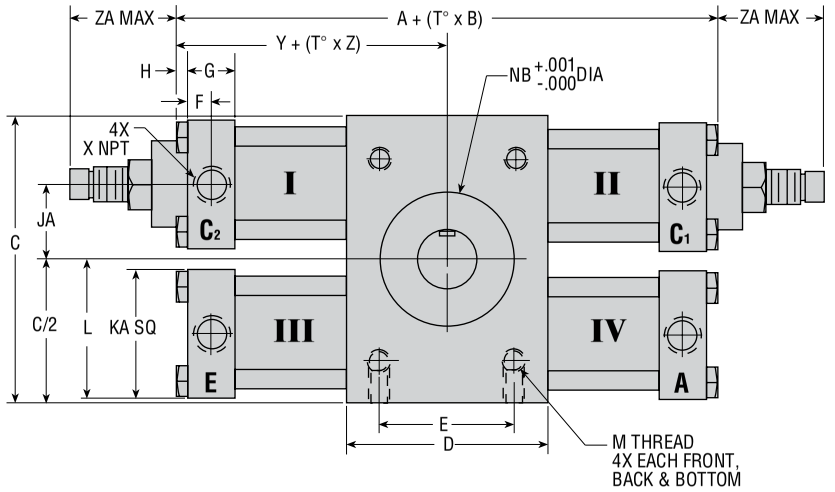
SERIES	ROTATIONAL TOLERANCE**	BACKLASH
2000	±1°	1° 30'
4000 & 6000	±0° 30'	1° 15'
8000	±0° 15'	1°

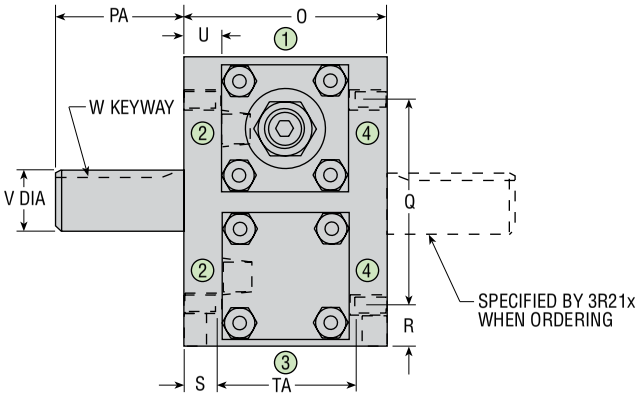
**Rotational position from one intermediate position to another (measured at centers of backlash).

SIZING AND APPLICATION ASSISTANCE
See PHD Product Sizing Catalog for specific and complete sizing information.
Online sizing assistance is available at: ***www.phdinc.com/apps/sizing***

DIMENSIONS: 3 POSITION ROTARY ACTUATORS

IMPERIAL





CAP STYLE	SERIES	LETTER DIMENSION																										
		A	B	C	D	E	F	G	H	JA	KA	L	M	NB	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	1.125 x .056 DP	2.000	.875	2.000	.500	.250	1.500	.312	.4998/.5003	1/8 x 1/16 x .625	1/8	2.849	.0087	0
-A	2000	6.198	.0174	3.000	2.000	1.500	.500	.750	0.00	.750	1.375	1.437	1/4-20 x .312 DP	1.125 x .056 DP	2.000	.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	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	2.000 x .039 DP	3.000	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	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	2.1654 x .052 DP	3.000	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	3.625	3/4-10 x 1.250 DP	3.3465 x .120 DP	5.000	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

OPTION LOCATION REFERENCE

ACTUATOR TYPE	LETTER OPTION REFERENCED BY TUBE NUMBER						PORT & NEEDLE LOCATIONS REFERENCED BY CIRCLED NUMBERS								
							STANDARD			-T			-I		
	-A	-B	-D	-P	-M	-E	PORT	-P	-D	PORT	-P	-D	PORT	-P	-D
3R11A & 3R21A	STANDARD	I & II	I & II	ALL	ALL	ALL	2	1 & 3	1	4	1 & 3	1	1 & 3	4	4
3R11H & 3R21H	STANDARD	N/A	I & II	ALL	ALL	ALL	2	1 & 3	1	4	1 & 3	1	1 & 3	4	4

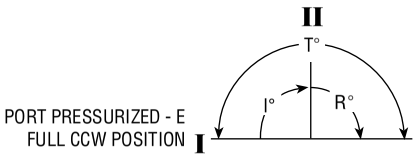
QUICK REFERENCE FOR: A + (T° x B)

SERIES	DEGREE OF ROTATION					
	45	90	180	270	360	450
*2000	6.481	7.264	8.830	10.396	11.962	13.528
4000	9.076	10.246	12.586	14.926	17.266	19.606
6000	10.296	11.466	13.806	16.146	18.486	20.826
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 2000 only.

SHAFT KEYWAY: SHOWN AT MID-ROTATION
PORT POSITIONS: INDICATED BY CIRCLED NUMBERS
CUSHIONS: SERIES 2000 ACTUATORS:
ADD 1/2" TO RESPECTIVE "A" AND "Y" DIMENSION FOR EACH CUSHION
MTG. HOLES: CENTERED ON CENTERLINE OF ACTUATOR BODY
STOP TUBES: LOCATED IN TUBES I & II
PLUMBING SCHEMATIC: LOCATED IN PHD PRODUCT SIZING CATALOG

PORTS PRESSURIZED
C1 & C2

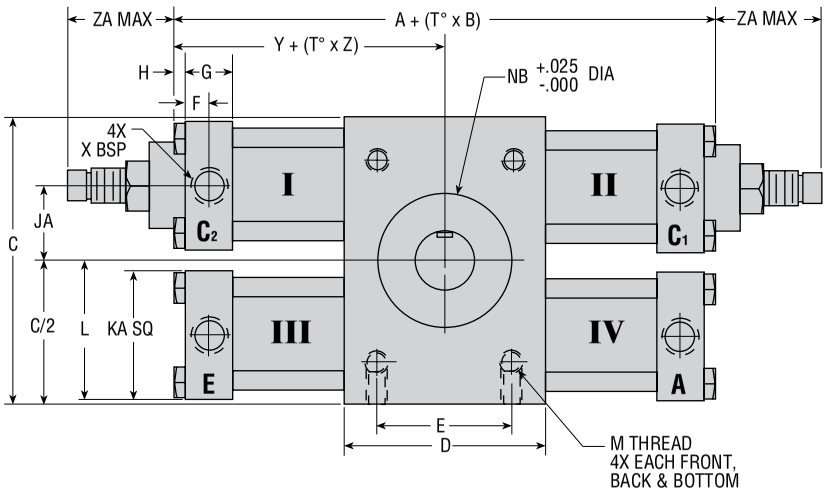


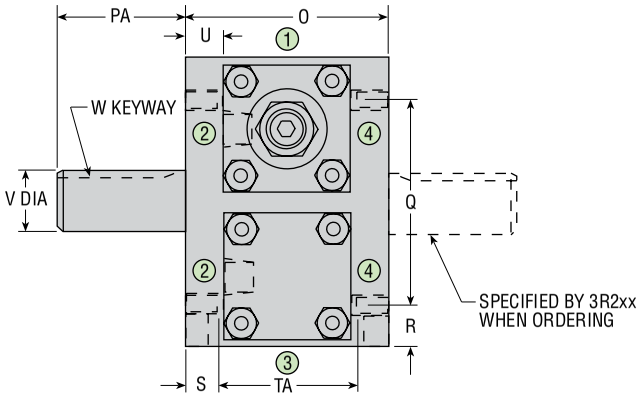
PORT PRESSURIZED - E
FULL CCW POSITION

PORT PRESSURIZED - A
FULL CW POSITION

All dimensions are reference only unless specifically toleranced.

DIMENSIONS: 3 POSITION ROTARY ACTUATORS





CAP STYLE	SERIES	LETTER DIMENSION																			IMPERIAL SHAFTS*		METRIC SHAFTS*				
		A	B	C	D	E	F	G	H	JA	KA	L	M	NB	O	PA	Q	R	S	TA	U	V	W	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	28.58 x 1.4 DP	50.8	22	50.8	13	6	38.1	8	12.69/12.71	3.15 x 1.59 x 16	12.00/11.97	4 x 2.5 x 15	G1/8	72	0.22	0
-A	2000	157	0.44	76	51	38.1	13	19	0	19	35	36	M6 x 1.0 x 8	28.58 x 1.4 DP	50.8	22	50.8	13	6	38.1	8	12.69/12.71	3.15 x 1.59 x 16	12.00/11.97	4 x 2.5 x 15	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	50.80 x 1.0 DP	76.2	48	76.2	16	13	50.8	14	22.22/22.23	4.75 x 2.36 x 38	22.00/21.96	6 x 3.5 x 32	G1/4	100	0.33	38
BOTH	6000	232	0.66	127	102	63.5	10	19	5	29	57	58	M10 x 1.5 x 16	55.00 x 1.3 DP	76.2	48	88.9	19	13	50.8	10	28.55/28.58	6.35 x 3.18 x 38	28.00/27.96	8 x 5 x 40	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	85.00 x 3.0 DP	127.0	89	127.0	38	32	63.5	19	44.42/44.45	9.53 x 2.36 x 78	44.00/43.96	12 x 5 x 56	G3/8	154	0.66	73

* BOTH IMPERIAL AND METRIC SHAFT OPTIONS AVAILABLE ON METRIC BODY (IMPERIAL SHAFT = DESIGN 5, AND METRIC SHAFT = DESIGN 6). NUMBERS FOR METRIC UNITS AND ARE IN mm.

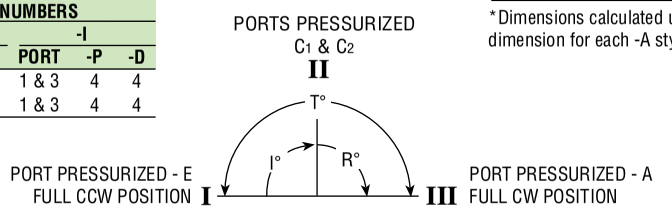
QUICK REFERENCE FOR: A + (T° x B)

SERIES	DEGREE OF ROTATION					
	45	90	180	270	360	450
*2000	164.6	184.5	224.2	264.1	303.8	343.6
4000	230.5	260.2	319.8	379.1	438.6	498.0
6000	261.5	291.1	410.8	350.7	469.5	529.0
8000	368.3	427.7	539.6	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 2000 only.

OPTION LOCATION REFERENCE

ACTUATOR TYPE	LETTER OPTION REFERENCED BY TUBE NUMBER						PORT & NEEDLE LOCATIONS REFERENCED BY CIRCLED NUMBERS								
							STANDARD			-T			-I		
	-A	-B	-D	-P	-M	-E	PORT	-P	-D	PORT	-P	-D	PORT	-P	-D
3R1xA & 3R2xA	STANDARD	I & II	I & II	ALL	ALL	ALL	2	1 & 3	1	4	1 & 3	1	1 & 3	4	4
3R1xH & 3R2xH	STANDARD	N/A	I & II	ALL	ALL	ALL	2	1 & 3	1	4	1 & 3	1	1 & 3	4	4

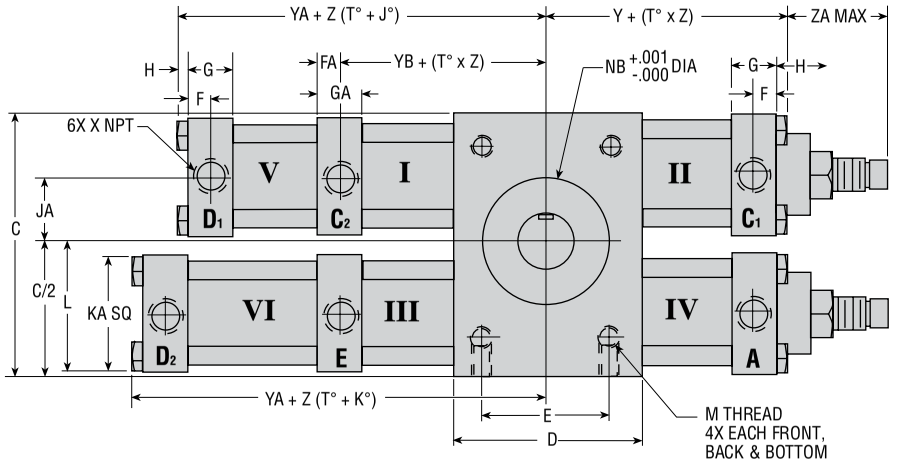


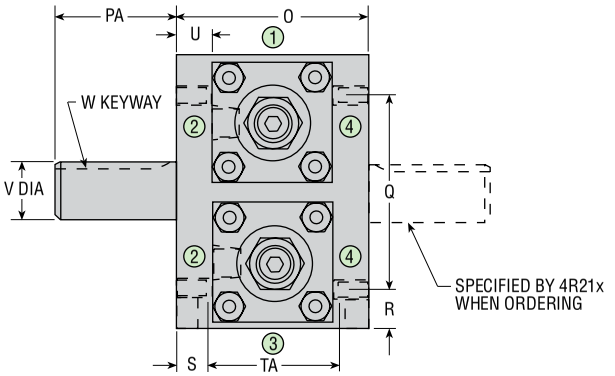
SHAFT KEYWAY: SHOWN AT MID-ROTATION
PORT POSITIONS: INDICATED BY CIRCLED NUMBERS
CUSHIONS: SERIES 2000 ACTUATORS:
ADD 13.0 mm TO RESPECTIVE "A" AND "Y" DIMENSION FOR EACH CUSHION
MTG. HOLES: CENTERED ON CENTERLINE OF ACTUATOR BODY
STOP TUBES: LOCATED IN TUBES I & II
PLUMBING SCHEMATIC: LOCATED IN PHD PRODUCT SIZING CATALOG.

All dimensions are reference only unless specifically toleranced.

DIMENSIONS: 4 POSITION ROTARY ACTUATORS

IMPERIAL



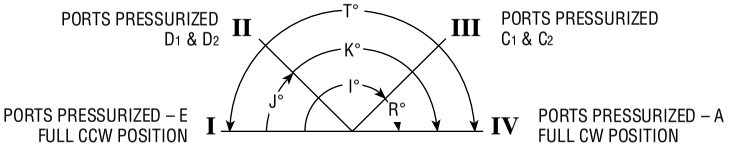


SERIES	LETTER DIMENSION																											
	C	D	E	F	FA	G	GA	H	JA	KA	L	M	NB	O	PA	Q	R	S	TA	U	V	W	X	Y	YA	YB	Z	ZA
4000	4.250	3.000	2.000	.344	.375	.688	.719	.250	1.156	1.875	2.094	5/16-18 x .500 DP	2.000 x .039	3.000	1.875	3.000	.625	.500	2.000	.562	.8748/.8753	3/16 x 3/32 x 1.500	1/4	3.953	6.721	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	2.1654 x .052	3.000	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	3.3465 x .120	5.000	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

OPTION LOCATION REFERENCE

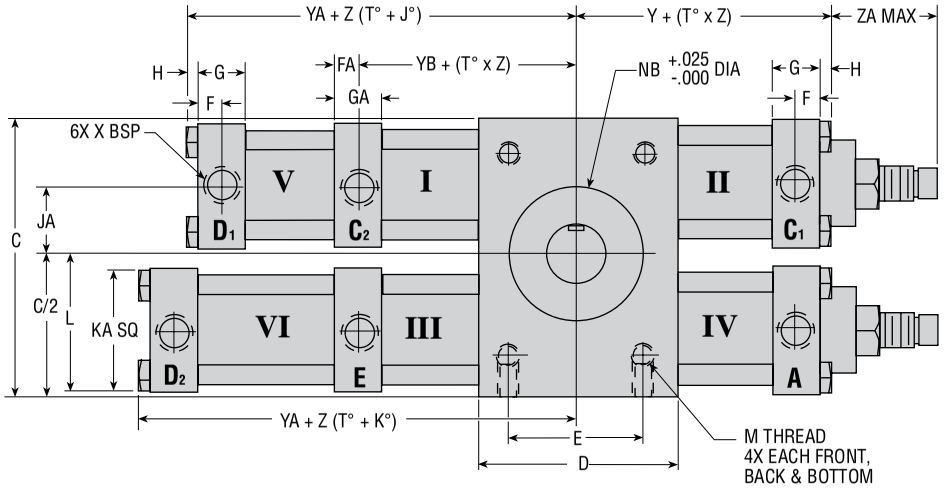
ACTUATOR TYPE	LETTER OPTION REFERENCED BY TUBE NUMBER						PORT & NEEDLE LOCATIONS REFERENCED BY CIRCLED NUMBERS											
							STANDARD			-T			-I			-I		
	-A	-B	-D	-P	-M	-E	PORT	-P	-D	PORT	-P	-D	PORT	-P	-D	PORT	-P	-D
4R11A & 4R21A	STANDARD	II & IV	II & IV	ALL	ALL	ALL	2	1 & 3	1 & 3	4	1 & 3	1 & 3	1 & 3	2 & 4	4	1 & 3	4	4
4R11H & 4R21H	STANDARD	N/A	II & IV	ALL	ALL	ALL	2	1 & 3	1 & 3	4	1 & 3	1 & 3	1 & 3	2 & 4	4	1 & 3	4	4

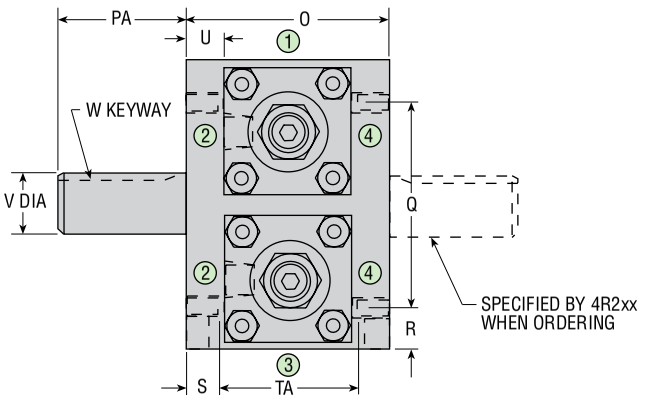
SHAFT KEYWAY: SHOWN AT MID-ROTATION
PORT POSITIONS: INDICATED BY CIRCLED NUMBERS
MTG. HOLES: CENTERED ON CENTERLINE OF ACTUATOR BODY
STOP TUBES: LOCATED IN TUBES I & II
PLUMBING SCHEMATIC: LOCATED IN PHD PRODUCT SIZING CATALOG



All dimensions are reference only unless specifically toleranced.

DIMENSIONS: 4 POSITION ROTARY ACTUATORS



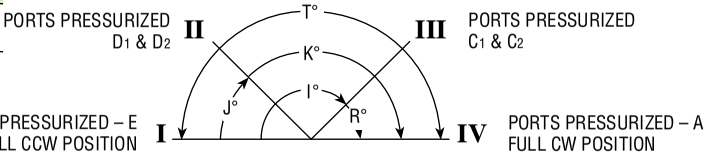


SERIES	LETTER DIMENSION																											
																				IMPERIAL SHAFTS*		METRIC SHAFTS*						
	C	D	E	F	FA	G	GA	H	JA	KA	L	M	NB	O	PA	Q	R	S	TA	U	V	W	V	W	X	Y	YA	YB	Z	ZA
4000	108	76	50.8	9	10	17	18	6	29	48	53	M8 x 1.25 x 13	50.80 x 1.0 DP	76.2	48	76.2	16	13	50.8	14	22.22/22.23	4.75 x 2.36 x 38	22.00/21.96	6 x 3.5 x 32	G1/4	100	171	85	0.33	38
6000	127	102	63.5	10	9	19	18	5	29	57	58	M10 x 1.5 x 16	55.00 x 1.3 DP	76.2	48	88.9	19	13	50.8	10	28.55/28.58	6.35 x 3.18 x 38	28.00/27.96	8 x 5 x 40	G1/4	116	186	101	0.33	48
8000	203	127	76.2	12	12	27	27	11	48	89	92	M20 x 2.5 x 32	85.00 x 3.0 DP	127.0	89	127.0	38	32	63.5	19	44.42/44.45	9.53 x 2.36 x 78	44.00/43.96	12 x 5 x 56	G3/8	154	251	133	0.66	73

* BOTH IMPERIAL AND METRIC SHAFT OPTIONS AVAILABLE ON METRIC BODY
(IMPERIAL SHAFT = DESIGN 5, AND METRIC SHAFT = DESIGN 6).
NUMBERS FOR METRIC UNITS AND ARE IN mm.

OPTION LOCATION REFERENCE

ACTUATOR TYPE	LETTER OPTION REFERENCED BY TUBE NUMBER						PORT & NEEDLE LOCATIONS REFERENCED BY CIRCLED NUMBERS								
							STANDARD			-T			-I		
	-A	-B	-D	-P	-M	-E	PORT	-P	-D	PORT	-P	-D	PORT	-P	-D
4R1xA & 4R2xA	STANDARD	II & IV	II & IV	ALL	ALL	ALL	2	1 & 3	1 & 3	4	1 & 3	1 & 3	1 & 3	4	4
4R15xH & 4R2xH	STANDARD	N/A	II & IV	ALL	ALL	ALL	2	1 & 3	1 & 3	4	1 & 3	1 & 3	1 & 3	4	4

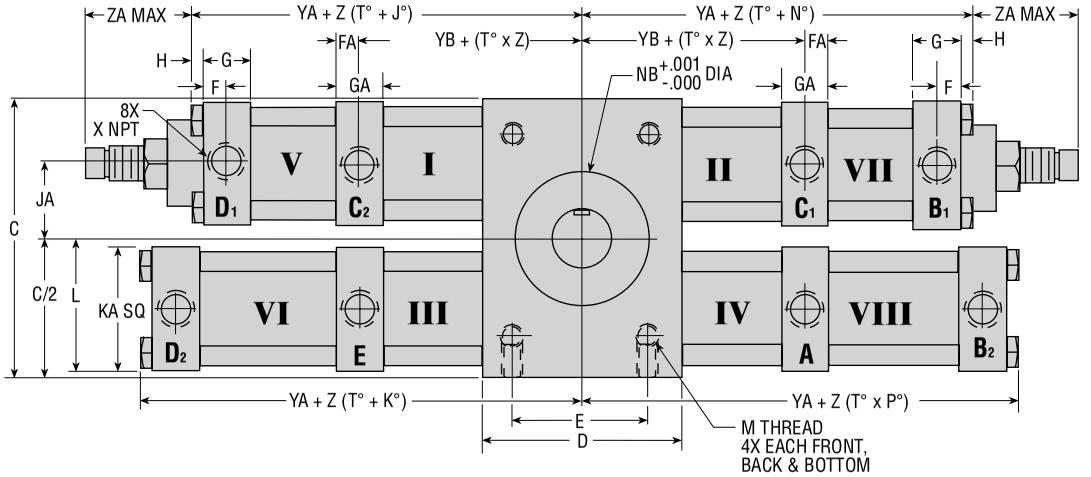


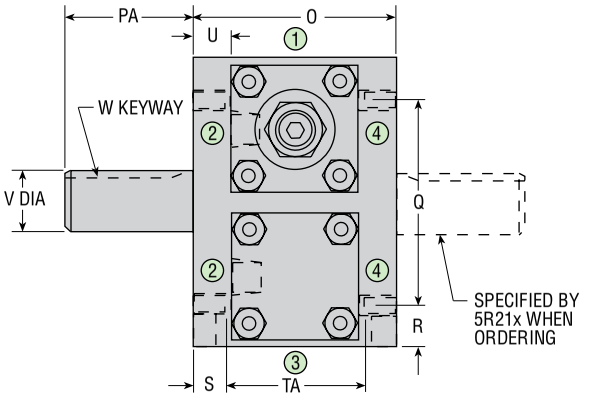
SHAFT KEYWAY: SHOWN AT MID-ROTATION
PORT POSITIONS: INDICATED BY CIRCLED NUMBERS
MTG. HOLES: CENTERED ON CENTERLINE OF ACTUATOR BODY
STOP TUBES: LOCATED IN TUBES I & II
PLUMBING SCHEMATIC: LOCATED IN PHD PRODUCT SIZING CATALOG.

All dimensions are reference only unless specifically toleranced.

DIMENSIONS: 5 POSITION ROTARY ACTUATORS

IMPERIAL



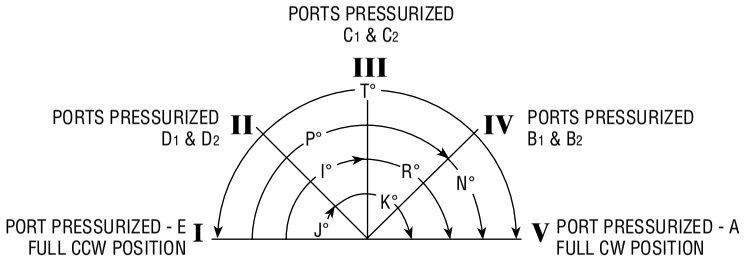


SERIES	LETTER DIMENSION																										
	C	D	E	F	FA	G	GA	H	JA	KA	L	M	NB	O	PA	Q	R	S	TA	U	V	W	X	YA	YB	Z	ZA
4000	4.250	3.000	2.000	.344	.375	.688	.719	.250	1.156	1.875	2.094	5/16-18 x .500 DP	2.000 x .039 DP	3.000	1.875	3.000	.625	.500	2.000	.562	.8748/.8753	3/16 x 3/32 x 1.500	1/4	6.721	3.360	.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	2.1654 x .052 DP	3.000	1.875	3.500	.750	.500	2.000	.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	3.3465 x .120 DP	5.000	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

OPTION LOCATION REFERENCE

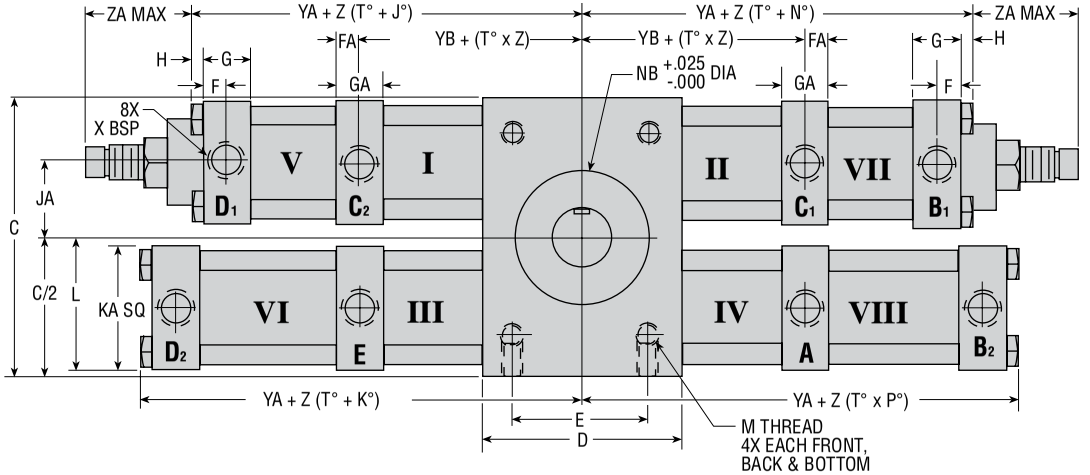
ACTUATOR TYPE	LETTER OPTION REFERENCED BY TUBE NUMBER						PORT & NEEDLE LOCATIONS REFERENCED BY CIRCLED NUMBERS								
							STANDARD			-T			-I		
	-A	-B	-D	-P	-M	-E	PORT	-P	-D	PORT	-P	-D	PORT	-P	-D
5R11A & 5R21A	STANDARD	VII & V	VII & V	ALL	ALL	ALL	2	1 & 3	1	4	1 & 3	1	1 & 3	4	4
5R11H & 5R21H	STANDARD	N/A	VII & V	ALL	ALL	ALL	2	1 & 3	1	4	1 & 3	1	1 & 3	4	4

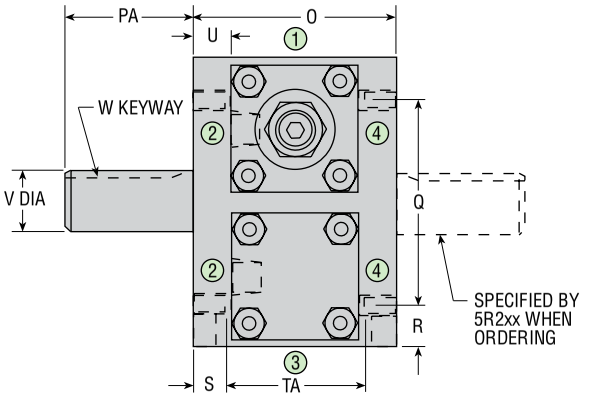
SHAFT KEYWAY: SHOWN AT MID-ROTATION
PORT POSITIONS: INDICATED BY CIRCLED NUMBERS
MTG. HOLES: CENTERED ON CENTERLINE OF ACTUATOR BODY
STOP TUBES: LOCATED IN TUBES I & II
PLUMBING SCHEMATIC: LOCATED IN PHD PRODUCT SIZING CATALOG



All dimensions are reference only unless specifically toleranced.

DIMENSIONS: 5 POSITION ROTARY ACTUATORS



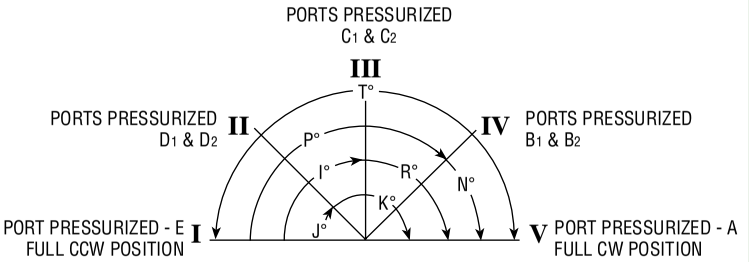


SERIES	LETTER DIMENSION																										
																				IMPERIAL SHAFTS*		METRIC SHAFTS*					
	C	D	E	F	FA	G	GA	H	JA	KA	L	M	NB	O	PA	Q	R	S	TA	U	V	W	V	W	X	YA	YB	Z	ZA
4000	108	76	50.8	9	10	17	18	6	29	48	53	M8 x 1.25 x 13	50.80 x 1.0 DP	76.2	48	76.2	16	13	50.8	14	22.22/22.23	4.75 x 2.36 x 38	22.00/21.96	6 x 3.5 x 32	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	55.00 x 1.3 DP	76.2	48	88.9	19	13	50.8	10	28.55/28.58	6.35 x 3.18 x 38	28.00/27.96	8 x 5 x 40	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	85.00 x 3.0 DP	127.0	89	127.0	38	32	63.5	19	44.42/44.45	9.53 x 2.36 x 78	44.00/43.96	12 x 5 x 56	G3/8	251	133	0.66	73

* BOTH IMPERIAL AND METRIC SHAFT OPTIONS AVAILABLE ON METRIC BODY
(IMPERIAL SHAFT = DESIGN 5, AND METRIC SHAFT = DESIGN 6).
NUMBERS FOR METRIC UNITS AND ARE IN mm.

OPTION LOCATION REFERENCE

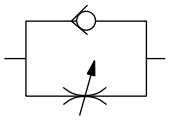
ACTUATOR TYPE	LETTER OPTION REFERENCED BY TUBE NUMBER						PORT & NEEDLE LOCATIONS REFERENCED BY CIRCLED NUMBERS								
							STANDARD			-T			-I		
	-A	-B	-D	-P	-M	-E	PORT	-P	-D	PORT	-P	-D	PORT	-P	-D
5R1xA & 5R2xA	STANDARD	VII & V	VII & V	ALL	ALL	ALL	2	1 & 3	1	4	1 & 3	1	1 & 3	4	4
5R1xH & 5R2xH	STANDARD	N/A	VII & V	ALL	ALL	ALL	2	1 & 3	1	4	1 & 3	1	1 & 3	4	4



SHAFT KEYWAY: SHOWN AT MID-ROTATION
PORT POSITIONS: INDICATED BY CIRCLED NUMBERS
MTG. HOLES: CENTERED ON CENTERLINE OF ACTUATOR BODY
STOP TUBES: LOCATED IN TUBES I & II
PLUMBING SCHEMATIC: LOCATED IN PHD PRODUCT SIZING CATALOG

All dimensions are reference only unless specifically toleranced.

P PORT CONTROL®



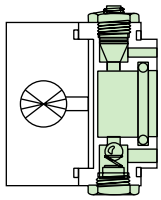
The exclusive PHD Port Control®, "built-in" speed control valve, based on the "meter-out" principle, features an adjustable needle and a separate ball check. Both are built into the rotary actuator end cap and are used to control the speed of the actuator over its entire rotation.

The self-locking needle has micrometer threads and is adjustable under pressure. It determines the orifice size which controls the exhaust volume only of the actuator proper. 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 rotary actuators. It saves space and eliminates the cost of fittings and installation for external flow control valves.

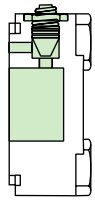
D ADJUSTABLE CUSHIONS

PHD Cushions are designed for smooth deceleration at the end of rotation. When the cushion is activated, the remaining volume in the cylinder must exhaust past an adjustable needle which controls the amount of deceleration. Effective cushion length is approximately 30° of rotation.

Cushions on Series 2000, 4000, 6000 and 8000 are furnished on one of two racks only.



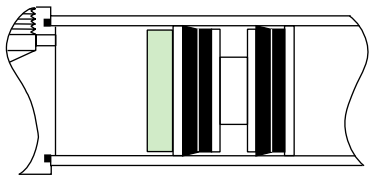
2000 Cushion Block Style



4000-8000 Poppet Style

B SHOCK PADS

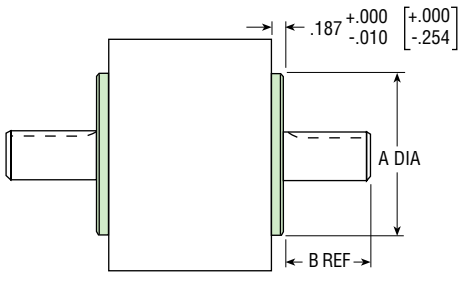
Polyurethane pads for absorption of shock and noise are available on each end of Series 2000-8000 Rotary Actuators. Reducing shock permits higher piston velocities for shorter cycle times. Reducing noise levels provides improved environment for increased productivity. Pads eliminate metal-to-metal contact between piston and end caps. **NOTE:** Air application only.



G SHAFT SEAL COVERS

Not available on Rx6x

Fits all PHD Series 2000-8000, except when ordering hollow shafts. Isolates internal or external pressures. Maximum pressure differential is 500 psi [34.4 bar]. Furnished installed on actuator only (both sides). Covers are made of hard anodized aluminum. Not to be used as a pilot.

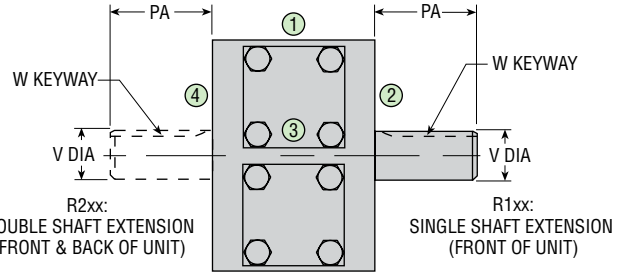


SERIES	LETTER A	LETTER B
2000	1.875 [47.63]	.688 [17.5]
4000	3.000 [76.20]	1.688 [42.9]
6000	3.250 [82.55]	1.688 [42.9]
8000	4.480 [113.79]	3.312 [84.1]

NUMBERS IN [ ] ARE FOR METRIC UNITS AND ARE IN mm.

All dimensions are reference only unless specifically toleranced.

BASIC SHAFT DIMENSIONS: R1xx and R2xx



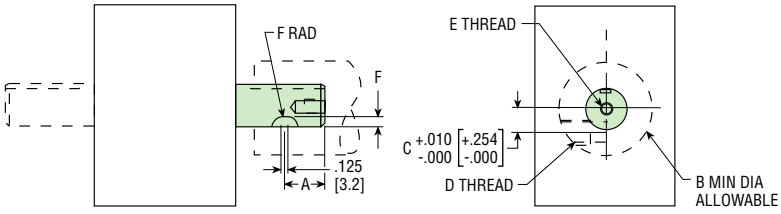
SERIES	LETTER DIMENSION				
		IMPERIAL*		METRIC**	
	PA	V	W	V	W
2000	.875 [22]	.4998/.5003 [12.69/12.71]	1/8 x 1/16 x .625 [3.18 x 1.56 x 16]	— [12.00/11.97]	— [4 x 2.5 x 15]
4000	1.875 [48]	.8748/.8753 [22.22/22.23]	3/16 x 3/32 x 1.500 [4.75 x 2.36 x 38]	— [22.00/21.96]	— [6 x 3.5 x 32]
6000	1.875 [48]	1.124/1.125 [28.55/28.58]	1/4 x 1/8 x 1.500 [6.35 x 3.18 x 38]	— [28.00/27.96]	— [8 x 5 x 40]
8000	3.500 [89]	1.749/1.750 [44.42/44.45]	3/8 x 3/16 x 3.000 [9.53 x 2.36 x 76]	— [44.00/43.96]	— [12 x 5 x 56]

NOTES:
1) **SHAFT KEYWAY:** SHOWN AT MID-ROTATION
2) *IMPERIAL SHAFT UNITS (Rx1x, Rx5x)
3) **METRIC SHAFT UNITS (Rx6x)

K PRELOADED KEYWAY SHAFT

Not available on Rx6x

Required when use of hub adaptor is desired.

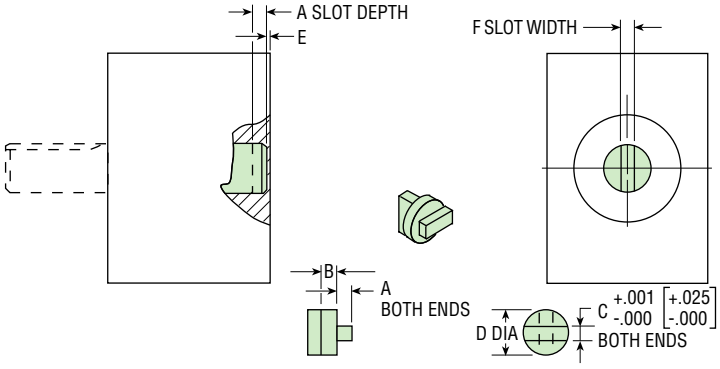


SERIES	LETTER DIMENSION					
	A	B	C	D	E	F
2000	.375 [9.5]	1.500 [38.1]	.250 [6.35]	3/8-24 [M10]	10-32 x .312 DP [M5 x 8]	.156 [4]
4000	.812 [20.6]	2.000 [50.8]	.437 [11.11]	1/2-20 [M12]	5/16-24 x .440 DP [M8 x 11]	.220 [6]
6000	.812 [20.6]	3.000 [76.2]	.563 [14.28]	5/8-11 [M16]	3/8-24 x .560 DP [M10 x 14]	.251 [6]
8000	1.500 [38.1]	4.000 [101.6]	.875 [22.22]	1-8 [M24]	1/2-20 x .687 DP [M12 x 17.5]	.438 [11]

SHAFT KEYWAY: SHOWN AT MID-ROTATION
R2xx UNITS: WHEN ORDERING SPECIFY -K-K FOR PRELOAD ON BOTH SHAFT EXTENSIONS. PRELOAD WILL BE ON OPPOSITE SIDES OF SHAFT.
SET SCREW: INCLUDED WITH UNIT

C CROSS KEY SHAFT

Not available on Rx6x

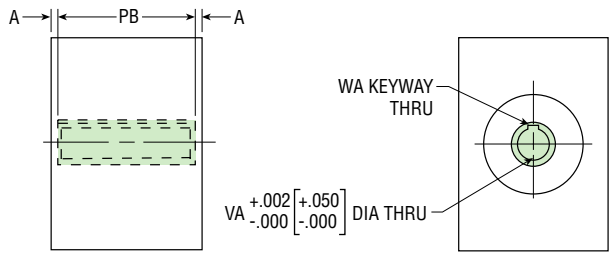


SERIES	LETTER DIMENSION					
	A	B	C	D	E	F
2000	.250 [6.4]	.215 [5.5]	.230 [5.8]	.500 [12.7]	.118 [3]	.250 [6.3]
4000	.250 [6.4]	.265 [6.7]	.248 [6.3]	.875 [22.2]	.120 [3]	.248 [6.3]
6000	.437 [11]	.485 [12.3]	.500 [12.7]	1.125 [28.6]	.150 [3.8]	.5002 [12.7]
8000	.437 [11]	.805 [20.4]	.875 [22.2]	1.750 [44.5]	.245 [6.2]	.8752 [22.2]

SHAFT KEYWAY: SHOWN AT MID-ROTATION
R2xx UNITS: WHEN ORDERING SPECIFY -C-C FOR CROSSKEY ON BOTH SHAFT EXTENSIONS
CROSSKEY: INCLUDED WITH UNIT

H HOLLOW SHAFT

Not available on Rx6x



SERIES	LETTER DIMENSION			
	A	PB	VA	WA
2000	.042 [1.1]	1.920 [48.76]	.250 [6.35]	— —
4000	.042 [1.1]	2.917 [74.09]	.500 [12.7]	1/8 x 1/16 [3.18 x 1.58]
6000	.135 [3.4]	2.730 [69.34]	.687 [17.46]	3/16 x 3/32 [4.76 x 2.38]
8000	.240 [6.1]	4.520 [114.80]	1.125 [28.57]	1/4 x 1/8 [6.35 x 3.18]

SHAFT KEYWAY: SHOWN AT MID-ROTATION

MAGNETIC PISTON FOR USE WITH PHD PROXIMITY SWITCHES

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

E SOLID STATE SWITCHES

Series 1000-8000 Rotary Actuators may be equipped with a magnetic band (specify -E) on the pistons which activates externally mounted PHD Solid State Switches. These switches allow the interfacing of the PHD Actuators to various logic systems. This option is for use with the following switches.

SERIES 1750 SOLID STATE SWITCHES

PART NO.	COLOR	DESCRIPTION
17503-2-06	Yellow	NPN (Sink) Type 4.5-24 VDC, 6 foot cable
17504-2-06	Red	PNP (Source) Type 4.5-24 VDC, 6 foot cable
17523-2	Yellow	NPN (Sink) Type 4.5-24 VDC, Quick Connect
17524-2	Red	PNP (Source) Type 4.5-24 VDC, Quick Connect

SWITCH BRACKETS

	PART NO.
SERIES	SERIES 1750
2000	17000-32-5
4000	17000-34-5
6000	17000-38-0
8000	17000-39-0

M REED SWITCHES

The PHD Magnetic Reed Switches may be used in situations where the Solid State Switches are not applicable. As with the Solid State 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.

SERIES 1750 REED SWITCHES

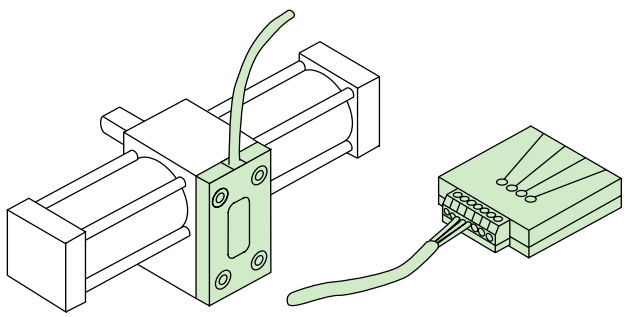
PART NO.	DESCRIPTION	
17502-2-06	White	NPN (Sink) or PNP (Source) 4.5-24 VDC, 6 foot cable
17509-3-06	Green	AC Type 110-120 VAC with Current Limit, 6 foot cable
17522-2	White	NPN (Sink) or PNP (Source) 4.5-24 VDC, Quick Connect
17529-3	Green	AC Type 110-120 VAC, Quick Connect with Current Limit

J SENSOR/SET POINT MODULE

Not available on Rx6x

PHD offers a solid state sensor transducer along with a Set Point Module which provides up to four adjustable sensing positions throughout the 180° maximum sensing range. These signals can be used as inputs to a programmable controller to signal ends of rotation in addition to multiple signals during rotation for indication of arc traveled.

The Set Point Module allows independent adjustment of each sensing position and is available for 4.5 to 24 VDC current sinking or current sourcing.



SET POINT MODULE

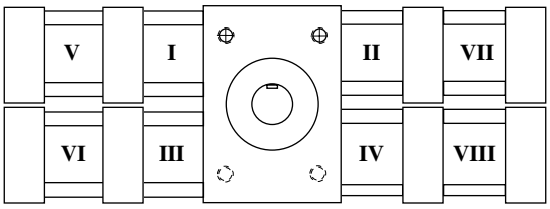
PART NO.	DESCRIPTION
9800-01-0300	NPN (Sink) 4.5-24 VDC
9800-01-0400	PNP (Source) 4.5-24 VDC

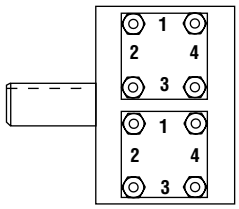
See Switches and Sensors section for information.

PORT & PORT CONTROL® LOCATIONS

Standard port location on all Multi-Position Actuators is position 2. Standard Port Control® and cushion adjustment needles are located in position 1 and 3. Other port and adjusting needle locations are available as specified.

Needles may not be located in same position as ports.





I PORT POSITION 1 TOP RACK PORT POSITION 3 BOTTOM RACK

This option positions the ports in position 1 on tubes I, II, V, and VII and in position 3 on tubes III, IV, VI, and VIII. This allows access to the ports on the "Top" and "Bottom" sides of the actuator.

T PORT POSITION 4

This option positions the ports in position 4 on all tubes.

V FLUORO-ELASTOMER SEALS

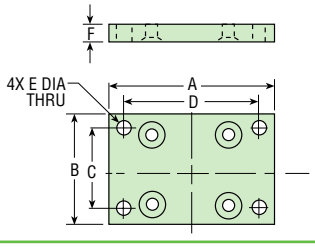
Fluoro-Elastomer seals are available to achieve seal compatibility with certain fluids. Seal compatibility should be checked with the fluid manufacturer for proper application.

Z1 ELECTROLESS NICKEL PLATING

Electroless nickel plating is done on all externally exposed ferrous parts except the pinion shaft. This optional plating treatment gives an alternative method of protecting the unit from severe environments.

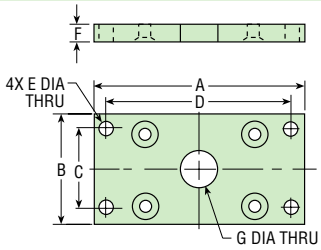
NOTE: Standard plating is Zinc and Black Oxide.

MOUNTING FLANGE (HARDWARE INCLUDED)



BOTTOM MOUNTING FLANGE

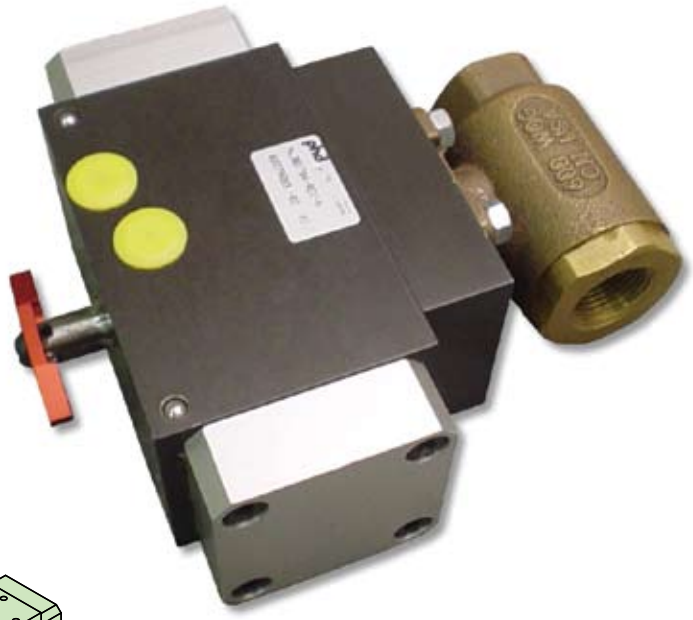
SERIES	KIT NO. IMPERIAL	KIT NO. METRIC	LETTER DIMENSION A	B	C	D	E	F
2000	13756	14320	4.250 [108]	2.000 [51]	1.625 [41.3]	2.625 [66.7]	.281 [7.1]	.250 [6.3]
4000	13757	14321	4.500 [114]	3.000 [76]	2.375 [60.3]	3.875 [98.4]	.406 [10.3]	.437 [11.1]
6000	13758	14322	4.500 [114]	4.000 [102]	3.375 [85.7]	3.875 [98.4]	.406 [10.3]	.437 [11.1]

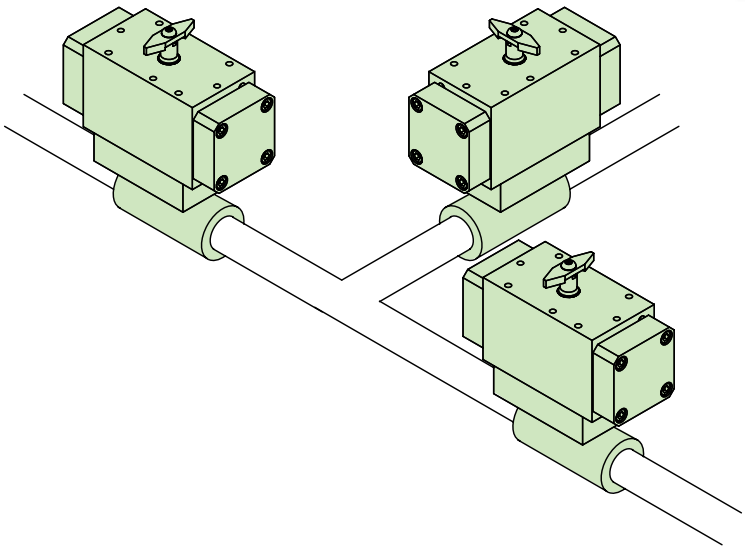


SIDE MOUNTING FLANGE

SERIES	KIT NO. IMPERIAL	KIT NO. METRIC	LETTER DIMENSION A	B	C	D	E	F	G
2000	13759	14316	4.250 [108]	2.000 [51]	1.375 [34.9]	3.625 [92.1]	.281 [7.1]	.250 [6.3]	.625 [15.9]
4000	13760	14317	5.750 [146]	3.000 [76]	2.125 [54.0]	5.125 [130.2]	.406 [10.3]	.437 [11.1]	1.000 [25.4]
6000	13761	14318	6.500 [165]	4.000 [102]	3.375 [85.7]	5.875 [149.2]	.406 [10.3]	.437 [11.1]	1.250 [31.8]
8000	13762	14319	12.000 [305]	5.000 [127]	3.000 [76.2]	10.000 [254.0]	.781 [19.8]	.750 [19.1]	1.875 [47.6]

BALL VALVE ROTARY
Model# ML302704





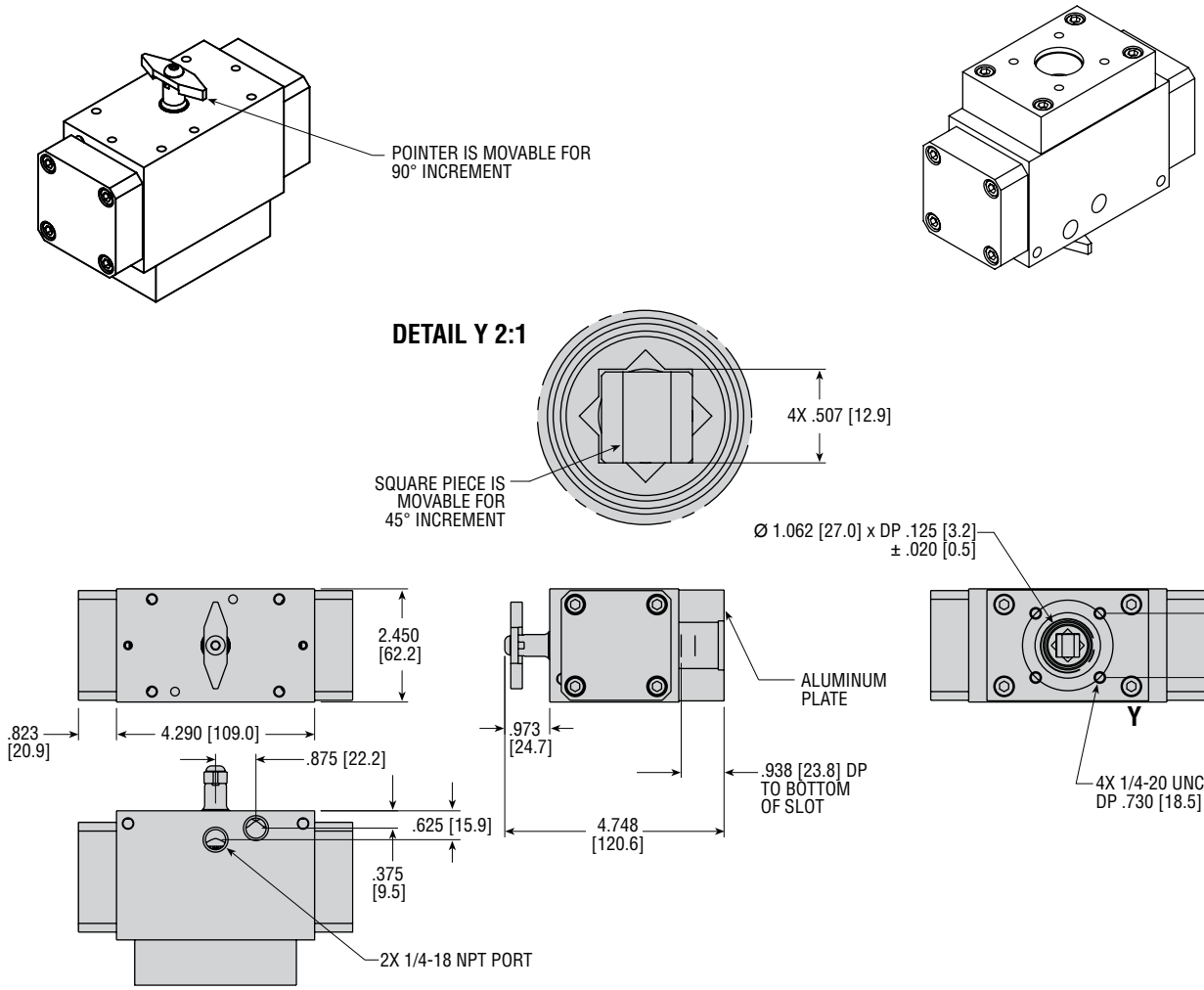
Major Benefits

- Pneumatic ball valve actuator
- Direct replacement
- Higher torque
- Single and double acting
- Other designs available
- Corrosion resistant option available

Industry Uses

- Automotive
- Metal forming

DIMENSIONS: BALL VALVE ROTARY MODEL# ML302704



NOTES:
1) ALL DIMENSIONS ARE FOR REFERENCE ONLY
2) 90° ROTATION W/ 2.000" BORE UNIT
3) UNIT SHOWN AT FULL CLOCKWISE POSITION
4) SPRING CLOCKWISE FOR 76 in-lb OF TORQUE (201 lb TOTAL SPRING PRELOAD)
5) FLAG AND VALVE POSITION INSERT MOVABLE FOR 45° INCREMENTS
6) HARDWARE KIT INCLUDED FOR MOUNT VALVE (1/4-20 STUDS- NO WASHERS OR NUTS)

All dimensions are reference only unless specifically toleranced.

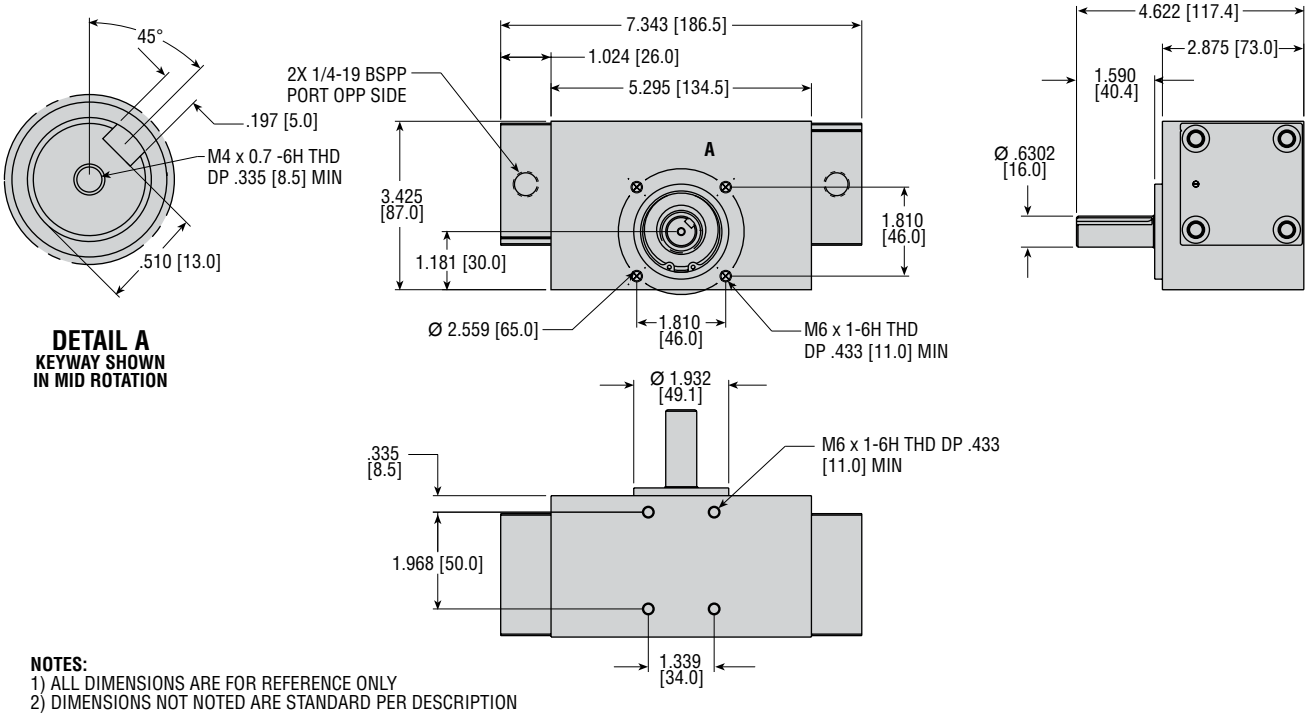
REPLACEMENT ROTARY Model# ML216496

Major Benefits

- Direct mounting replacement
- Pinion shaft modified as direct replacement
- Boss provides easy alignment

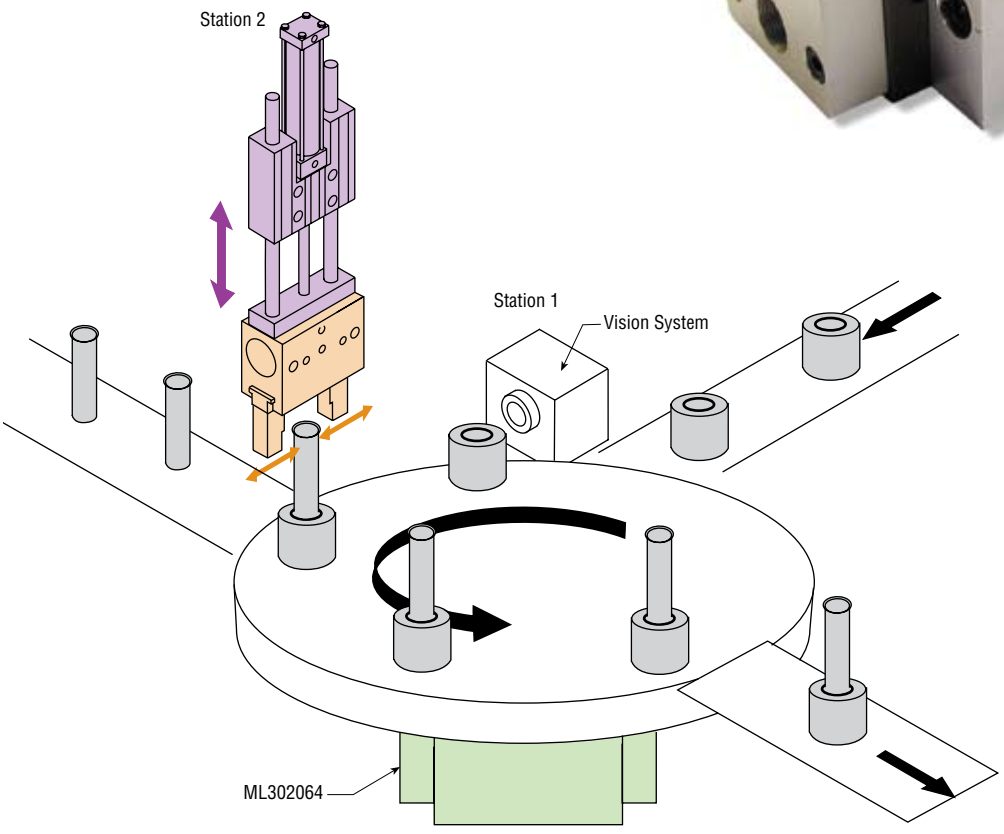
Industry Uses

- Carpet industry
- Metal forming
- Food industry
- Wood processing



NOTES:
1) ALL DIMENSIONS ARE FOR REFERENCE ONLY
2) DIMENSIONS NOT NOTED ARE STANDARD PER DESCRIPTION

SERIES RLS WITH CLUTCH Model# ML302064



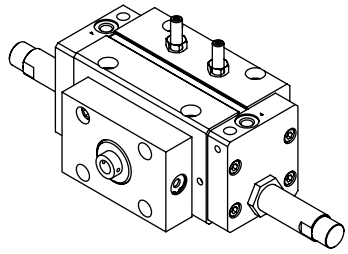
Major Benefits

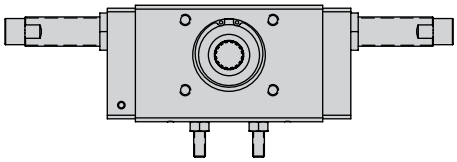
- Rotary with unidirectional clutch
- Modified to accept clutch
- Adjustable rotation

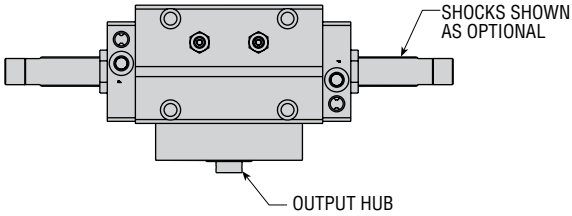
Industry Uses

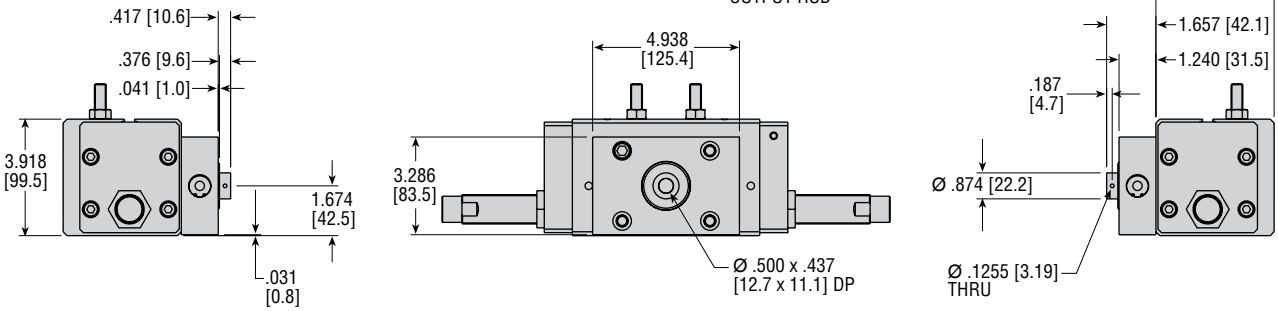
- Assembly machines

DIMENSIONS: SERIES RLS WITH CLUTCH MODEL# ML302064









NOTE:
1) ALL DIMENSIONS ARE FOR REFERENCE ONLY UNLESS SPECIFICALLY TOLERANCED
2) DIMENSIONS NOT SHOWN ARE STANDARD PER UNIT DESCRIPTION
3) UNIT INCLUDES A LEFT-HAND CLUTCH MECHANISM (OUTPUT HUB WILL ONLY ROTATE COUNTERCLOCKWISE)

phd Unlimited™
UNIQUE SOLUTIONS

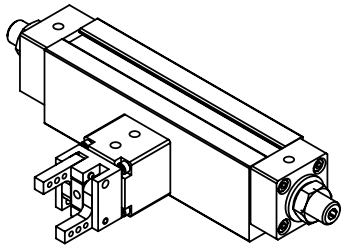
360° ROTARY WITH GRIPPER
Model# ML307464

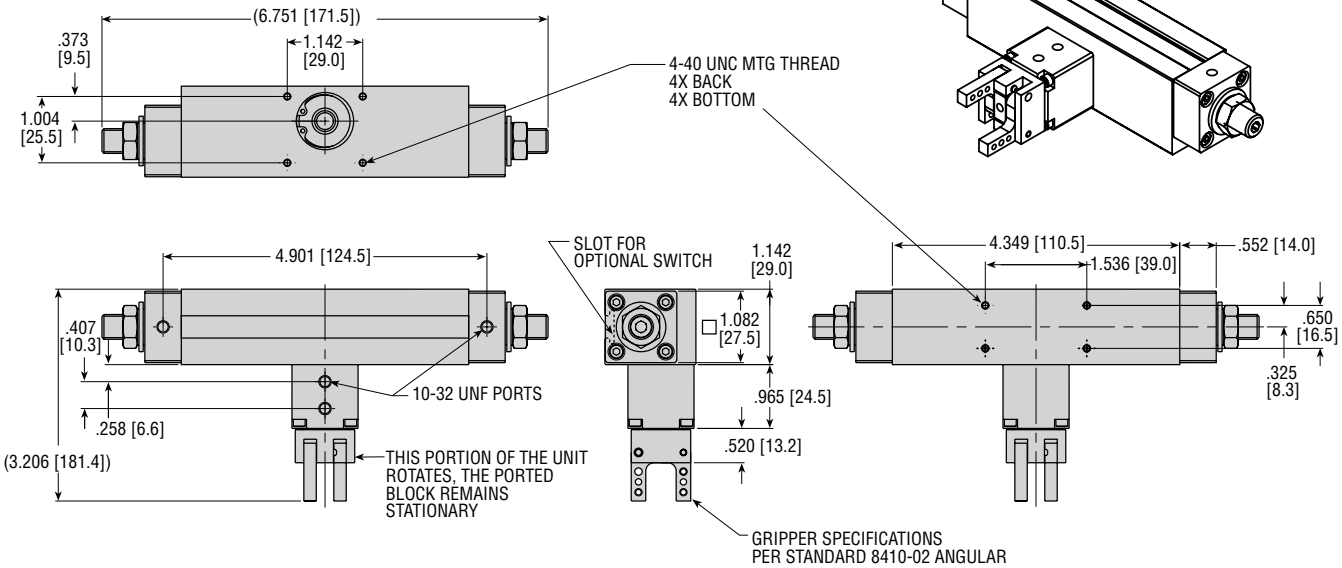
Major Benefits

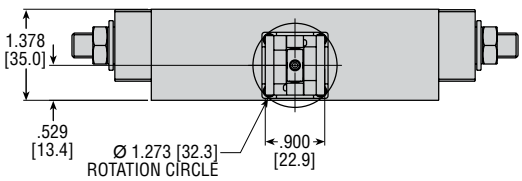
- 360° Series RLS Rotary with Series 8400 Angular Gripper
- Gripper built into the rotary
- Stationary ports - ports do not rotate

Industry Uses

- Assembly machines







NOTES:
1) ALL DIMENSIONS ARE REFERENCE ONLY; TITLE BLOCK TOLERANCES DO NOT APPLY
2) ROTARY WITH 360° ROTATION SIMILAR TO RLS116X270-AB-M
3) GRIPPER SIMILAR TO 8410-02-001
4) SEE ABOVE SIMILAR TO'S FOR FURTHER UNIT SPECIFICATIONS
5) SWITCH NOT AVAILABLE FOR GRIPPER

All dimensions are reference only unless specifically toleranced.

multi-motions

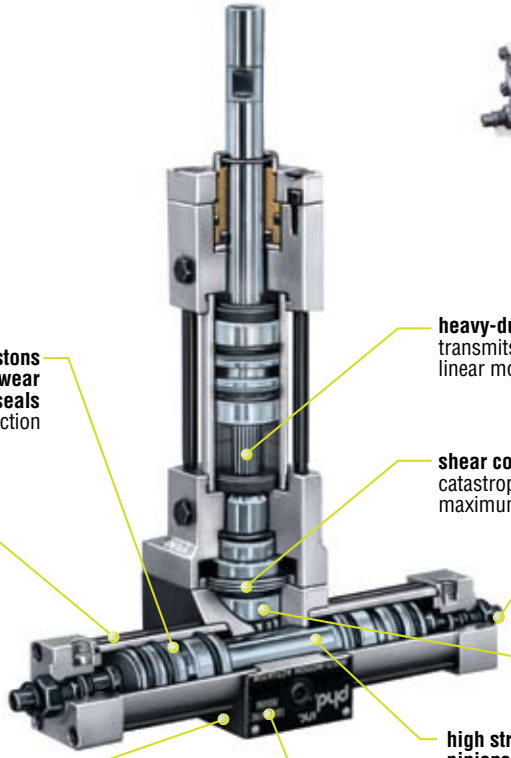
SERIES		SIZE	MAXIMUM STROKE	ANGLE OF ROTATION	MAJOR BENEFIT	INDUSTRY USE
1000-8000 **page 6-3**		1000 2000 3000 4000 5000 6000 7000 8000	1"-12" in 1" increments [25 mm to 300 mm in 25 mm increments] Consult PHD for longer strokes	45°, 90°, 180° 270°, 360° 450° Consult PHD for other available rotations	• Linear and rotary motion from the same output shaft	• Semiconductor • Assembly machinery • Automotive assembly • Foundry operation • Material handling • Welding/soldering • Medical assembly • Lathe loading
2000-8000 Air-Oil Tandem **page 6-13**		2000 4000 6000 8000	1"-12" in 1" increments [25 mm to 300 mm in 25 mm increments] Consult PHD for longer strokes	45°, 90°, 180° 270°, 360° 450° Consult PHD for other available rotations	• Control of hydraulics with simplicity of pneumatics • Smooth rotation	• Semiconductor • Assembly machinery • Automotive assembly • Foundry operation • Material handling • Welding/soldering • Medical assembly • Lathe loading
2000-8000 Multi-Position **page 6-25**		2000 4000 6000 8000	1"-12" in 1" increments [25 mm to 300 mm in 25 mm increments] Consult PHD for longer strokes	45°, 90°, 180° 270°, 360° 450° Consult PHD for other available rotations	• 3, 4, or 5 rotary position • Each position located by positive internal stops	• Semiconductor • Assembly machinery • Automotive assembly • Foundry operation • Material handling • Welding/soldering • Medical assembly • Lathe loading

SEE THE PHD CLASSICS CATALOG FOR THE FOLLOWING PHD MULTI-MOTION ACTUATORS:

Miniature Series MA/MT and Series MC

1000-8000

LINEAR AND ROTARY MOTION FROM THE SAME OUTPUT SHAFT



free floating aluminum pistons with pressure and wear compensating piston seals provide long life and low friction

units are also available with **double rack configurations** for increased torque

body has threaded mounting holes on the back and bottom for versatile mounting locations

hardcoated aluminum body is impregnated with PTFE for wear resistance and lower friction

heavy-duty spline bar transmits rotary and linear motion

shear coupling prevents catastrophic damage to unit if maximum torque is exceeded

angle adjustments and port controls are built-in providing adjustment and control

heavy duty sealed ball bearings ensure shaft stability under heavy loading and high impact loading

high strength alloy steel racks and pinions ensure long life

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.

Industry Uses

- Part positioning
- Pick and place applications
- Testing procedures (pharmaceutical)
- Part load/unload or transfer

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.

Options may affect unit length. See unit dimension and options pages for adders.

MOUNTING STYLE
B - Tapped holes in linear and rotary section -(standard)
RF - Rod Flange on linear section
CF - Flange on rotary section
F - Foot Mount thru holes on linear section

ANGLE OF ROTATION STANDARD ANGLES
45°, 90°, 180°, 270°, 360°, and 450°
For other available rotations, consult PHD.

ROD END STYLE
PL - Plain rod end
PK - Plain with Keyway and preload Keyway
KY - Threaded with Keyway and preload Keyway
MT - Male Thread only

ROTARY SECTION CUSHION
D1 - Cushion clockwise
D2 - Cushion counterclockwise

ROTARY SECTION SHOCK PADS
B1 - Shock Pad clockwise
B2 - Shock Pad counterclockwise
(Shock Pads are not available for Hydraulic use.)

ROTARY SECTION OPTIONS
C - Port in Position 1 (Available only on Series 1000, 3000, 5000, and 7000. Not available on double rack units.)
F - Port in Position 4
K - PVA (1000- 4000 only)
H - Hall Sensor (Set Point Module is ordered separately). For rotations not exceeding 180°, see Switches & Sensors section. (N/A on Mx2x units)
I - Port Position 1 on top rack
Port Position 3 on bottom rack
NOTE: Sensor must be used with a PHD Set Point Module. See Switches and Sensors section for information and ordering data.

MA1 1 F 3 180 x 3 - KY - DR-BC - D1-B2 - S - C - M

TYPE
MA1 - 150 psi [10 bar] Air
MA2 - 150 psi [10 bar] Air with Aux. Shaft Ext.
MH1 - 1500 psi [100 bar] Hyd.
MH2 - 1500 psi [100 bar] Hyd. with Aux. Shaft Ext.

DESIGN NO.
1 - Imperial
5 - Metric

STROKE
1" [25 mm] to 12" [300 mm] in 1" [25 mm] increments
Other strokes available.
Consult PHD.

LINEAR SECTION CUSHION
DR - Cushion on rod end
DC - Cushion on cap end

LINEAR SECTION SHOCK PADS
BR - Shock Pad on rod end
BC - Shock Pad on cap end
(Cushion and Shock Pads are not available on the same end. Shock Pads are not available for Hydraulic use.)

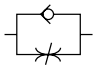
LINEAR SECTION OPTIONS
R - PVA (1000-4000 only)
S* - Port in Position #2
T* - Port in Position #3
U* - Port in Position #4
*Options -S, -T, and -U imply that mounting holes and flow control locations remain unchanged relative to new port position. (Rotates with port. See options page 6-11.)

ROTARY AND LINEAR OPTIONS
E - Magnetic Piston for Hall Effect Switch
M - Magnetic Piston for Reed Switch
N - SAE Ports (Hydraulic units only)
V - Fluoro-Elastomer Seals
W - Close Tolerance Stroke & Rotation
Z1 - Electroless Nickel Plate, all ferrous parts

SERIES
1 (000) 1-1/8" [29] Bore linear section, 1" [25] Bore rotary section - Single Rack
2 (000) 1-1/8" [29] Bore linear section, 1" [25] Bore rotary section - Double Rack
3 (000) 1-3/8" [35] Bore linear & rotary section - Single Rack
4 (000) 1-3/8" [35] Bore linear & rotary section - Double Rack
5 (000) 2" [50] Bore linear & rotary section - Single Rack
6 (000) 2" [50] Bore linear & rotary section - Double Rack
7 (000) 3" [75] Bore linear & rotary section - Single Rack
8 (000) 3" [75] Bore linear & rotary section - Double Rack

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

PORT CONTROL©



BUILT-IN METER OUT FLOW CONTROL VALVE
Port Control is standard on both sections of Series 1000-4000 and rotary section only of Series 5000-8000 Actuators.

ANGLE ADJUSTMENT
Angle Adjustment is standard on all Multi-Motion Actuators.

SWITCH MOUNTING BRACKETS

SERIES	SIZE NO. LINEAR SECTION	SIZE NO. ROTARY SECTION
1000 & 2000	-36	-32
3000 & 4000	-37	-34
5000 & 6000	-40	-38
7000 & 8000	-41	-39

See Switches and Sensors section for complete ordering information.

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

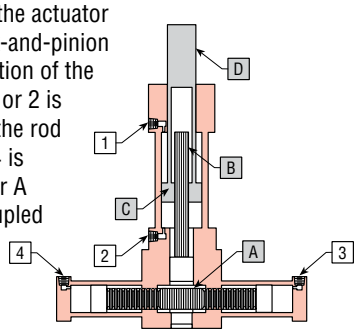
*See hydraulic pressure ratings for options chart below. All hydraulic ratings are based on non-shock hydraulic service.

	WEIGHT						ROTARY BORE DIAMETER		LINEAR BORE DIAMETER		ROTARY DISPLACEMENT		LINEAR DISPLACEMENT			
	BASE		ROT. ADDER		LINEAR ADDER								EXTEND		RETRACT	
SERIES	lb	kg	lb/deg	kg/deg	lb/in	kg/mm	in	mm	in	mm	in³/°	cm³/°	in³/in	cm³/mm	in³/in	cm³/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

	TORQUE OUTPUT		THRUST FORCE EXTEND		THRUST FORCE RETRACT	
SERIES	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				
3000	1.11	1.82	1.48	95.5	1.04	67.0
4000	2.22	3.64				
5000	2.36	3.87	3.14	202.5	1.65	106.5
6000	4.72	7.74				
7000	10.60	17.37	7.06	455.4	3.93	253.5
8000	21.20	34.75				

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.



HYDRAULIC PRESSURE RATINGS FOR OPTIONS

ROTARY SECTION

	OPTION psi [bar]							
	PLAIN		PORT CONTROLS		-Dx		-E or -M	
SERIES	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

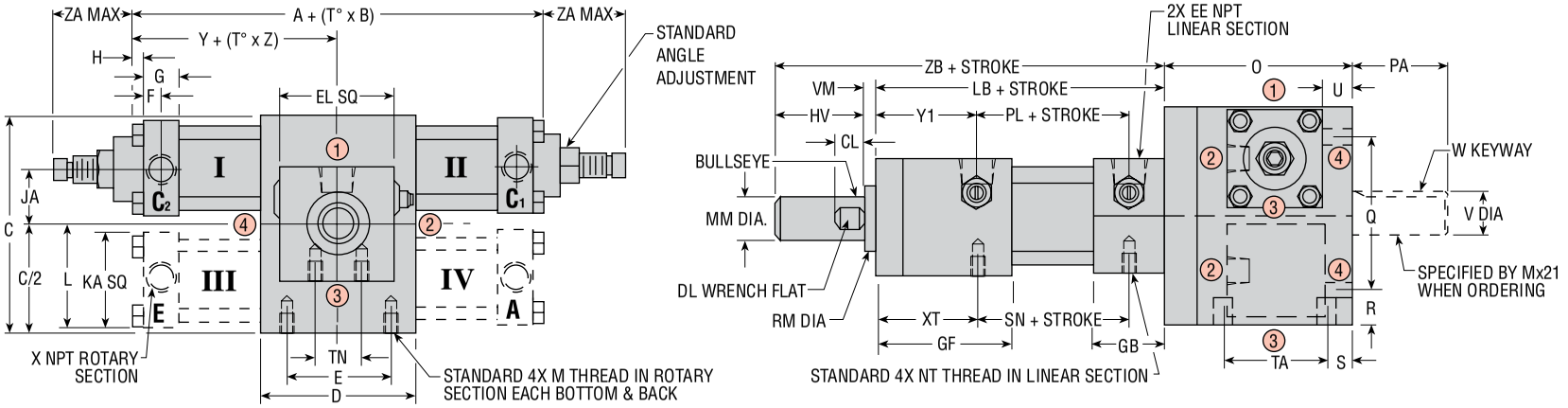
LINEAR SECTION

	OPTION psi [bar]							
	PLAIN		PORT CONTROLS		-Dx		-E or -M	
SERIES	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 AND APPLICATION ASSISTANCE

See PHD Product Sizing Catalog for specific and complete sizing information.
Online sizing assistance is available at: ***www.phdinc.com/apps/sizing***



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	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	1000 & 2000	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	1.875
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

LINEAR SECTION

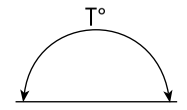
SERIES	LETTER DIMENSION																			
	CL	DL	EE	EL	GB	GC	GF	HV	LB	MM	NT	PL	RM	SN	TN	VM	XT	Y1	ZB
1000 & 2000	.530	1/2	1/4	1.750	1.250	1.000	2.187	1.500	5.000	.625	1/4-28 x .312 DP	2.812	1.000	2.812	.625	.250	1.562	1.562	6.750
3000 & 4000	.530	5/8	3/8	2.250	1.375	1.000	2.625	1.625	5.562	.750	5/16-24 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

QUICK REFERENCE FOR: A + (T° x B)

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

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

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 "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



PORT PRESSURIZED - FULL CCW POSITION
C_1 ON SERIES 1000, 3000, 5000, & 7000
OR C_1 & E ON SERIES 2000, 4000, 6000, & 8000 **I**

II PORT PRESSURIZED - FULL CW POSITION
C_2 ON SERIES 1000, 3000, 5000, & 7000
OR C_2 & A ON SERIES 2000, 4000, 6000, & 8000

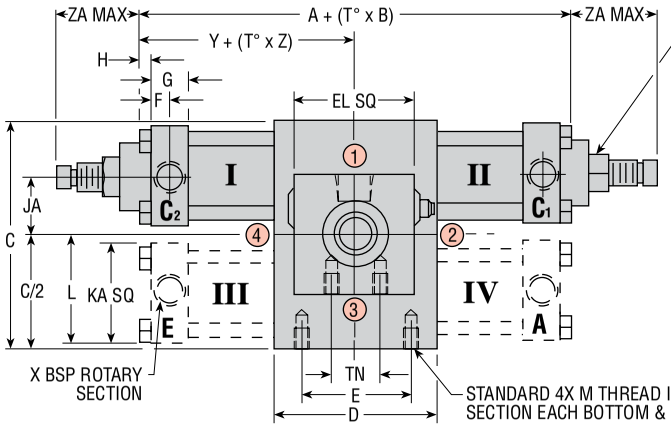
ROTARY SECTION OPTION LOCATION REFERENCE

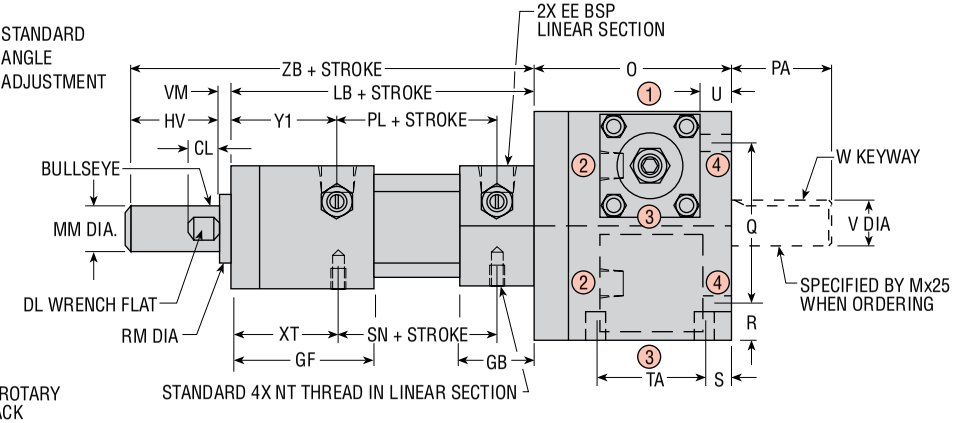
ACTUATOR TYPE	LETTER OPTION REFERENCED BY TUBE NUMBER							PORT & NEEDLE LOCATIONS REFERENCED BY CIRCLED NUMBERS												
	-B		-D		-P			STANDARD			-C			-F			-I		
	-B1	-B2	-D1	-D2	STANDARD	-M	-E	PORT	-P	-D	PORT	-P	-D	PORT	-P	-D	PORT	-P	-D
MA11 & MA21	II	I	II	I	I & II	I & II	I & II	2	1	1	1	2	2	4	1	1	1, 3	4	4
MH11 & MH21	—	—	II	I	I & II	I & II	I & II	2	1	1	1	2	2	4	1	1	1, 3	4	4

All standard rod ends have four wrench flats.

All dimensions are reference only unless specifically toleranced.

DIMENSIONS: 1000-8000 MULTI-MOTION ACTUATORS





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
BOTH	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

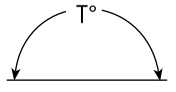
QUICK REFERENCE FOR: A + (T° x B)

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.

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

PORT PRESSURIZED - FULL CCW POSITION
C_1 ON SERIES 1000, 3000, 5000, & 7000
OR C_1 & E ON SERIES 2000, 4000, 6000, & 8000 **I**



PORT PRESSURIZED - FULL CW POSITION
C_2 ON SERIES 1000, 3000, 5000, & 7000
II OR C_2 & A ON SERIES 2000, 4000, 6000, & 8000

ROTARY SECTION OPTION LOCATION REFERENCE

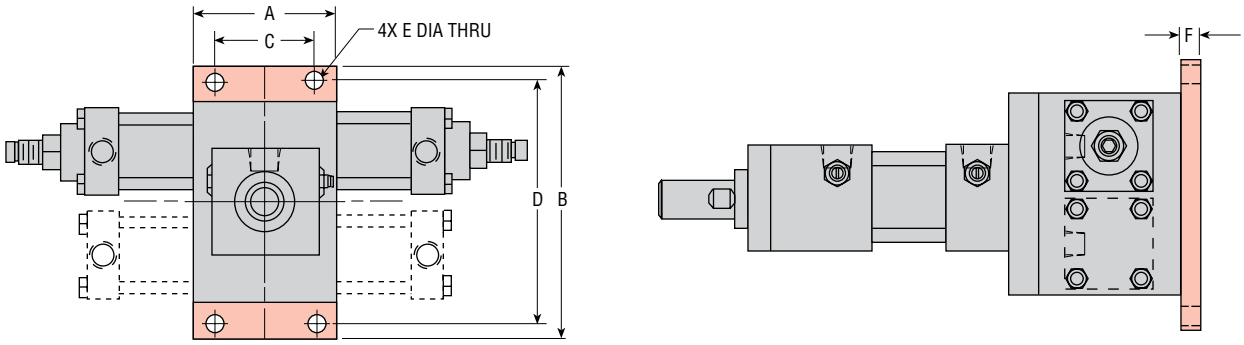
ACTUATOR TYPE	LETTER OPTION REFERENCED BY TUBE NUMBER							PORT & NEEDLE LOCATIONS REFERENCED BY CIRCLED NUMBERS												
	-B		-D		-P			STANDARD			-C			-F			-I		
	-B1	-B2	-D1	-D2	STANDARD	-M	-E	PORT	-P	-D	PORT	-P	-D	PORT	-P	-D	PORT	-P	-D
MA15 & MA25	II	I	II	I	I & II	I & II	I & II	2	1	1	1	2	2	4	1	1	1, 3	4	4
MH15 & MH25	—	—	II	I	I & II	I & II	I & II	2	1	1	1	2	2	4	1	1	1, 3	4	4

All standard rod ends have four wrench flats.

All dimensions are reference only unless specifically toleranced.

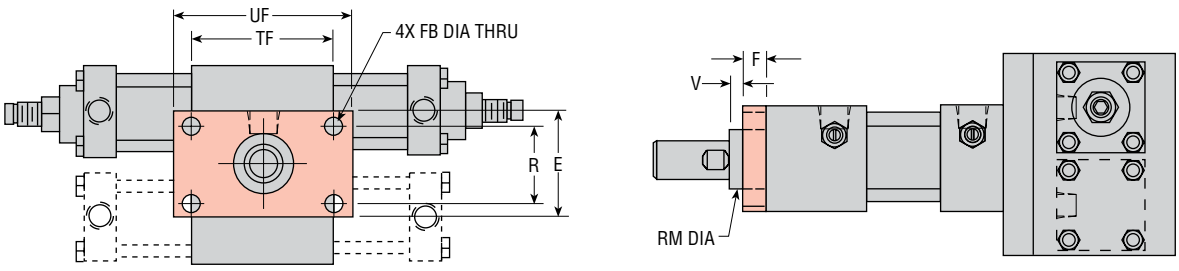
DIMENSIONS: MOUNTING STYLES

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]

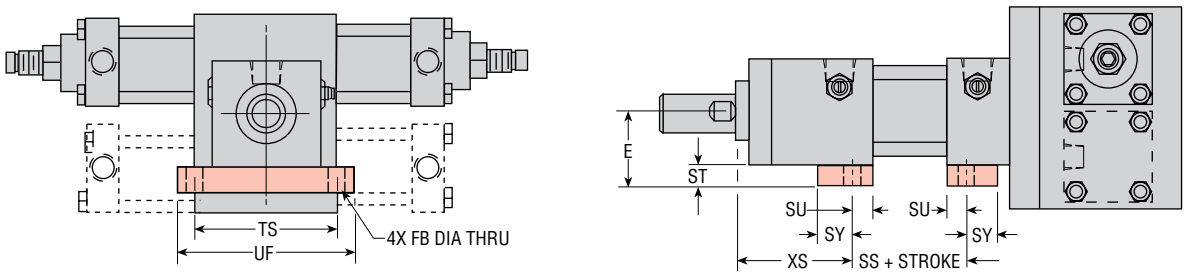
RF MOUNTING STYLE



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]	

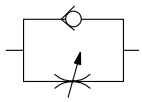
CUSHIONS: ADD TO (+ STROKE) DIMENSION FOR EACH CUSHION:
SERIES 1000, 2000, 3000, & 4000 = 1" [25 mm], SERIES 5000 & 6000 = 1-1/4" [32 mm], SERIES 7000 & 8000 = 1-1/2" [38 mm]
SHOCK PADS: ADD 1/4" [6.4 mm] TO (+ STROKE) DIMENSION FOR EACH SHOCK PAD

All dimensions are reference only unless specifically toleranced.

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.

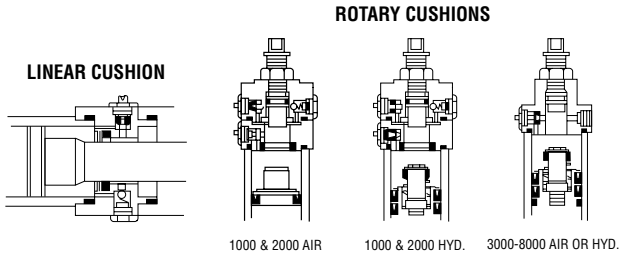


Standard on Series 1000-4000 and on the rotary section only of Series 5000-8000.

DR DC LINEAR SECTION CUSHIONS

D1 D2 ROTARY SECTION CUSHIONS

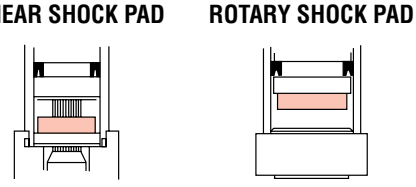
Adjustable cushions, available on all PHD Multi-Motion Actuators, allow smooth deceleration at the end of stroke and rotation to eliminate mechanical shock and hammer effect.



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

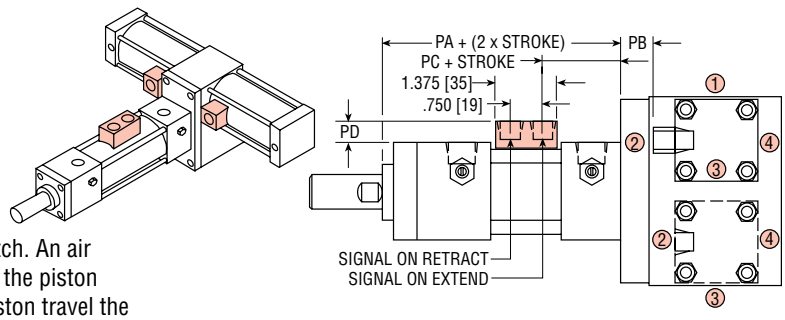


Polyurethane pads for absorption of shock and noise are available on each end of stroke and rotation on Series 1000-8000 Multi-Motion Actuators. Reducing shock permits higher piston velocities for shorter cycle times. Reducing noise levels provides improved environment for increased productivity. Pads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

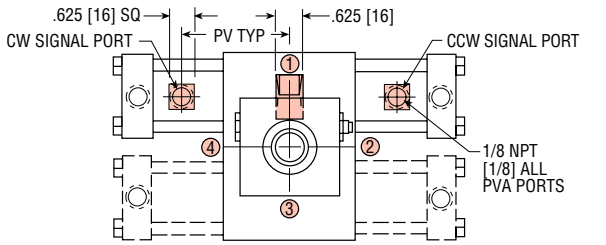


The PVA functions as a built-in pneumatic limit switch. An air pressure signal is provided at the end-of-piston travel as the piston seal uncovers an orifice in the block. Upon reversal of piston travel the pilot pressure is shut off and the pilot line is vented through the rotary actuator housing.

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.

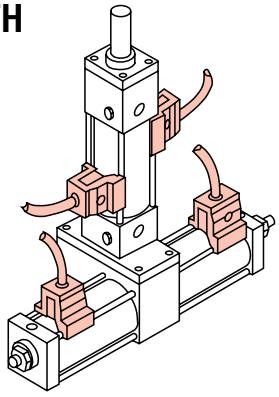


SERIES	LETTER DIMENSION					
	PA	PB	PC	PD	PV STANDARD	PV W/-B
1000 & 2000	4.500 [114]	.375 [9.5]	1.281 [32.5]	.375 [9.5]	2.191 [55.7]	1.848 [46.9]
3000 & 4000	5.125 [130]	.812 [20.6]	1.406 [35.7]	.312 [7.9]	2.847 [72.3]	2.410 [61.2]

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

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

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

H HALL EFFECT SENSOR/ TRANSDUCER

For use on all PHD Multi-Motion Actuators. The Hall Effect Sensor/Transducer provides up to four adjustable sensing positions throughout the 180° maximum sensing range. Minimum arc between two points is 1.5° of rotation. Can be used to signal ends of rotation in addition to multiple signals during rotation for indication of arc traveled.

Solid state electronics with Hall Effect sensing technology provide infinite trouble-free cycles.

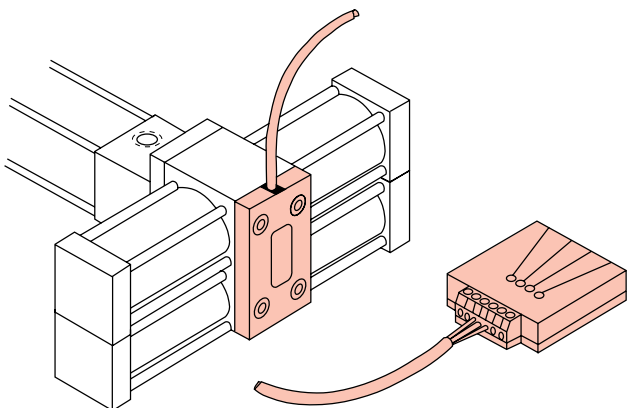
Wide signal range capability permits interfacing with most programmable controllers and logic systems.

Independent adjustment of each set point position from a single sensor.

LED indicators for visual confirmation of each output state.

Set Point Module is available for either current sinking or current sourcing models with 4.5 to 24 VDC output capability.

117 VAC interface module available to supply DC voltage to set point while providing 117 VAC output capability.



SET POINT MODULE

PART NO.	DESCRIPTION
9800-01-0300	4.5-24 VDC, Sink Type Output
9800-01-0400	4.5-24 VDC, Source Type Output

See Switches and Sensors section for information.

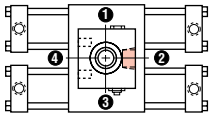
All dimensions are reference only unless specifically toleranced.

PORT POSITIONS

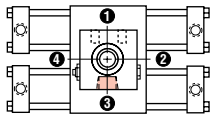
LINEAR SECTION

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.)

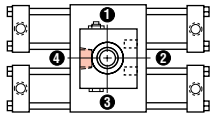
S **PORT POSITION 2**



T **PORT POSITION 3**



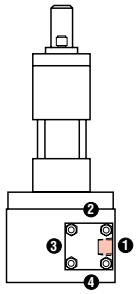
U **PORT POSITION 4**



ROTARY SECTION

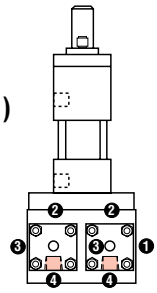
Port Position 2 is standard.

C **PORT POSITION 1**

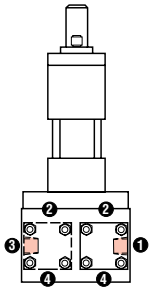


Available only on Series 1000, 3000, 5000, and 7000 Actuators.

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



I **PORT POSITION 1 TOP RACK**
PORT POSITION 3 BOTTOM RACK



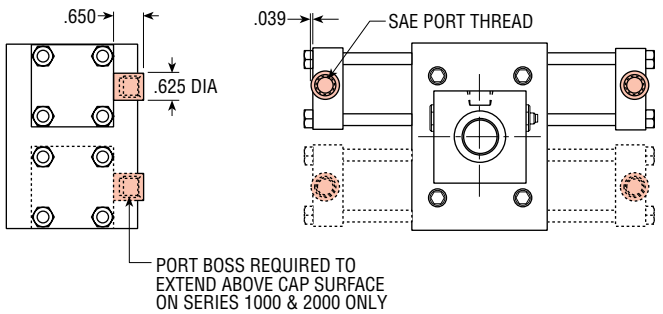
This option positions the ports in position 1 on tubes I and II and in position 3 on tubes III and IV. This allows access to the ports on the "Top" and "Bottom" sides of the actuator. Available on 2000, 4000, 6000, and 8000 actuators.

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.

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

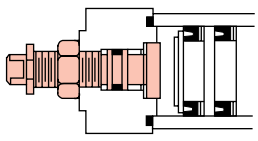


ANGLE ADJUSTMENT (STANDARD)

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°.



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

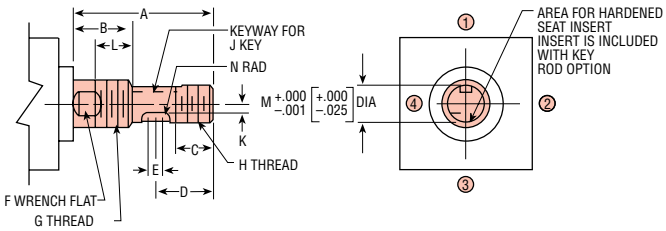
This option may be specified when a precise stroke and rotation is required and angle adjustment is not acceptable. By specifying this option, rotation will be within a tolerance of +30 minutes, -0 minutes and stroke will be a tolerance of ± .005 [± 0.127 mm].

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

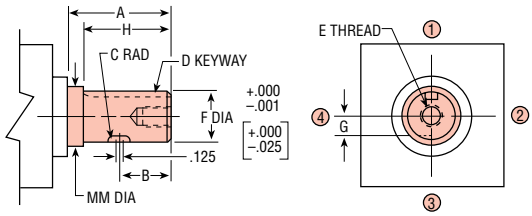
-KY THREADED ROD END WITH KEYWAY AND PRE-LOAD



NOTE: Keyway shown at mid-rotation

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]

-PK PLAIN ROD END WITH KEYWAY AND PRE-LOAD



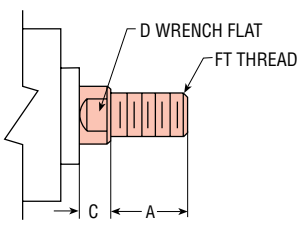
CIRCLED NUMBERS: INDICATE PORT POSITIONS
KEY: INCLUDED WITH ROD END OPTION

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]
3000 & 4000	.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]
7000 & 8000	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.

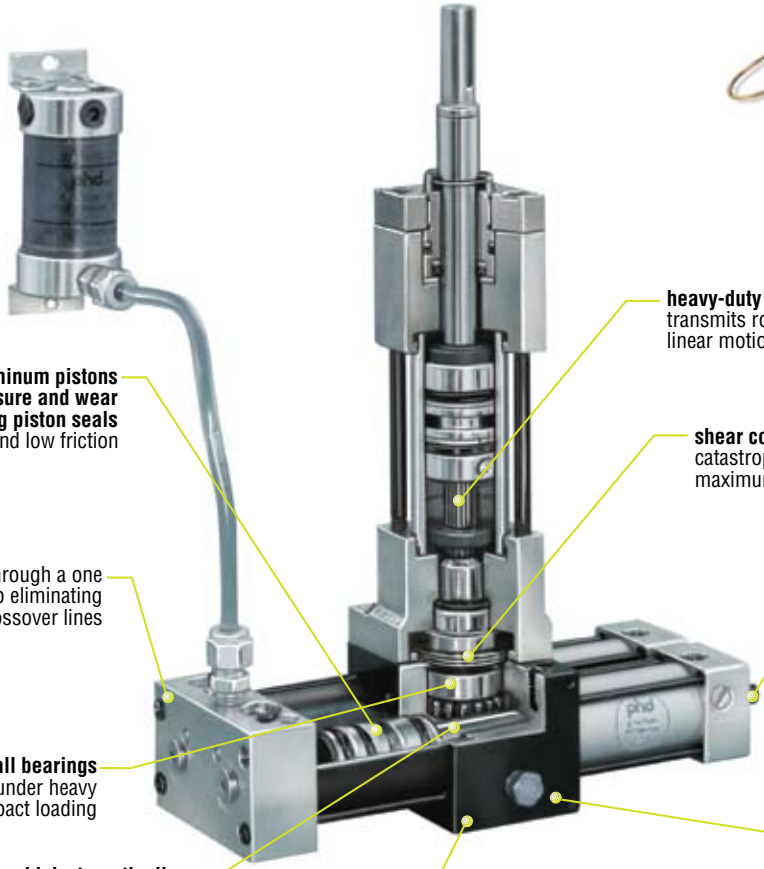


All standard rod ends have four wrench flats.

All dimensions are reference only unless specifically toleranced.

2000-8000
air/oil tandem

LONG LIFE AND LOW FRICTION WITH SMOOTH CONSISTENT MOTION



free floating aluminum pistons with pressure and wear compensating piston seals provide long life and low friction

heavy-duty spline bar transmits rotary and linear motion

shear coupling prevents catastrophic damage to unit if maximum torque is exceeded

oil transfer is through a one piece tandem cap eliminating external crossover lines

angle adjustments and port controls are built-in providing adjustment and control

heavy duty sealed ball bearings ensure shaft stability under heavy loading and high impact loading

high strength alloy steel racks and pinions ensure long life

hardcoated aluminum body is impregnated with PTFE for wear resistance and lower friction

body has threaded mounting holes on the back and bottom for versatile mounting locations

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 crossovers.
- Shear coupling prevents catastrophic damage to unit if maximum torque is exceeded.
- Built-in flow controls and angle adjustments are standard on most sizes.

Industry Uses

- Part inspection/replacement
- Part transfer
- Multi-positional placement
- Pick and place

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.

MOUNTING STYLE
B - Tapped holes in linear and rotary section -(standard)
RF - Rod Flange on linear section
CF - Flange on rotary section
F - Foot Mount thru holes

TOTAL ANGLE OF ROTATION STANDARD ANGLES
45°, 90°, 180°, 270°, 360°, and 450°
For other available rotations, consult PHD.

ROD END STYLE
PL - Plain rod end
PK - Plain with Keyway and preload Keyway
KY - Threaded with Keyway and preload Keyway
MT - Male Thread only

Options may affect unit length. See unit dimension and options pages for adders.

ROTARY SECTION CUSHION
D1 - Cushion clockwise
D2 - Cushion counterclockwise

ROTARY SECTION OPTIONS
F - Port in Position 4
H - Hall Sensor (Set Point Module is ordered separately). For rotations not exceeding 180°. (N/A on Mx2x units)
I - Port Position 1 on top rack
Port Position 3 on bottom rack
Y - Tandem cap rotated 180°
NOTE: Sensor must be used with a PHD Set Point Module. See Switches and Sensors section for information and ordering data.

3	MR1	3	F	4	180	-	45	x	3	-	KY	-	DR-BC	-	D1	-	S	-	H	-	M

ONLY FOR USE WITH 3 POSITION TANDEM

DESIGN NO.
3 - Imperial
8 - Metric

TYPE
MR1 - 150 psi [10 bar] Air
MR2 - 150 psi [10 bar] Air with Aux. Shaft Ext.

STROKE
1" to 12" [25 to 300 mm] in 1" [25 mm] increments
Other strokes available. Consult PHD.

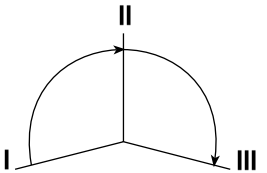
LINEAR SECTION CUSHION
DR - Cushion on rod end
DC - Cushion on cap end

LINEAR SECTION SHOCK PADS
BR - Shock Pad on rod end
BC - Shock Pad on cap end
(Cushion and Shock Pads are not available on the same end. Shock Pads are not available for Hydraulic use.)

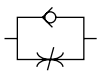
LINEAR SECTION OPTIONS
S* - Port in Position 2
T* - Port in Position 3
U* - Port in Position 4
*Options -S, -T, and -U imply that mounting holes and flow control locations remain unchanged relative to new port position. (Rotates with port. See options page 6-22.)

ROTARY AND LINEAR OPTIONS
E - Magnetic Piston for Hall Effect Switch
M - Magnetic Piston for Reed Switch
V - Fluoro-Elastomer Seals
W - Close Tolerance Stroke & Rotation
Z1 - Electroless Nickel Plate, all ferrous parts

SERIES
2 (000) 1-1/8" [29 mm] Bore linear section, 1" [25 mm] Bore rotary section - Double Rack
4 (000) 1-3/8" [35 mm] Bore linear & rotary section - Double Rack
6 (000) 2" [50 mm] Bore linear & rotary section - Double Rack
8 (000) 3" [75 mm] Bore linear & rotary section - Double Rack



PORT CONTROL©



BUILT-IN METER OUT FLOW CONTROL VALVE
Port Control is standard on both sections of Series 2000 & 4000 and rotary section only of Series 6000 & 8000 Actuators.

PROXIMITY SWITCH MOUNTING BRACKETS

SERIES	SIZE NO. LINEAR SECTION	SIZE NO. ROTARY SECTION
2000	-36	-32
4000	-37	-34
6000	-40	-38
8000	-41	-39

See the Switches and Sensors section for complete ordering information.

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'

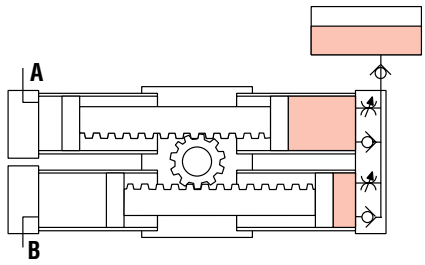
	WEIGHT						ROTARY BORE DIAMETER		LINEAR BORE DIAMETER		ROTARY DISPLACEMENT		LINEAR DISPLACEMENT			
	BASE		ROT. ADDER		LINEAR ADDER								EXTEND		RETRACT	
SERIES	lb	kg	lb/deg	kg/deg	lb/in	kg/mm	in	mm	in	mm	in^3/deg	cm^3/deg	in^3/in	cm^3/mm	in^3/in	cm^3/mm
2000	7.3	3.3	.0043	.0020	.38	.0068	1.000	25.4	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

	TORQUE OUTPUT		THRUST FORCE EXTEND		THRUST FORCE RETRACT	
SERIES	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.

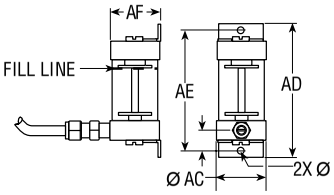


SIZING AND APPLICATION ASSISTANCE

See PHD Product Sizing Catalog for specific and complete sizing information.
Online sizing assistance is available at: ***www.phdinc.com/apps/sizing***

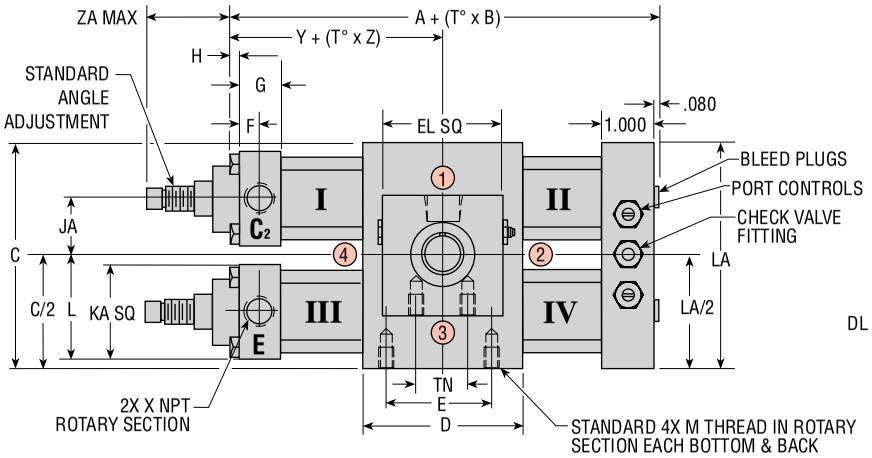
RESERVOIR PART NO.	AB	AC	AD	AE	AF
13459-02-2	16.4	63.5	139.7	130.2	64.3
13459-03-2	13.8	38.1	98.4	88.9	38.9

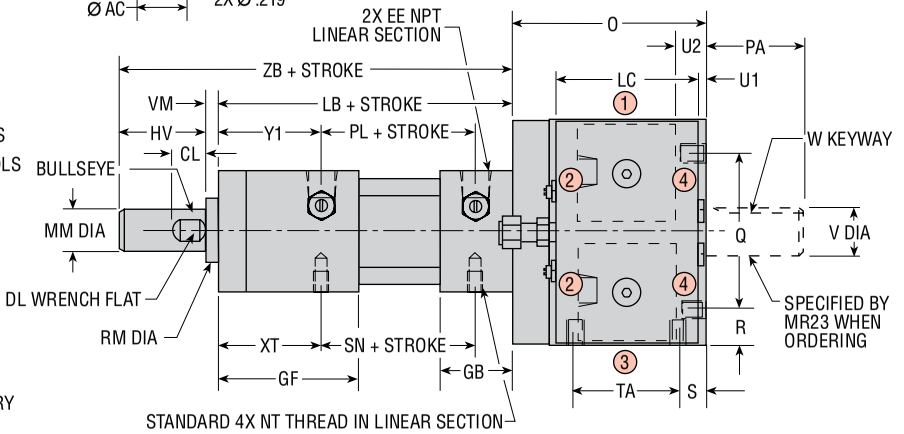
TANK DIMENSIONS



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	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	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			-I		
	-D1	-D2	STANDARD	-M	-E	PORT	-P	-D	PORT	-P	-D	PORT	-P	-D
MR13 & MR23	II	IV	II & IV	I & III	I & III	2	2	2	4	2	2	1, 3	2	2

PORT PRESSURIZED - E
FULL CCW POSITION

PORT PRESSURIZED - C2
FULL CW POSITION

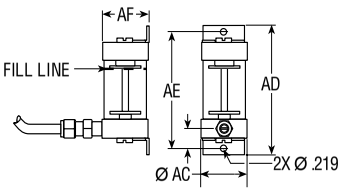
All standard rod ends have four wrench flats.

All dimensions are reference only unless specifically toleranced.

DIMENSIONS: AIR/OIL TANDEM MULTI-MOTION ACTUATORS

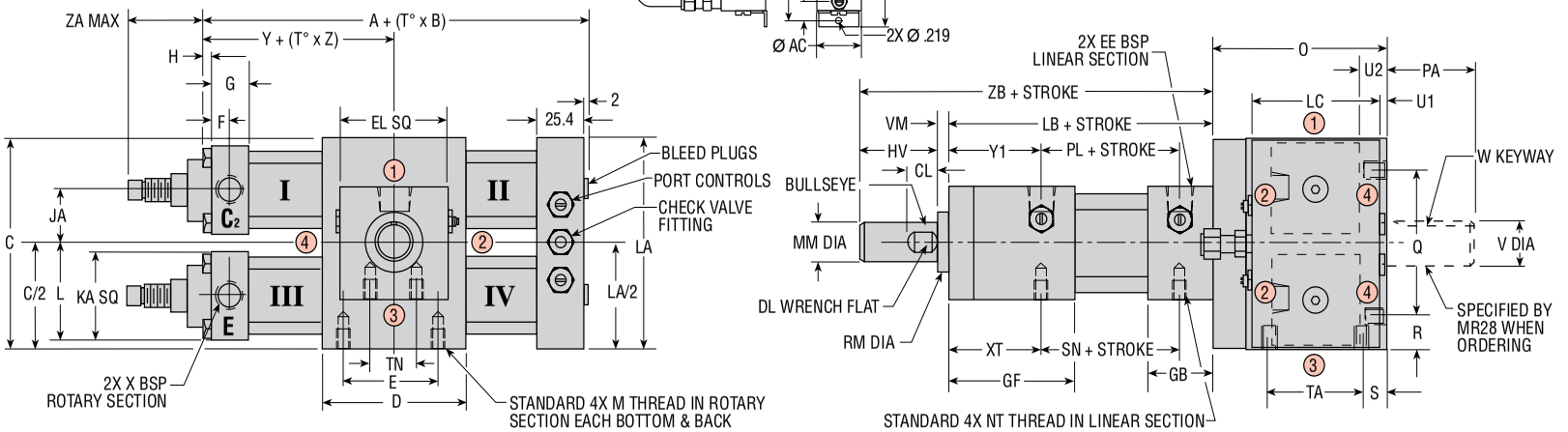
RESERVOIR PART NO.	AB	AC	AD	AE	AF
68397-02-2	16.4	63.5	139.7	130.2	64.3
68397-03-2	13.8	38.1	98.4	88.9	38.9

TANK DIMENSIONS



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.



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	158	0.44	76	51	38.1	6	13	0	19	35	36	73	44	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	72	0.22	29
4000	203	0.66	108	76	50.8	9	17	6	29	48	53	106	70	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	100	0.33	38
6000	233	0.66	127	102	63.5	10	19	5	29	57	58	119	70	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	116	0.33	48
8000	283	1.32	203	127	76.2	12	27	11	48	89	92	156	76	M20 x 2.5 x 32	159	89	127	38	32	63.5	25	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)

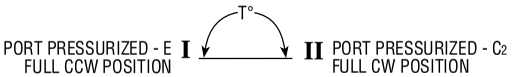
SERIES	DEGREE OF ROTATION					
	45	90	180	270	360	450
2000	177.7	197.6	237.4	277.2	317.0	356.7
4000	232.6	262.2	321.7	381.2	440.6	500.0
6000	263.1	292.9	352.3	411.7	471.2	530.9
8000	342.1	401.5	520.4	639.3	758.1	877.0

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 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		-P			STANDARD			-F			-I		
	-D1	-D2	STANDARD	-M	-E	PORT	-P	-D	PORT	-P	-D	PORT	-P	-D
MR18 & MR28	II	IV	II & IV	I & III	I & III	2	2	2	4	2	2	1, 3	2	2

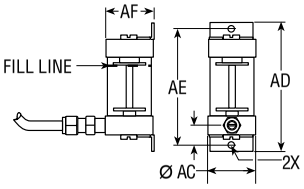
All standard rod ends have four wrench flats.



All dimensions are reference only unless specifically toleranced.

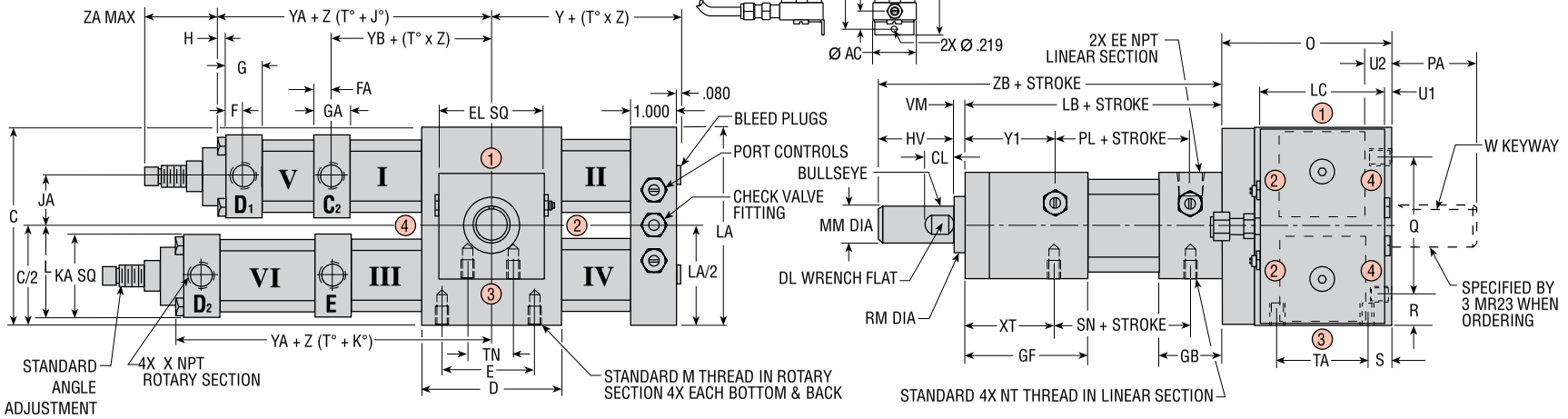
RESERVOIR PART NO.	AB	AC	AD	AE	AF
13459-02-2	16.4	63.5	139.7	130.2	64.3
13459-03-2	13.8	38.1	98.4	88.9	38.9

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.

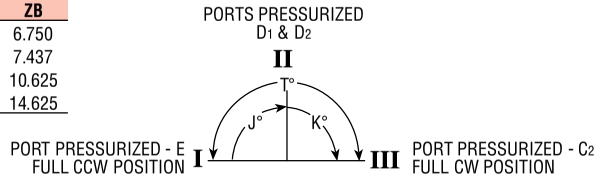


ROTARY SECTION

SERIES	LETTER DIMENSION																													
	C	D	E	F	FA	G	GA	H	JA	KA	L	LA	LC	M	O	PA	Q	R	S	TA	U1	U2	V	W	X	Y	YA	YB	Z	ZA
2000	3.000	2.000	1.500	.500	.500	.750	.750	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	3.366	5.983	2.599	.0087	1.125
4000	4.250	3.000	2.000	.344	.375	.688	.719	.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	4.033	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	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	4.627	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	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	5.048	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
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



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

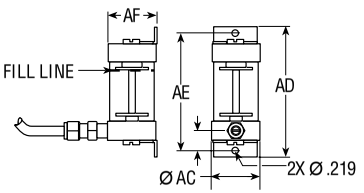
ACTUATOR TYPE	LETTER OPTION REFERENCED BY TUBE NUMBER						PORT & NEEDLE LOCATIONS REFERENCED BY CIRCLED NUMBERS								
	-D		-P	-M	-E		STANDARD			-F			-I		
	-D1	-D2	STANDARD	I & III	I & III		PORT	-P	-D	PORT	-P	-D	PORT	-P	-D
3MR13 & 3MR23	II	IV	II & IV	V & VI	V & VI		2	2	2	4	2	2	1, 3	2	2

All standard rod ends have four wrench flats.

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

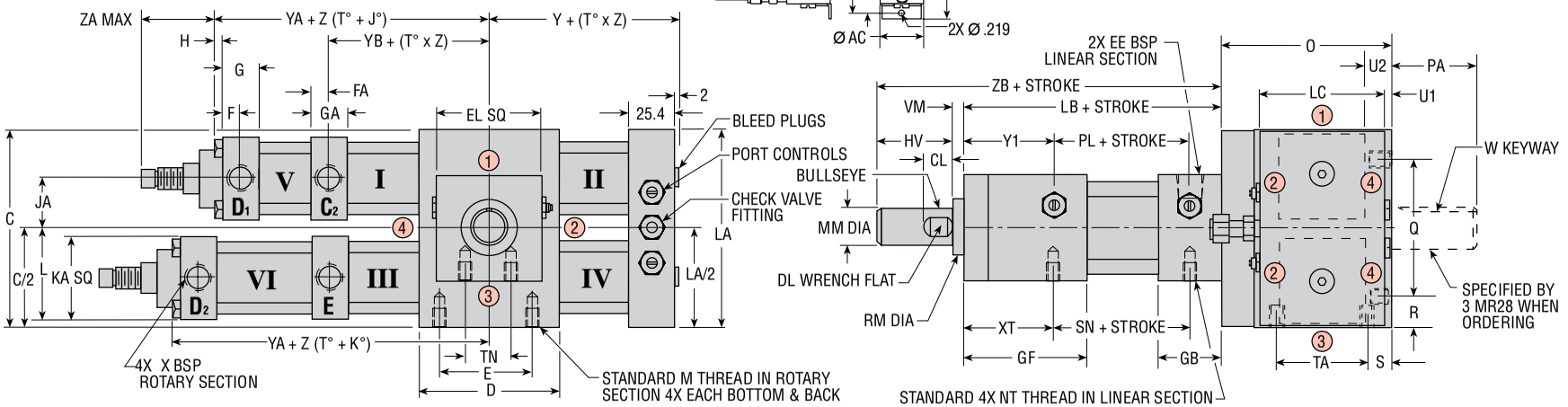
RESERVOIR PART NO.	AB	AC	AD	AE	AF
68397-02-2	16.4	63.5	139.7	130.2	64.3
68397-03-2	13.8	38.1	98.4	88.9	38.9

TANK DIMENSIONS



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.

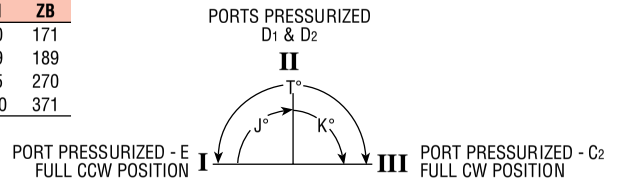


ROTARY SECTION

SERIES	LETTER DIMENSION																													
	C	D	E	F	FA	G	GA	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	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	18	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	18	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	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	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



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 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		-P	-M	-E	STANDARD			-F			-I		
	-D1	-D2	STANDARD	I & III	I & III	PORT	-P	-D	PORT	-P	-D	PORT	-P	-D
3MR18 & 3MR28	II	IV	II & IV	V & VI	V & VI	2	2	2	4	2	2	1, 3	2	2

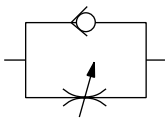
All standard rod ends have four wrench flats.

All dimensions are reference only unless specifically toleranced.

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 2000-4000 and on the rotary section only of Series 6000-8000.

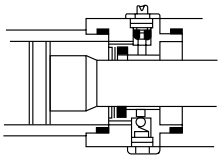
DR DC LINEAR SECTION ADJUSTABLE CUSHIONS

D1 D2 ROTARY SECTION ADJUSTABLE CUSHIONS

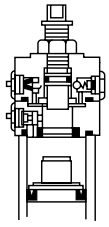
Adjustable cushions, available on all PHD Multi-Motion Actuators, allow smooth deceleration at the end of stroke and rotation to eliminate mechanical shock and hammer effect.

Effective cushioning length (approximate)
Rotary Section 2000-6000 = 30°, 8000 = 20°
Linear Section 2000-4000 = 3/4", 6000 = 1", 8000 = 1-1/4"

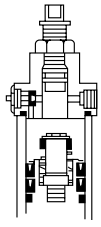
LINEAR CUSHION



ROTARY CUSHIONS



2000



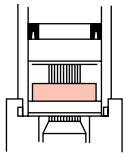
4000-8000

BR BC LINEAR SECTION SHOCK PADS

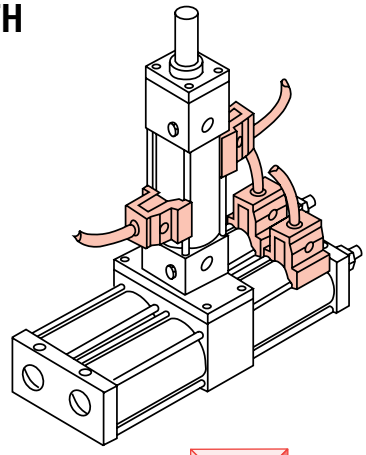
Polyurethane pads for absorption of shock and noise are available on each end of stroke on Series 2000-8000 Multi-Motion Actuators. Reducing shock permits higher piston velocities for shorter cycle times. Reducing noise levels provides improved environment for increased productivity. Pads eliminate metal-to-metal contact between piston and end caps.

NOTE: Pneumatic application only. Linear Section, add 1/4" [6.4 mm] to all (+ Stroke) dimensions for each shock pad.

LINEAR SHOCK PAD



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 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 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

H HALL EFFECT SENSOR/ TRANSDUCER

For use on all PHD Multi-Motion Actuators. The Hall Effect Sensor/Transducer provides up to four adjustable sensing positions throughout the 180° maximum sensing range. Minimum arc between two points is 1.5° of rotation. Can be used to signal ends of rotation in addition to multiple signals during rotation for indication of arc traveled.

Solid state electronics with Hall Effect sensing technology provide infinite trouble-free cycles.

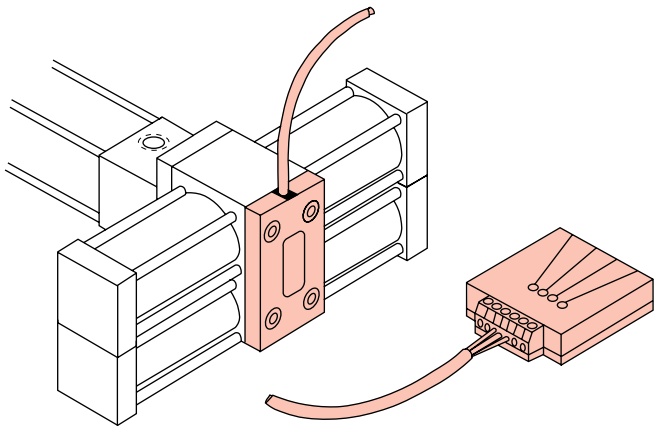
Wide signal range capability permits interfacing with most programmable controllers and logic systems.

Independent adjustment of each set point position from a single sensor.

LED indicators for visual confirmation of each output state.

Set Point Module is available for either current sinking or current sourcing models with 4.5 to 24 VDC output capability.

117 VAC interface module available to supply DC voltage to set point while providing 117 VAC output capability.



SET POINT MODULE

PART NO.	DESCRIPTION
9800-01-0300	4.5-24 VDC, Sink Type Output
9800-01-0400	4.5-24 VDC, Source Type Output

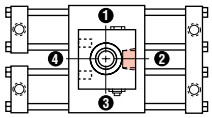
See Switches and Sensors section for information.

PORT POSITIONS

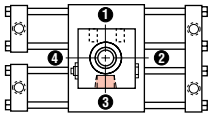
LINEAR SECTION

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. (Rotate with port.)

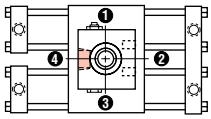
S **PORT POSITION 2**



T **PORT POSITION 3**

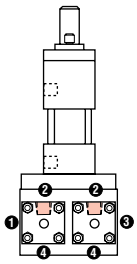


U **PORT POSITION 4**

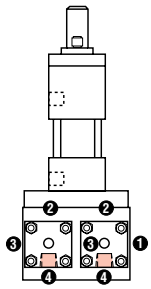


ROTARY SECTION

Port Position 2 is standard.

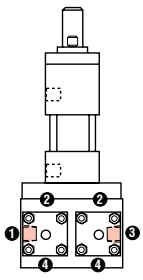


F **PORT POSITION 4**
(air section ports)



I **PORT POSITION 1**
TOP RACK

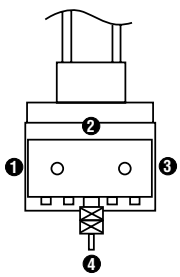
PORT POSITION 3
BOTTOM RACK
(air section ports)



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.

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.

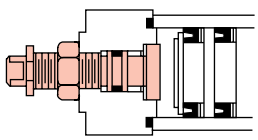


ANGLE ADJUSTMENT (STANDARD)

SERIES 2000-8000

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: AIR/OIL TANDEM 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

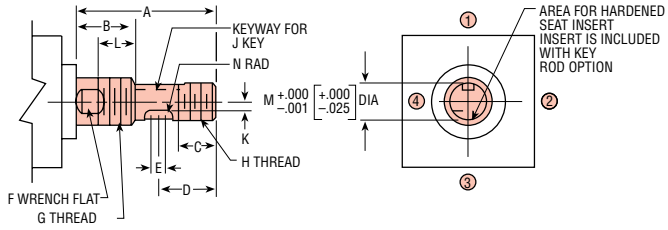
This option may be specified when a precise rotation and stroke is required and angle adjustment is not acceptable. By specifying this option, rotation will be within a tolerance of +30 minutes, -0 minutes and stroke will be a tolerance of ± .005 [± 0.127 mm].

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

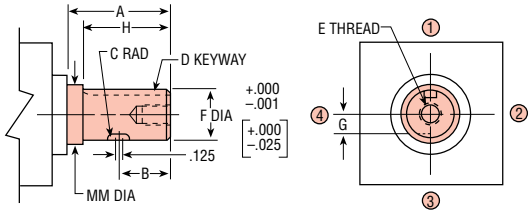
-KY THREADED ROD END WITH KEYWAY AND PRE-LOAD



LETTER DIM.	SERIES 2000	4000	6000	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



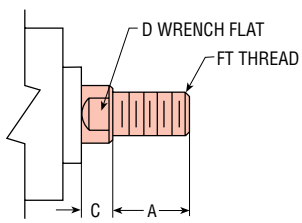
CIRCLED NUMBERS: INDICATE PORT POSITIONS
KEY: INCLUDED WITH ROD END OPTION

LETTER DIM.	SERIES 2000	4000	6000	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
2000	.625 [15.87]	.750 [19]	.375 [9.5]	1/2 [19.00]	7/16-20 [M12 x 1.25]
4000	.750 [19.05]	1.000 [25]	.375 [9.5]	5/8 [15.80]	9/16-18 [M14 x 1.50]
6000	1.375 [34.93]	2.375 [60.5]	.625 [15.9]	1-1/8 [28.5]	1-14 [M27 x 2.0]
8000	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.

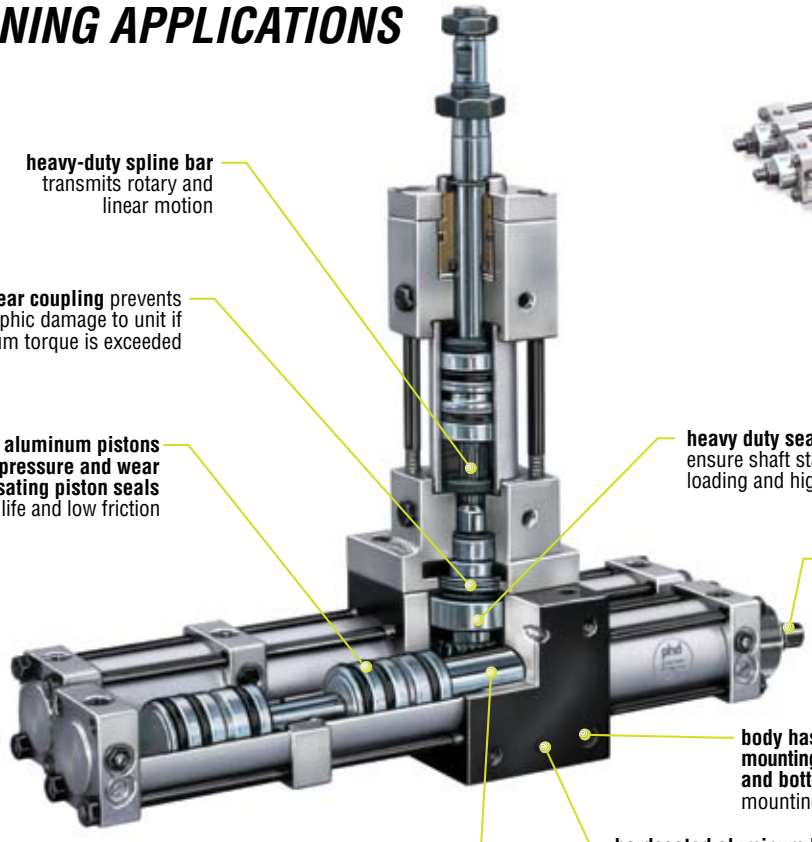


All standard rod ends have four wrench flats.

All dimensions are reference only unless specifically toleranced.

2000-8000 multi-position

MULTIPLE ROTARY POSITIONS IDEAL FOR FEEDING AND POSITIONING APPLICATIONS



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.

Industry Uses

- Multi-station load/unload
- Inspect/reject/replacement
- Lathe loading
- Part transfer
- Pick and place

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.

DESIGN NO.
1 - Imperial
5 - Metric

MOUNTING STYLE
B - Tapped holes in linear and rotary section -(standard)
RF - Rod Flange on linear section
CF - Flange on rotary section
F - Foot Mount thru holes

TOTAL ANGLE OF ROTATION STANDARD ANGLES
45°, 90°, 180°, 270°, 360°, and 450°
For other available rotations, consult PHD.

ANGLE OF ROTATION FROM POSITION I TO POSITION II.

ROD END STYLE
PL - Plain rod end
KY - Keyed rod end
PK - Plain keyed rod end
MT - Male Thread

ANGLE OF ROTATION FROM POSITION I TO POSITION IV. USED ON 5 POSITION ONLY.

ROTARY SECTION CUSHION
D1 - Cushion clockwise
D2 - Cushion counterclockwise

ROTARY SECTION SHOCK PADS
B1 - Shock Pad clockwise
B2 - Shock Pad counterclockwise
(Shock Pads are not available for Hydraulic use. Available on end positions only.)

ROTARY SECTION OPTIONS
F - Port in Position 4
H - Hall Sensor for units not exceedng 180°. (Set Point Module is ordered separately). See Switches and Sensors section. (N/A on Mx2x units)
I - Port Position 1 on top rack Port Position 3 on bottom rack

5	MA1	1	F	4	180	-	45	-	90	-	135	x	3	-	KY	-	DR-BC	-	D1-B2	-	S	-	H	-	M

NO. OF ROTARY POSITIONS
3 - 3 Position
4 - 4 Position
5 - 5 Position

TYPE
MA1 - 150 psi [10 bar] Air
MA2 - 150 psi [10 bar] Air with Aux. Shaft Ext.
MH1 - 1500 psi [100 bar] Hyd.
MH2 - 1500 psi [100 bar] Hyd. with Aux. Shaft Ext.

SERIES
2 (000) 1-1/8" [29 mm] Bore linear section
1" [25 mm] Bore rotary section - Double Rack
4 (000) 1-3/8" [35 mm] Bore linear & rotary section - Double Rack
6 (000) 2" [50 mm] Bore linear & rotary section - Double Rack
8 (000) 3" [75 mm] Bore linear & rotary section - Double Rack
NOTE: Series 2000 available in 3 Position only.

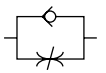
ANGLE OF ROTATION FROM POSITION I TO POSITION III. USED ON 4 & 5 POSITION ONLY.

STROKE
1" to 12"
[25 to 300 mm] in 1" [25 mm] increments
Other strokes available. Consult PHD.

LINEAR SECTION CUSHION
DR - Cushion on rod end
DC - Cushion on cap end

LINEAR SECTION SHOCK PADS
BR - Shock Pad on rod end
BC - Shock Pad on cap end
(Cushion and Shock Pads are not available on the same end. Shock Pads are not available for Hydraulic use.)

PORT CONTROL©



BUILT-IN METER OUT FLOW CONTROL VALVE
Port Control is standard on both sections of Series 2000 & 4000 and rotary section only of Series 6000 & 8000 Actuators.

LINEAR SECTION OPTIONS
S* - Port in Position 2
T* - Port in Position 3
U* - Port in Position 4
W - Close Tolerance Stroke
*Options -S, -T, and -U imply that mounting holes and flow control locations remain unchanged relative to new port position. (Rotates with port. See option page 6-36.)

ANGLE ADJUSTMENT
Angle Adjustment is standard on all Multi-Motion Actuators for end of rotation adjustment.

ROTARY AND LINEAR OPTIONS
E - Magnetic Piston for Hall Effect Switch
M - Magnetic Piston for Reed Switch
V - Fluoro-Elastomer Seals
Z1 - Electroless Nickel Plate, all ferrous parts

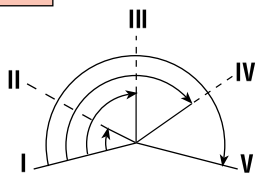
Options may affect unit length. See unit dimension and options pages for adders.

PROXIMITY SWITCH MOUNTING BRACKETS

SERIES	SIZE NO. LINEAR SECTION	SIZE NO. ROTARY SECTION
2000	-36	-32
4000	-37	-34
6000	-40	-38
8000	-41	-39

See Switches and Sensors section for complete ordering information.

NOTES:
1) Sensor must be used with a PHD Set Point Module. See Switches and Sensors section for information and ordering data.
2) SAE Ports available, consult PHD for specific port sizes.



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	Factory lubricated for rated life
MAINTENANCE	Field repairable

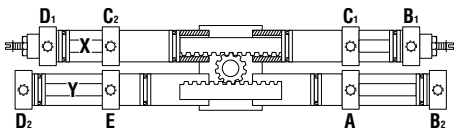
*See hydraulic pressure ratings for options chart below. All hydraulic ratings are based on non-shock service.

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 in	mm	LINEAR BORE DIAMETER in	mm	ROTARY DISPLACEMENT in³/°	cm³/°	LINEAR DISPLACEMENT EXTEND in³/in	cm³/mm	RETRACT in³/in	cm³/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 in-lb/psi	Nm/bar	THRUST FORCE EXTEND lb/psi	N/bar	THRUST FORCE RETRACT 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 B_1 and B_2 traps the racks between the rod ends of the outer pistons X and Y to rotate output shaft to position IV. Pressurizing ports C_1 and C_2 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 D_1 and D_2, 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 psi	bar	PORT CONTROLS psi	bar	-Dx psi	bar	-E or -M psi	bar
2000	–	–	–	–	–	–	–	–
4000	–	–	–	–	–	–	–	–
6000	–	–	N/A	N/A	–	–	750	52
8000	–	–	N/A	N/A	–	–	500	35

NOTE: — = Standard Rating

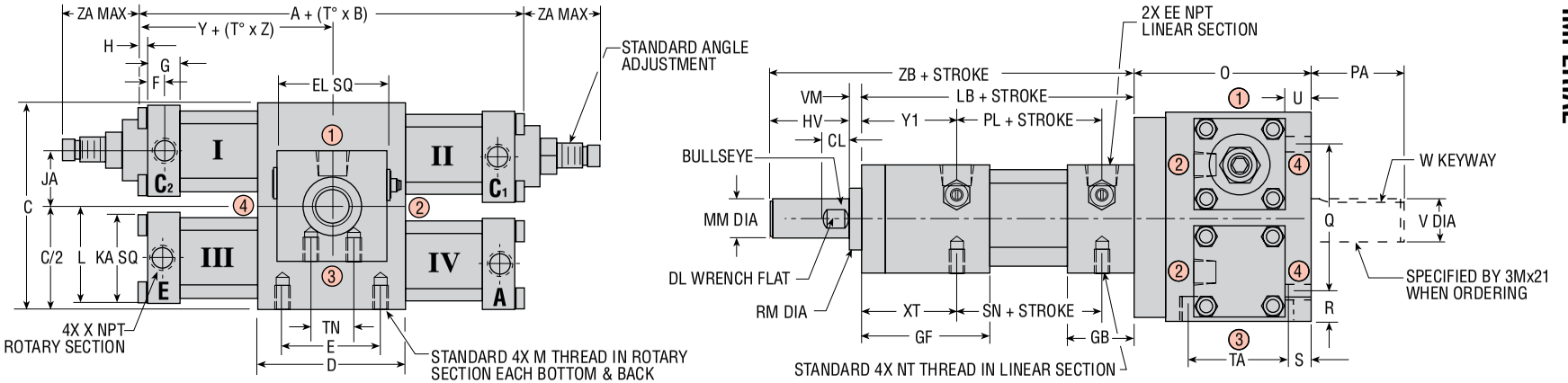
SIZING AND APPLICATION ASSISTANCE

See PHD Product Sizing Catalog for specific and complete sizing information.

Online sizing assistance is available at:

www.phdinc.com/apps/sizing

DIMENSIONS: 3 POSITION MULTI-MOTION ACTUATORS



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	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	2000	6.198	.0174	3.000	2.000	1.500	.500	.750	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	3.099	.0087	1.125
BOTH	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	6000	9.126	.026	5.000	4.250	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	1.875
BOTH	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

LINEAR SECTION

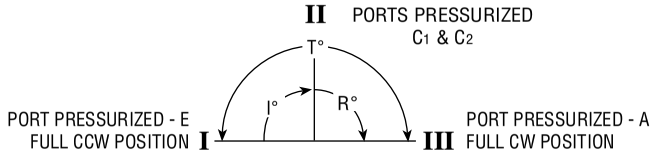
SERIES	LETTER DIMENSION																		
	CL	DL	EE	EL	GB	GC	GF	HV	LB	MM	NT	PL	RM	SN	TN	VM	XT	Y1	ZB
2000	.530	1/2	1/4	1.750	1.250	1.000	2.187	1.500	5.000	.625	1/4-28 x .312 DP	2.812	1.000	2.812	.625	.250	1.562	1.562	6.750
4000	.530	5/8	3/8	2.250	1.375	1.000	2.625	1.625	5.562	.750	5/16-24 x .500 DP	2.937	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	360	450
*2000	6.481	7.264	8.830	10.396	11.962	13.528
4000	9.076	10.246	12.586	14.926	17.266	19.606
6000	10.296	11.466	13.806	16.146	18.486	20.826
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 2000 ONLY.

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

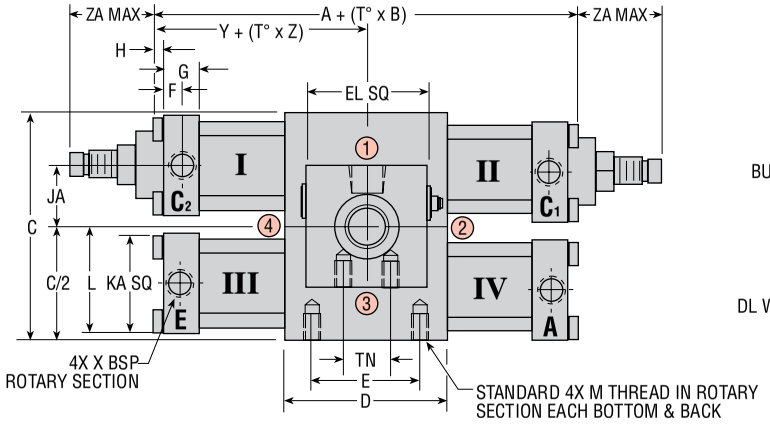


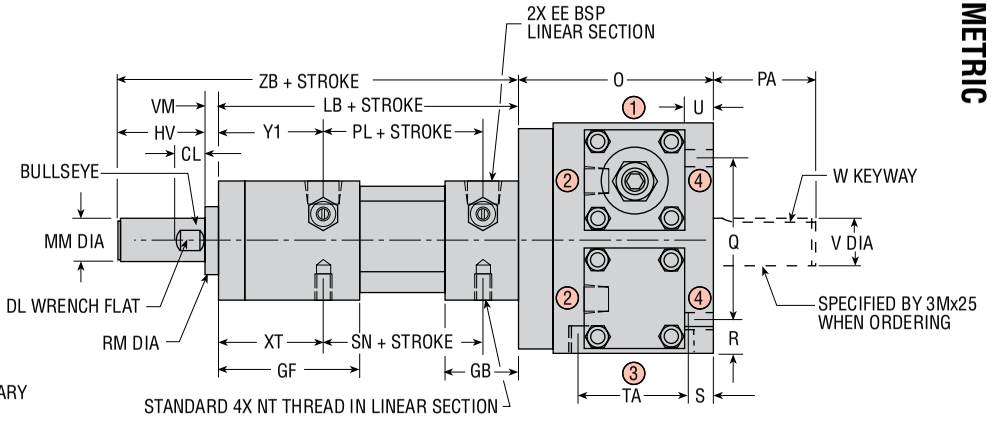
ROTARY SECTION OPTION LOCATION REFERENCE

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

All standard rod ends have four wrench flats.

All dimensions are reference only unless specifically toleranced.





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	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

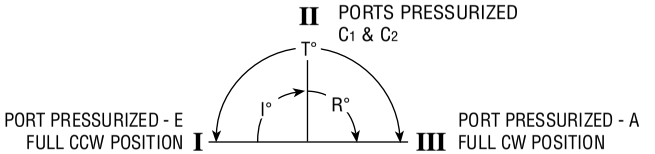
SERIES	LETTER DIMENSION CL	DL	EE	EL	GB	GC	GF	HV	LB	MM	NT	PL	RM	SN	TN	VM	XT	Y1	ZB
2000	13	13	G1/4	44	32	25	56	38	127	15.9	M6 x 1.0 x 8	71	25.4	71.4	15.9	6	40	40	171
4000	13	16	G3/8	57	35	25	67	41	141	19.0	M8 x 1.25 x 13	75	31.8	74.6	22.2	6	49	49	189
6000	25	29	G3/8	76	51	32	95	76	184	34.9	M10 x 1.50 x 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	360	450
*2000	164.6	184.5	224.2	264.1	303.8	343.6
4000	230.5	260.2	319.8	379.1	438.6	498.0
6000	261.5	291.1	410.8	350.7	469.5	529.0
8000	368.3	427.7	539.6	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 2000 ONLY.

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



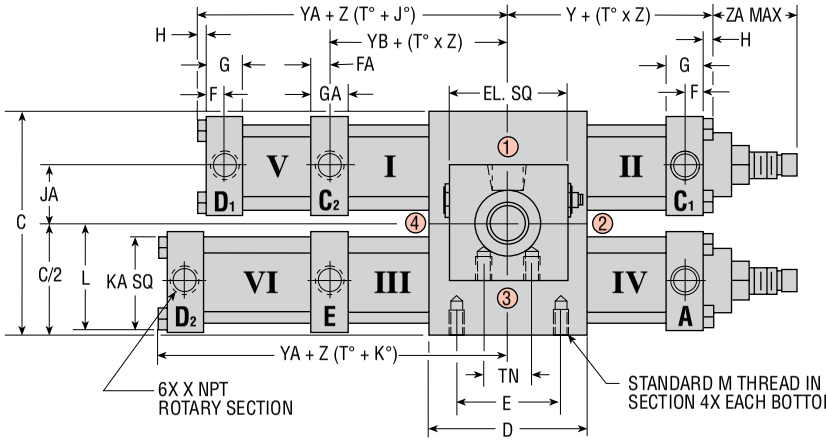
All standard rod ends have four wrench flats.

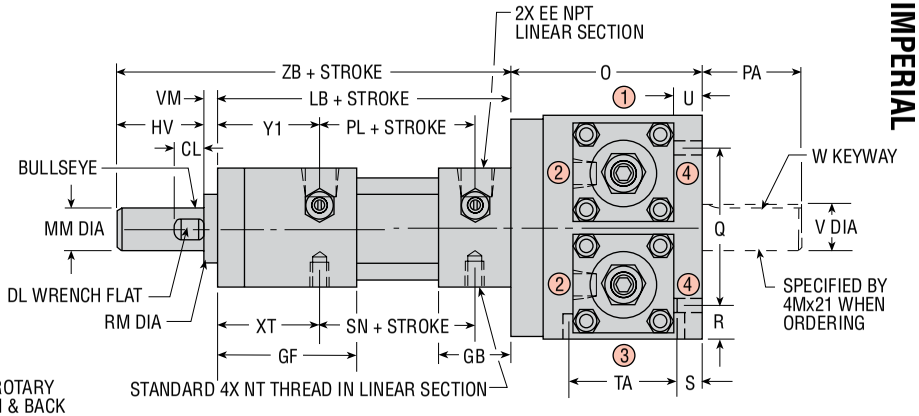
ROTARY SECTION OPTION LOCATION REFERENCE

ACTUATOR TYPE	LETTER OPTION REFERENCED BY TUBE NUMBER -B	-D	-P STANDARD	-M	-E	PORT & NEEDLE LOCATIONS REFERENCED BY CIRCLED NUMBERS STANDARD PORT	-P	-D	-F PORT	-P	-D	-I PORT	-P	-D
3MA15 & 3MA25	I & II	I & II	ALL	ALL	ALL	2	1 & 3	1	4	1 & 3	1	1, 3	2	2
3MH15 & 3MH25	—	I & II	ALL	ALL	ALL	2	1 & 3	1	4	1 & 3	1	1, 3	2	2

DIMENSIONS: 4 POSITION MULTI-MOTION ACTUATORS

IMPERIAL



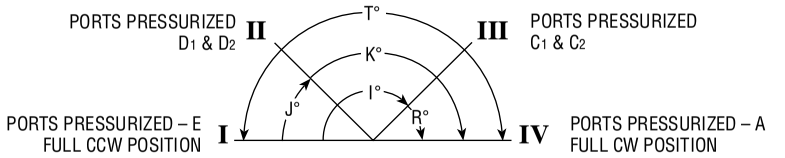


ROTARY SECTION

	LETTER DIMENSION																										
SERIES	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

	LETTER DIMENSION																		
SERIES	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

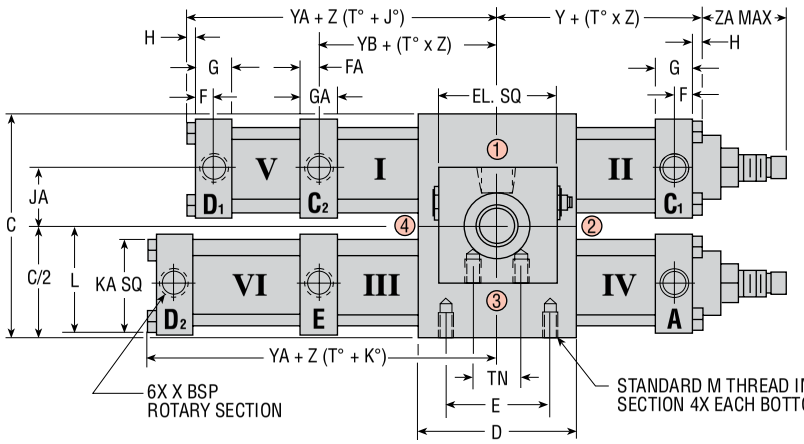


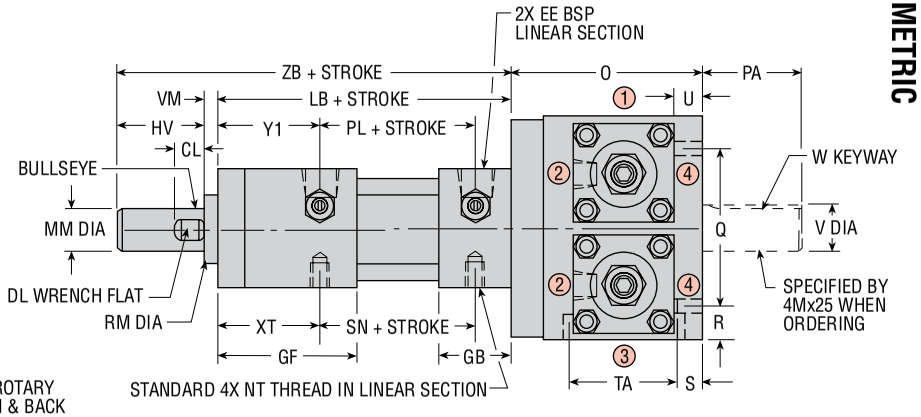
BULLSEYE: REFERENCE MARK INDICATING ORIENTATION OF ROD END TO ROTARY SECTION
SHAFT KEYWAY & BULLSEYE: SHOWN AT MID-ROTATION
ROD END: STANDARD IS A "PL" (PLAIN) ROD END
PORT POSITIONS: INDICATED BY CIRCLED NUMBERS. LINEAR SECTION NEEDLE & MTG. HOLES REMAIN UNCHANGED RELATIVE TO PORTS WITH OPTIONAL PORT 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 REFERENCED BY TUBE NUMBER					PORT & NEEDLE LOCATIONS REFERENCED BY CIRCLED NUMBERS								
			-P			STANDARD			-F			-I		
	-B	-D	STANDARD	-M	-E	PORT	-P	-D	PORT	-P	-D	PORT	-P	-D
4MA11 & 4MA21	II & IV	II & IV	ALL	ALL	ALL	2	1 & 3	1	4	1 & 3	1	1, 3	2	2
4MH11 & 4MH21	—	II & IV	ALL	ALL	ALL	2	1 & 3	1	4	1 & 3	1	1, 3	2	2

All standard rod ends have four wrench flats.



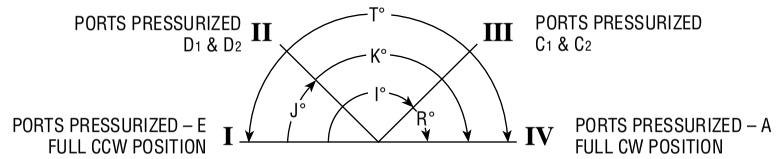


ROTARY SECTION

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	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	102	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	118	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	126	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



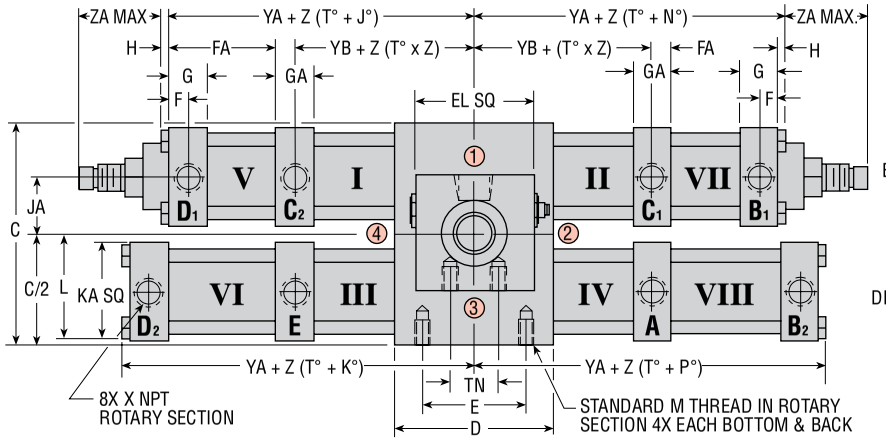
BULLSEYE: REFERENCE MARK INDICATING ORIENTATION OF ROD END TO ROTARY SECTION
SHAFT KEYWAY & BULLSEYE: SHOWN AT MID-ROTATION
ROD END: STANDARD IS A "PL" (PLAIN) ROD END
PORT POSITIONS: INDICATED BY CIRCLED NUMBERS. LINEAR SECTION NEEDLE & MTG. HOLES REMAIN UNCHANGED RELATIVE TO PORTS WITH OPTIONAL PORT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

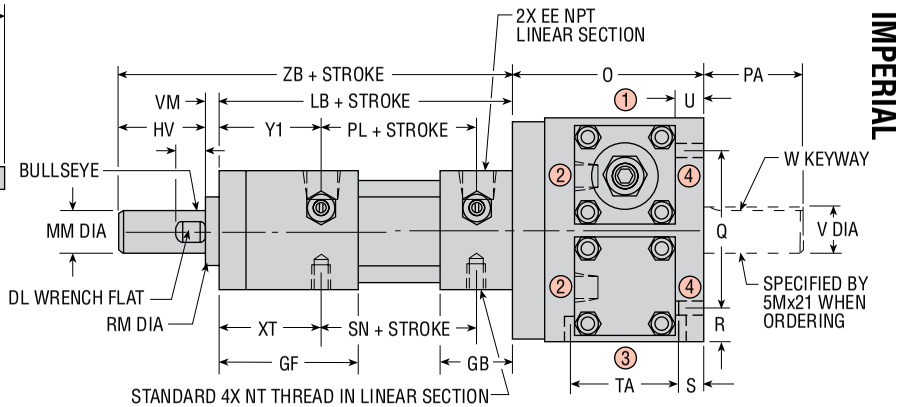
ROTARY SECTION OPTION LOCATION REFERENCE

ACTUATOR TYPE	LETTER OPTION REFERENCED BY TUBE NUMBER					PORT & NEEDLE LOCATIONS REFERENCED BY CIRCLED NUMBERS								
			-P			STANDARD			-F			-I		
	-B	-D	STANDARD	-M	-E	PORT	-P	-D	PORT	-P	-D	PORT	-P	-D
4MA15 & 4MA25	II & IV	II & IV	ALL	ALL	ALL	2	1 & 3	1	4	1 & 3	1	1, 3	2	2
4MH15 & 4MH25	—	II & IV	ALL	ALL	ALL	2	1 & 3	1	4	1 & 3	1	1, 3	2	2

All standard rod ends have four wrench flats.

All dimensions are reference only unless specifically toleranced.





IMPERIAL

DIMENSIONS: 5 POSITION MULTI-MOTION ACTUATORS

ROTARY SECTION

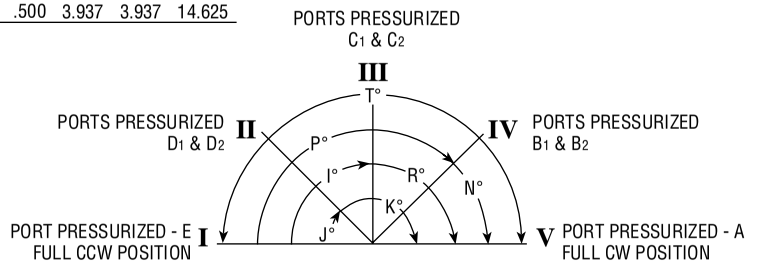
SERIES	LETTER DIMENSION																									
	C	D	E	F	FA	G	GA	H	JA	KA	L	M	O	PA	Q	R	S	TA	U	V	W	X	YA	YB	Z	ZA
4000	4.250	3.000	2.000	.344	.375	.688	.719	.250	1.156	1.875	2.094	5/16-18 x .500 DP	3.625	1.875	3.000	.625	.500	2.000	.562	.8748/.8753	3/16 x 3/32 x 1.500	1/4	6.721	3.360	.013	1.500
6000	5.000	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	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	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

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

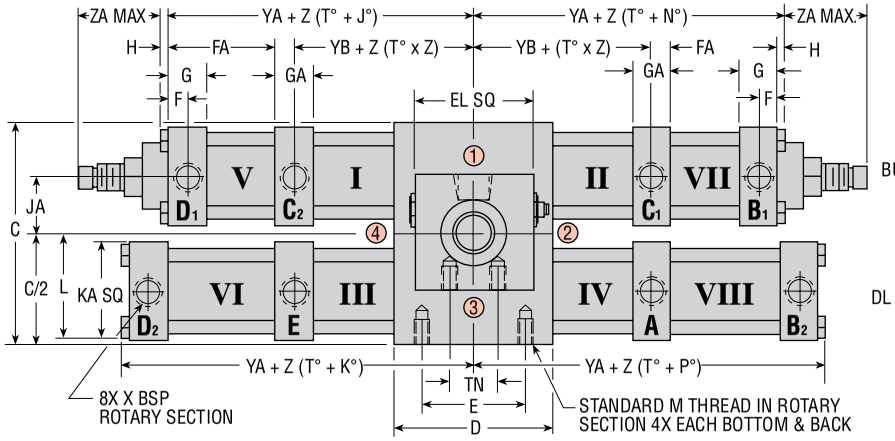
All standard rod ends have four wrench flats.

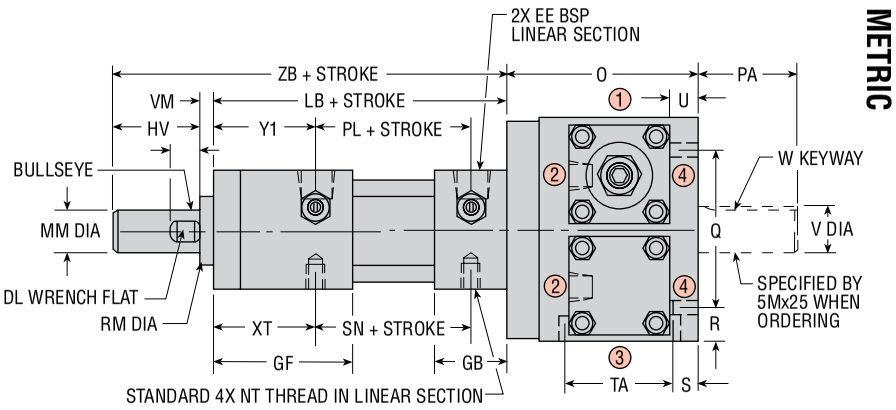


ROTARY SECTION OPTION LOCATION REFERENCE

ACTUATOR TYPE	LETTER OPTION REFERENCED BY TUBE NUMBER					PORT & NEEDLE LOCATIONS REFERENCED BY CIRCLED NUMBERS								
			-P			STANDARD			-F			-I		
	-B	-D	STANDARD	-M	-E	PORT	-P	-D	PORT	-P	-D	PORT	-P	-D
5MA11 & 5MA21	VII & V	VII & V	ALL	ALL	ALL	2	1 & 3	1	4	1 & 3	1	1, 3	2	2
5MH11 & 5MH21	—	VII & V	ALL	ALL	ALL	2	1 & 3	1	4	1 & 3	1	1, 3	2	2

All dimensions are reference only unless specifically toleranced.





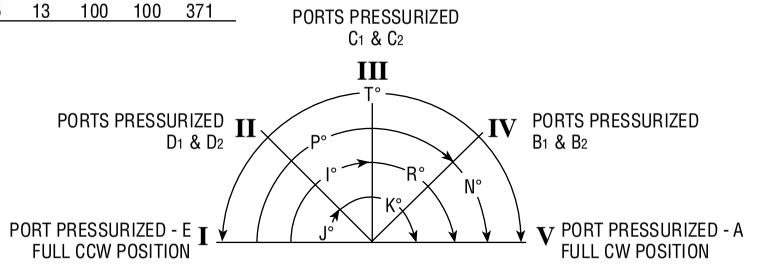
ROTARY SECTION

	LETTER DIMENSION																									
SERIES	C	D	E	F	FA	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

	LETTER DIMENSION																		
SERIES	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



ROTARY SECTION OPTION LOCATION REFERENCE

ACTUATOR TYPE	LETTER OPTION REFERENCED BY TUBE NUMBER					PORT & NEEDLE LOCATIONS REFERENCED BY CIRCLED NUMBERS								
			-P			STANDARD			-F			-I		
	-B	-D	STANDARD	-M	-E	PORT	-P	-D	PORT	-P	-D	PORT	-P	-D
5MA15 & 5MA25	VII & V	VII & V	ALL	ALL	ALL	2	1 & 3	1	4	1 & 3	1	1, 3	2	2
5MH15 & 5MH25	—	VII & V	ALL	ALL	ALL	2	1 & 3	1	4	1 & 3	1	1, 3	2	2

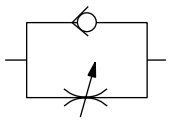
All standard rod ends have four wrench flats.

All dimensions are reference only unless specifically toleranced.

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 2000-4000 and on the rotary section only of Series 6000-8000.

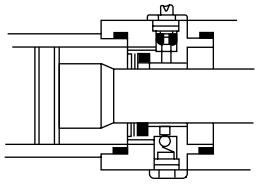
DR DC LINEAR SECTION ADJUSTABLE CUSHIONS

D1 D2 ROTARY SECTION ADJUSTABLE CUSHIONS

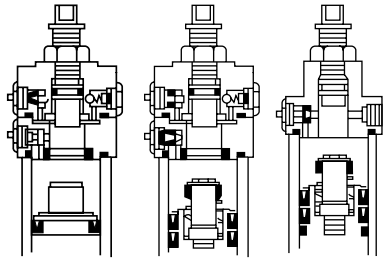
Adjustable cushions, available on all PHD Multi-Motion Actuators, allow smooth deceleration at the end of stroke and rotation to eliminate mechanical shock and hammer effect.

Effective cushioning length (approximate)
Rotary Section 2000-8000 = 30°
Linear Section 2000-4000 = 3/4", 6000 = 1", 8000 = 1-1/4"

LINEAR CUSHION



ROTARY CUSHIONS



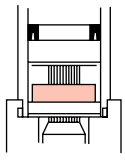
2000 AIR | 2000 HYD. | 4000-8000 AIR OR HYD.

BR BC LINEAR SECTION SHOCK PADS

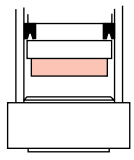
B1 B2 ROTARY SECTION SHOCK PADS

Polyurethane pads for absorption of shock and noise are available on each end of stroke and rotation on Series 2000-8000 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.

LINEAR SHOCK PAD

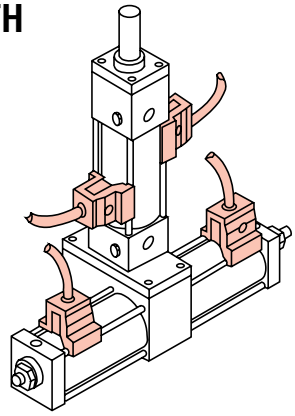


ROTARY SHOCK PAD



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

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

H HALL EFFECT SENSOR/ TRANSDUCER

For use on all PHD Multi-Motion Actuators. The Hall Effect Sensor/Transducer provides up to four adjustable sensing positions throughout the 180° maximum sensing range. Minimum arc between two points is 1.5° of rotation. Can be used to signal ends of rotation in addition to multiple signals during rotation for indication of arc traveled.

Solid state electronics with Hall Effect sensing technology provide infinite trouble-free cycles.

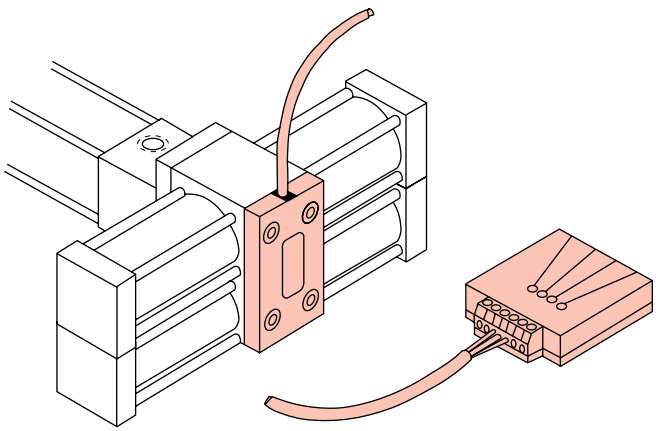
Wide signal range capability permits interfacing with most programmable controllers and logic systems.

Independent adjustment of each set point position from a single sensor.

LED indicators for visual confirmation of each output state.

Set Point Module is available for either current sinking or current sourcing models with 4.5 to 24 VDC output capability.

117 VAC interface module available to supply DC voltage to set point while providing 117 VAC output capability.



SET POINT MODULE

PART NO.	DESCRIPTION
9800-01-0300	4.5-24 VDC, Sink Type Output
9800-01-0400	4.5-24 VDC, Source Type Output

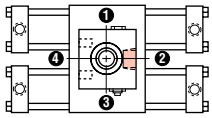
See Switches and Sensors section for information.

PORT POSITIONS

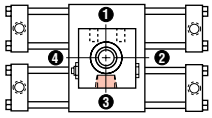
LINEAR SECTION

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.)

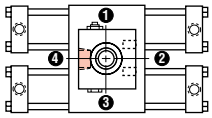
S **PORT POSITION 2 LINEAR SECTION**



T **PORT POSITION 3 LINEAR SECTION**



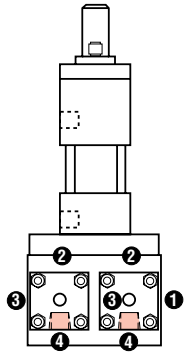
U **PORT POSITION 4 LINEAR SECTION**



ROTARY SECTION

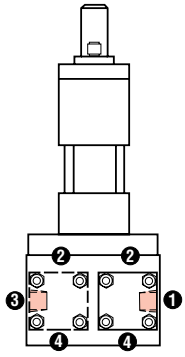
Port Position 2 is standard.

F **PORT POSITION 4 ROTARY SECTION**



I **PORT POSITION 1 TOP RACK PORT POSITION 3 BOTTOM RACK ROTARY SECTION**

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.

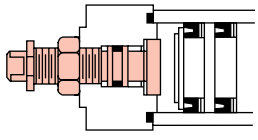


ANGLE ADJUSTMENT (STANDARD)

SERIES 2000-8000

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°.



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

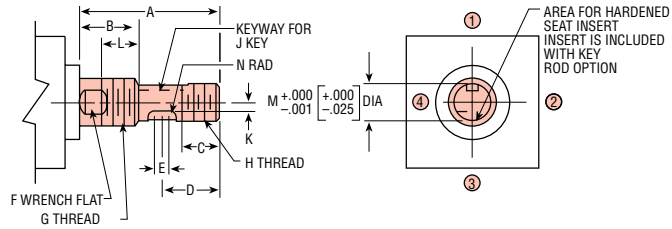
This option may be specified when a precise rotation and stroke is required and angle adjustment is not acceptable. By specifying this option, stroke will be a tolerance of ± .005 [± 0.127 mm].

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

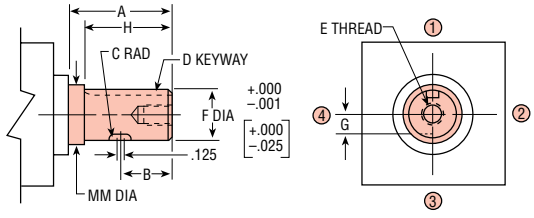
-KY THREADED ROD END WITH KEYWAY AND PRE-LOAD



LETTER DIM.	SERIES 2000	4000	6000	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



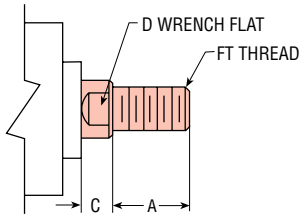
CIRCLED NUMBERS: INDICATE PORT POSITIONS
KEY: INCLUDED WITH ROD END OPTION

LETTER DIM.	SERIES 2000	4000	6000	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
2000	.625 [15.87]	.750 [19]	.375 [9.5]	1/2 [19.00]	7/16-20 [M12 x 1.25]
4000	.750 [19.05]	1.000 [25]	.375 [9.5]	5/8 [15.80]	9/16-18 [M14 x 1.50]
6000	1.375 [34.93]	2.375 [60.5]	.625 [15.9]	1-1/8 [28.5]	1-14 [M27 x 2.0]
8000	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 toleranced.

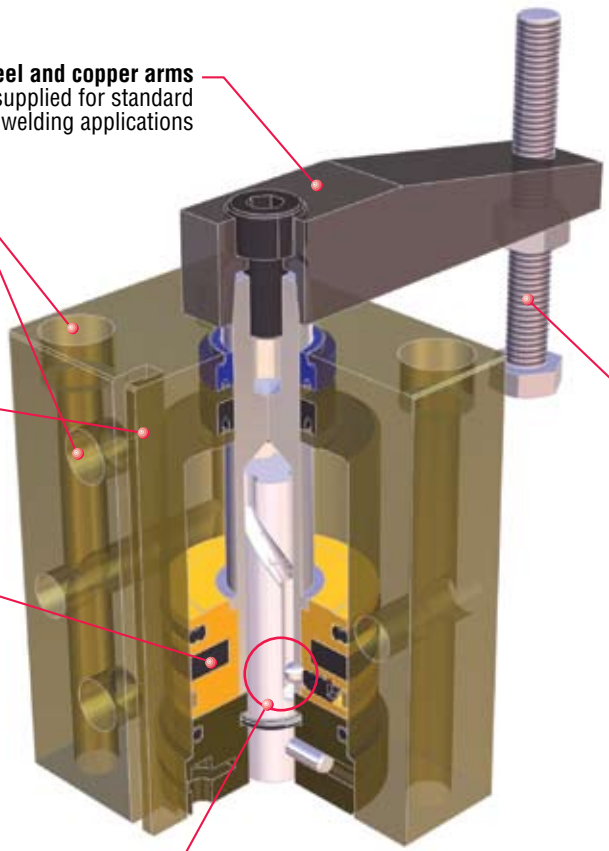
clamps

SERIES		SIZE	MAX STROKE	MAX FORCE * lb [N]	MAJOR BENEFIT	INDUSTRY USE
PA (Swing Arm) **pages 7-3**		2 3 4 5 6	1.043 [26.5] 1.181 [30] 1.181 [30] 1.161 [29.5] 1.181 [30]	46 [204] 82 [365] 143 [636] 223 [992] 378 [1682]	• Compact • 5 sizes • Multiple mounting surfaces • Left and right rotations • Steel and copper arms • Switch ready	• Welding • Machining • Assembly • General industrial automation
PB (Swing Arm) **page 7-7**		S2 L2 S3 L3 S4 L4 S5 L5	0.768 [19.5] 1.161 [29.5] 0.984 [25] 1.378 [35] 0.984 [25] 1.378 [35] 1.535 [39] 2.717 [69]	45 [200] 45 [200] 73 [325] 73 [325] 143 [636] 143 [636] 223 [992] 223 [992]	• 4 sizes with 8 strokes • Left and right rotations • Rod weld cover available • Anti-backlash arm and guide available • Switch ready on 4 sides of clamp	• Welding • Machining • Assembly • General industrial automation
PNC NumberCruncher® **page 7-13**		44 55 55-B01	MAX OPENING 16° 16° 16°	9005 [40056] 14790 [65790] 25404 [113000]	• High force • Standard characters • Operates within .5 sec • Quiet operation	• Numbering parts in steel, aluminum, copper, brass, plastic and leather
PHL (Die Lifter) **page 7-21**		6	MAX STROKE 1.969 [50] 3.150 [80] 3.937 [100] 4.921 [125] 6.299 [160] 7.874 [200]	MAX FORCE * lb [N] 420 [1870]	• Available as drop-in replacement for General Motors Global Die Standards (GMGDS) 90.35.05-A and B • Built-in rod compliance eliminates side load on piston rod, thus increasing cylinder life • Composite bearings with internal lubrication for long life	• Material handling • Automotive • General industrial automation
PEC (Arm Over) **page 7-25**		33 34	CLAMP TORQUE lb [N] 225 [25] 400 [45]	MAX HOLDING TORQUE lb [N] 1593 [180] 1593 [180]	• Superior part holding • Widest range of high clamping force in its class	• Assembly • Welding
PLK (Pin Locating) **page 7-29**		505 510	CLAMP FORCE lb [N] 223 [991] 223 [991]	CLAMP FORCE FACTOR Cf iMPERIAL METRIC 2.56 [165] 2.56 [165]	• Ideal for part clamping in weld areas • Completely enclosed finger/pin • Available in pin diameters from 12.5 to 24.5 mm diameter	• Assembly • Welding

*Maximum force is calculated at 87 psi [6 bar].

PA

IDEAL FOR A WIDE VARIETY OF AUTOMATED PART HOLDING AND TRANSFER APPLICATIONS



steel and copper arms are supplied for standard and welding applications

mounting patterns on three surfaces of the rectangular body provide flexibility in design and clamp mounting

flow controls are not required

body has controlled orifice communication

switch ready

Reed and Hall Effect Switches are available for easy interfacing to electronic controls and logic systems

steel and Neoprene-tipped spindles are available for clamping rugged or show finishes

simple design employs a hardened helical spline and three hardened drive balls, which ensure a long product life with little wear

left and right rotations can be ordered to fit the application

PA

Major Benefits

- Simple design, compact size, for low weight, long life, and high clamp force make these clamps ideal for part holding or transfer
- Available in five sizes
- Mounting patterns on three surfaces
- Available in left and right rotations
- 24 hour delivery

Industry Uses

- Welding equipment
- Door & window frames
- Assembly machine builders
- Machine tool (work holding)
- Aerospace
- Automotive Tier II and Tier III

ORDERING DATA: SERIES PA CLAMPS

TO ORDER SPECIFY:
Model, Body Style, Unit Size, Arm Rotation Direction, Design No., and Additional Options if desired.

MODEL	UNIT SIZE	BODY STYLE	ARM ROTATION DIRECTION*	DESIGN NO.	ARM OPTIONS	SPINDLE OPTIONS	SWITCH OPTIONS	PORT FITTINGS (BOTH PORTS)
PA	S	S	R	1	AS	TA	SW1	LBB

MODEL
PA

UNIT SIZE
2 - 25 mm Bore
3 - 32 mm Bore
4 - 40 mm Bore
5 - 50 mm Bore
6 - 63 mm Bore

BODY STYLE
S - Standard (Block)

ARM ROTATION DIRECTION*
R - Right
L - Left

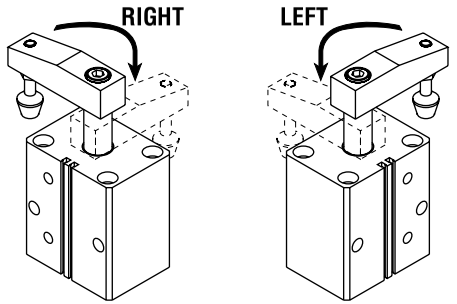
DESIGN NO.
1 - Imperial
5 - Metric

ARM OPTIONS
BLANK - None
AS - Single Steel
ASC - Single Copper

SPINDLE OPTIONS
BLANK - None
TA - Steel
TN - Neoprene Tipped

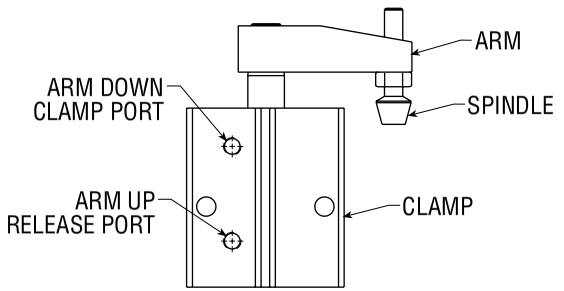
SWITCH OPTIONS
BLANK - None
SW1 - 2 Reed Switches Installed
SW2 - 2 Hall Effect Switches (PNP) installed
SW3 - 2 Hall Effect Switches (NPN) installed
SW4 - 2 Magnetoresistive Switches (PNP) w/Quick Connect installed
SW5 - 2 Magnetoresistive Switches (NPN) w/Quick Connect installed

PORT FITTINGS (BOTH PORTS)
BLANK - None
LBB - 90° Swivel Fitting (See Note 1)



***NOTE:** Rotation is the direction the arm rotates when clamping and looking down at rod end.

NOTE:
1) 90° Swivel fittings not available on size 2 units.



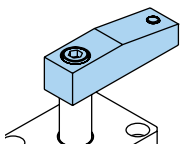
For additional information, request a Series PA Clamp Catalog.

SPECIFICATIONS	SERIES PA
WORKING PRESSURE	40 psi min. - 100 psi max. 2.9 bar min. - 7 bar max.
BODY	Hardcoated Aluminum
PISTON ROD	Chrome Plated Steel
SEALS	Urethane Wiper and Rod Seal Nitrile Pistons and Static Seals
LUBRICATION	Permanent for Non-Lube Air
TEMPERATURE LIMITS	-20° to 180°F [-30° to 82°C]

SPECIFICATIONS

MODEL SIZE	BORE mm	THEORETICAL CLAMPING FORCE SINGLE ARM AT 87 psi (6 bar) lb	N	TOTAL STROKE mm	ROTARY STROKE mm	CLAMP STROKE mm	STROKE TOLERANCE mm	ROTARY TOLERANCE including backlash deg	CLAMP WEIGHT lb	g
PAx2	25	46	204	26.5	10	16.5			0.88	400
PAx3	32	82	365	30	14	16			1.45	600
PAx4	40	143	636	30	13	17	- 0, + 2	± 3	1.94	880
PAx5	50	223	992	29.5	14.5	15			3.48	1580
PAx6	63	378	1682	30	13	17			4.84	2200

AS SINGLE ARM - STEEL



ASC SINGLE ARM - COPPER

Single arms are made of steel or copper, one alloy socket head cap screw included.

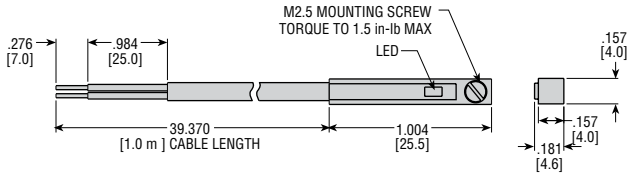
SW1 REED SWITCHES INSTALLED

SW2 HALL EFFECT SWITCHES (PNP) INSTALLED

SW3 HALL EFFECT SWITCHES (NPN) INSTALLED

SW4 MAGNETORESISTIVE SWITCHES (PNP) INSTALLED WITH QUICK CONNECT

SW5 MAGNETORESISTIVE SWITCHES (NPN) INSTALLED WITH QUICK CONNECT

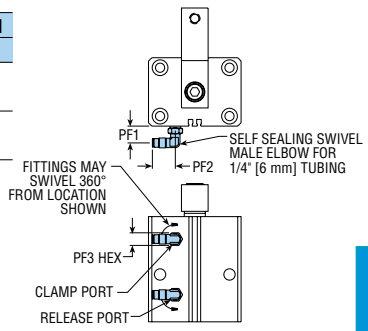


LBB PORT FITTINGS

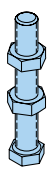
Port fitting is not available on size 2.

LETTER DIMENSION	PORT FITTING OPTION in	mm
PF1 (MIN)	.629	12.0
PF1 (MAX)	.748	16.0
PF2	.885	20.0
PF3	.472	12.0

To order fittings separately:
Part No. 71120-001 - Imperial
Part No. 71121-001 - Metric

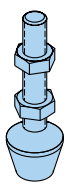


TA STEEL SPINDLE

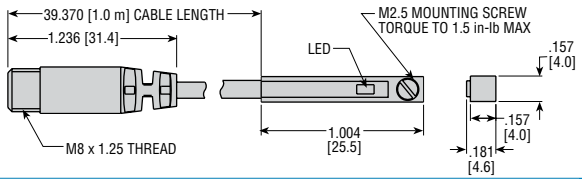


Steel spindles are plated steel with two hex nuts included.

TN NEOPRENE TIPPED SPINDLE

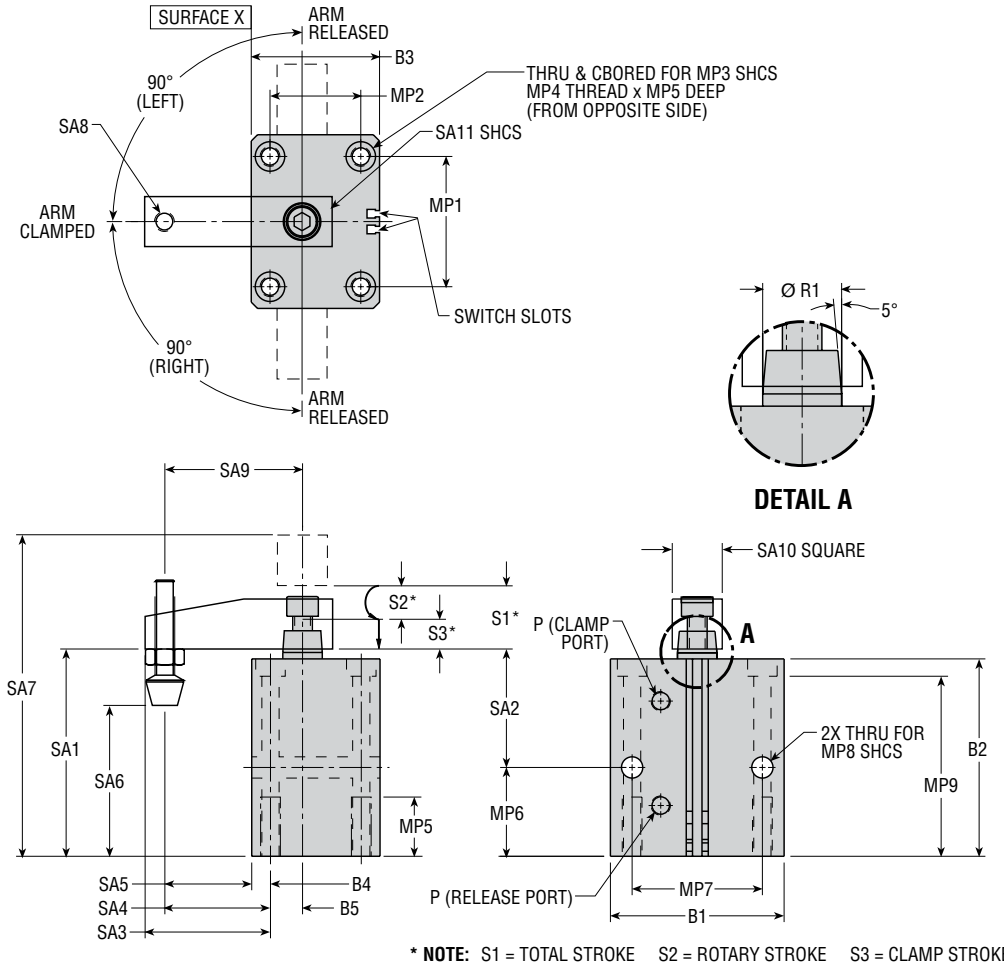


Neoprene tipped spindles are plated threaded steel with 65 Durometer Neoprene molded onto the end. Two hex nuts are included.



All dimensions are reference only unless specifically toleranced.

DIMENSIONS: SERIES PA CLAMPS



*** NOTE:** S1 = TOTAL STROKE S2 = ROTARY STROKE S3 = CLAMP STROKE

LETTER	MODEL NUMBER									
	PAS2x		PAS3x		PAS4x		PAS5x		PAS6x	
DIM	in	mm	in	mm	in	mm	in	mm	in	mm
B1	2.165	55.0	2.362	60.0	2.756	70.0	3.346	85.0	3.937	100.0
B2	3.071	78.0	3.543	90.0	3.543	90.0	3.937	100.0	3.937	100.0
B3	1.378	35.0	1.772	45.0	2.165	55.0	2.559	65.0	3.150	80.0
B4	.295	7.5	.295	7.5	.354	9.0	.374	9.5	.394	10.0
B5	.295	7.5	.492	12.5	.610	15.5	.846	21.5	1.083	27.5
MP1	1.575	40.0	1.772	45.0	2.047	52.0	2.598	66.0	3.150	80.0
MP2	.787	20.0	1.181	30.0	1.457	37.0	1.811	46.0	2.362	60.0
MP3	M6		M6		M8		M8		M10	
MP4	M8 x 1.25		M8 x 1.25		M10 x 1.5		M10 x 1.5		M12 x 1.75	
MP5	.787	20.0	.787	20.0	.984	25.0	1.181	30.0	1.181	30.0
MP6	1.260	32.0	1.693	43.0	1.575	40.0	1.772	45.0	1.417	36.0
MP7	1.575	40.0	1.772	45.0	2.047	52.0	2.598	66.0	3.150	80.0
MP8	M8		M8		M8		M10		M10	
MP9	2.795	71.0	3.268	83.0	3.189	81.0	3.583	91.0	3.504	89.0
P	10-32	M5	1/8 NPT	1/8 BSPP	1/8 NPT	1/8 BSPP	1/8 NPT	1/8 BSPP	1/8 NPT	1/8 BSPP
R1	.551	14.0	.630	16.0	.630	16.0	.787	20.0	.787	20.0
S1*	1.043	26.5	1.181	30.0	1.181	30.0	1.161	29.5	1.181	30.0
S2*	.394	10.0	.551	14.0	.512	13.0	.571	14.5	.512	13.0
S3*	.650	16.5	.630	16.0	.669	17.0	.591	15.0	.669	17.0
SA1	3.209	81.5	3.780	96.0	3.740	95.0	4.193	106.5	4.193	106.5
SA2	1.969	50.0	2.047	52.0	2.165	55.0	2.362	60.0	2.717	69.0
SA3	1.969	50.0	2.283	58.0	2.520	64.0	2.756	70.0	2.913	74.0
SA4	1.673	42.5	1.870	47.5	2.146	54.5	2.303	58.5	2.461	62.5
SA5	1.378	35.0	1.575	40.0	1.791	45.5	1.929	49.0	2.067	52.5
SA6	2.24-2.56	57.0-65.0	2.36-2.87	60.0-73.0	2.36-2.87	60.0-73.0	2.17-2.95	55.0-75.0	2.17-2.95	55.0-75.0
SA7	4.882	124.0	5.709	145.0	5.670	144.0	6.339	161.0	6.358	161.5
SA8	M6 x 1.0 thru		M8 x 1.25 thru		M8 x 1.25 thru		M12 x 1.75 thru		M12 x 1.75 thru	
SA9	1.969	50.0	2.362	60.0	2.756	70.0	3.150	80.0	3.543	90.0
SA10	.630	16.0	.748	19.0	.748	19.0	.984	25.0	.984	25.0
SA11	M8		M8		M8		M10		M10	

All dimensions are reference only unless specifically toleranced.

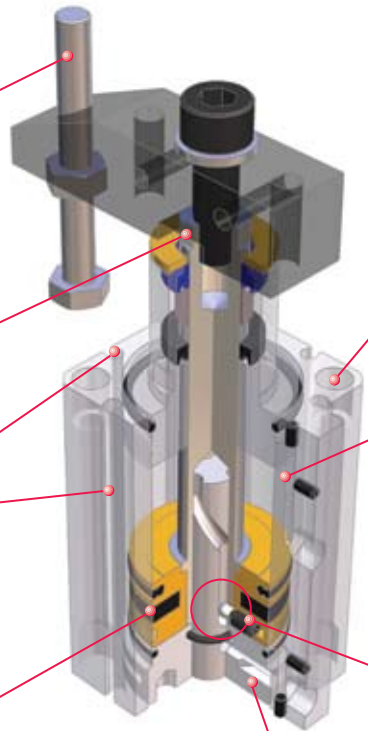
PB

WORK HOLDING IN A WELDING ENVIRONMENT

MRO Drop-In! replacement unit opportunity

rod weld cover available to protect cylinder rod and bearing areas from weld splatter during clamping

anti-backlash arm and guide available to minimize amount of arm backlash during clamping



arms are available as finished or blank that can be tooled by the customer

keyed interface between the rod and arm ensure location and easy installation

two switch grooves on all sides to ease cable routing

switches mount flush providing a clean protected profile

switch ready

mounting pattern on two surfaces

controlled orifice communication- flow controls are not required

hardened helical spline and three hardened drive balls ensure long product life with little wear

adjustable rear plug allows arm position to be adjusted up to 90° at installation or change clamps from a left to a right rotation by changing rear plug

Major Benefits

- Simple design, compact size, for low weight, long life, and high clamp force make these clamps ideal for part holding or transfer
- Available in four sizes
- Mounting patterns on two surfaces
- Available in left and right rotations
- 24 hour delivery

Industry Uses

- Sheet metal handling
- Conveyors
- Packaging
- Assembly machines
- General industrial automation

SUPERIOR DELIVERY 24 Hour* *From receipt of order

ORDERING DATA: SERIES PB CLAMPS

TO ORDER SPECIFY:
Model, Stroke Length, Unit Size, Arm Rotation Direction, Design No., and Additional Options if desired.

MODEL

UNIT SIZE
2 - 25 mm Bore
3 - 32 mm Bore
4 - 40 mm Bore
5 - 50 mm Bore

DESIGN NO.
1 - Imperial
5 - Metric

CLAMP ARM OPTIONS
BLANK - None
ASA - Single Aluminum
ASB - Single Aluminum Blank

MISCELLANEOUS OPTIONS
BLANK - None
SW41 - 1 NPN switch installed
SW42 - 2 NPN switches installed
SW51 - 1 PNP switch installed
SW52 - 2 PNP switches installed

ANTI-BACKLASH OPTIONS
BLANK - None
AB1 - Anti-backlash arm (See note 1)

PB L 4 R - 1 - ASA - TA - SW51 - LAA - AB1 - WC1 - SR22

STROKE LENGTH
L - Long stroke
S - Short stroke
(See chart for length)

ARM ROTATION DIRECTION
R - Right
L - Left

CLAMP TIP OPTIONS
BLANK - None
TA - Std. Adjustable (See note 1)

PORT FITTINGS (BOTH PORTS)
BLANK - None
LAA - 90° Swivel Fitting, Metal

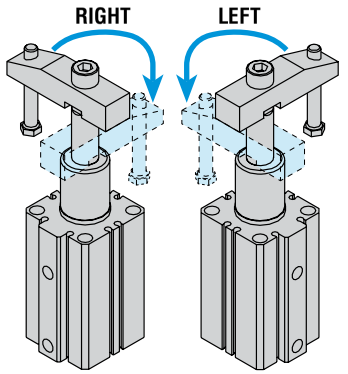
WELD COVER OPTIONS
BLANK - None
WC1 - Rod weld cover (See note 1)

SPEED REDUCER FITTINGS
BLANK - None
SR22 - Speed reducer fitting - PBx4
SR40 - Speed reducer fitting - PBx5
NOTE: Speed Reducer fitting not available for PBx2 and PBx3

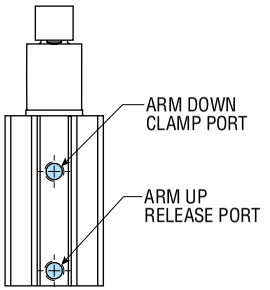
NOTE:
1) Must have arm option ordered with this option.

STROKE AVAILABILITY (mm)

CLAMP SERIES	TOTAL STROKE	CLAMP STROKE	ROTARY STROKE
PBS2x	19.5	10	9.5
PBL2x	29.5	20	9.5
PBS3x	25	10	15
PBL3x	35	20	15
PBS4x	25	10	15
PBL4x	35	20	15
PBS5x	39	20	19
PBL5x	69	50	19



NOTE: Rotation is the direction the arm rotates when clamping and looking down at rod end.



NOTE: Metric units have metric ports. Imperial units have imperial ports.

SPECIFICATIONS	SERIES PB
WORKING PRESSURE	40 psi min. - 100 psi max. 2.9 bar min. - 7 bar max.
BODY	Hard Anodized Aluminum
PISTON ROD	Chrome Plated Steel
SEALS	Urethane Wiper and Rod Seal Nitrile Pistons and Static Seals
LUBRICATION	Permanent for Non-Lube Air
TEMPERATURE LIMITS	-20° to 180°F [-30° to 82°C]

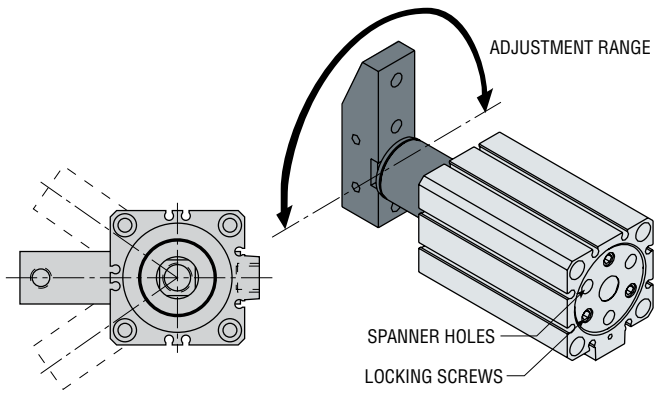
SPECIFICATIONS

MODEL SIZE	BORE mm	CLAMPING FORCE SINGLE ARM AT 87 psi (6 bar) lb	N	TOTAL STROKE mm	ROTARY STROKE mm	CLAMP STROKE mm	STROKE TOLERANCE mm	ROTARY TOLERANCE including backlash degree	CLAMP WEIGHT lb	g
PBS2	25	45	200	19.5	9.5	10	- 1 mm, + 2 mm	± 3°	0.72	326
PBL2	25	45	200	29.5	9.5	20			0.82	374
PBS3	32	73	325	25	15	10			1.18	537
PBL3	32	73	325	35	15	20			1.34	608
PBS4	40	143	636	25	15	10			1.50	680
PBL4	40	143	636	35	15	20			1.68	764
PBS5	50	223	992	39	19	20			2.55	1160
PBL5	50	223	992	69	19	50			3.10	1410

ADJUSTABLE ARM POSITION

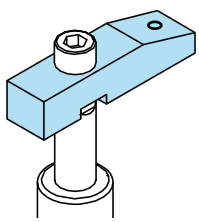
Series PB Clamps allow the rod or arm clamping position to be rotated clockwise or counterclockwise up to 90 degrees from the parallel location. This eliminates the need for special angled arms.

To reposition the clamping location, first remove air pressure, then loosen the three locking screws on the bottom of the rear plug. Engage the three spanner holes in the plug and turn, moving the rod to a new clamping position. Maintain the rod position by holding the rear plug and retighten the three locking screws to 125 in-lb [14.1 Nm] (PBx4, PBx5) or 50 in-lb [5.7 Nm] (PBx2, PBx3). The rear plug should not extend past the rear face of the body.



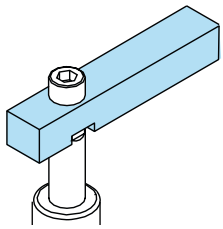
ASA SINGLE ALUMINUM ARM

Single arms are made of aluminum.



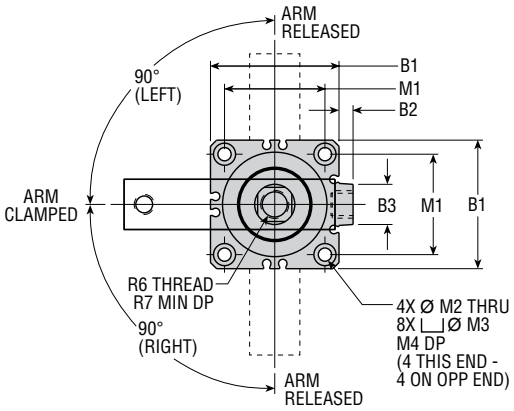
ASB SINGLE ALUMINUM BLANK ARM

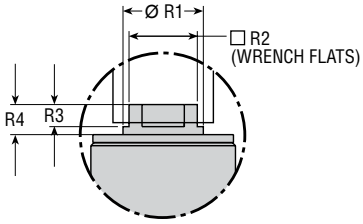
Single blank arms are made of aluminum and allow for creation of an arm up to twice as long as the standard aluminum arm.



For additional information, request a Series PB Clamp Catalog.

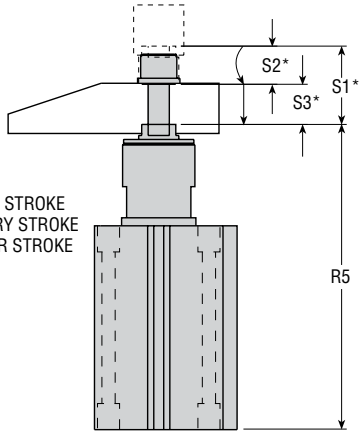
DIMENSIONS: SERIES PB CLAMPS



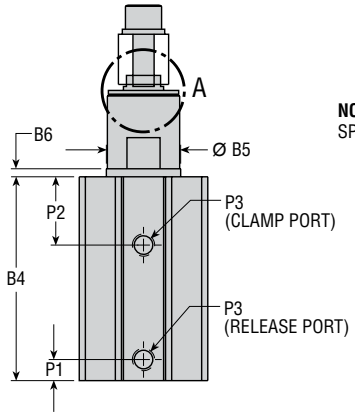


DETAIL A

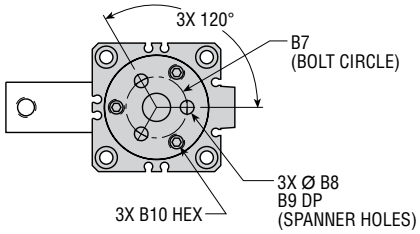
UNIT IS SHOWN WITH ARM OPTION -ASA



***NOTE:**
S1 = TOTAL STROKE
S2 = ROTARY STROKE
S3 = LINEAR STROKE



NOTE: DIMENSIONS FOR CUSTOMER SUPPLIED SPANNER WRENCH TO REPOSITION ARM



VIEW B-B

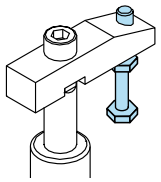
LETTER DIM	MODEL NUMBER															
	PBS2x		PBL2x		PBS3x		PBL3x		PBS4x		PBL4x		PBS5x		PBL5x	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
B1	1.575	40.0	1.575	40.0	1.772	45.0	1.772	45.0	2.047	52.0	2.047	52.0	2.520	64.0	2.520	64.0
B2	.197	5.0	.197	5.0	.177	4.5	.177	4.5	.197	5.0	.197	5.0	.276	7.0	.276	7.0
B3	.378	9.6	.378	9.6	.650	16.5	.650	16.5	.709	18.0	.709	18.0	.787	20.0	.787	20.0
B4	2.874	73.0	3.268	83.0	3.15	80.0	3.543	90.0	3.15	80.0	3.543	90.0	3.996	101.5	5.177	131.5
B5 MAX	.9055	23.000	.9055	23.000	1.1811	30.000	1.1811	30.000	1.1811	30.000	1.1811	30.000	1.4567	37.000	1.4567	37.000
B5 MIN	.9035	22.948	.9035	22.948	1.1787	29.938	1.1787	29.938	1.1787	29.938	1.1787	29.938	1.4543	36.938	1.4543	36.938
B6	.118	3.0	.118	3.0	.118	3.0	.118	3.0	.118	3.0	.118	3.0	.138	3.5	.138	3.5
B7	.630	16.0	.630	16.0	.866	22.0	.866	22.0	1.200	30.5	1.200	30.5	1.200	30.5	1.200	30.5
B8	.209	5.3	.209	5.3	.209	5.3	.209	5.3	.268	6.8	.268	6.8	.268	6.8	.268	6.8
B9	.235	6.0	.235	6.0	.315	8.0	.315	8.0	.236	6.0	.236	6.0	.236	6.0	.236	6.0
B10	.118	3.0	.118	3.0	.118	3.0	.118	3.0	.157	4.0	.157	4.0	.157	4.0	.157	4.0
M1	1.102	28.0	1.102	28.0	1.339	34.0	1.339	34.0	1.575	40.0	1.575	40.0	1.968	50.0	1.968	50.0
M2	.217	5.5	.217	5.5	.217	5.5	.217	5.5	.217	5.5	.217	5.5	.260	6.6	.260	6.6
M3	.354	9.0	.354	9.0	.354	9.0	.354	9.0	.354	9.0	.354	9.0	.433	11.0	.433	11.0
M4	.275	7.0	.275	7.0	.354	9.0	.354	9.0	.472	12.0	.472	12.0	.512	13.0	.512	13.0
P1	.256	6.5	.256	6.5	.354	9.0	.354	9.0	.354	9.0	.354	9.0	.413	11.0	.413	11.0
P2	1.063	27.0	1.063	27.0	1.358	34.5	1.358	34.5	1.358	34.5	1.358	34.5	1.535	39.0	1.535	39.0
P3	10-32 UNF	M5	10-32 UNF	M5	1/8 NPT	1/8 BSPP	1/8 NPT	1/8 BSPP	1/8 NPT	1/8 BSPP	1/8 NPT	1/8 BSPP	1/4 NPT	1/4 BSPP	1/4 NPT	1/4 BSPP
R1	.472	12.0	.472	12.0	.630	16.0	.630	16.0	.629	16.0	.630	16.0	.787	20.0	.787	20.0
R2 MAX	.3898	9.9	.3898	9.9	.5472	13.9	.5472	13.9	.548	13.9	.5472	13.9	.6654	16.9	.6654	16.9
R2 MIN	.3858	9.8	.3858	9.8	.5433	13.8	.5433	13.8	.5433	13.8	.5433	13.8	.6614	16.8	.6614	16.8
R3	.118	3.0	.118	3.0	.217	5.5	.217	5.5	.217	5.5	.217	5.5	.217	5.5	.217	5.5
R4	.157	4.0	.157	4.0	.256	6.5	.256	6.5	.256	6.5	.256	6.5	.295	7.5	.295	7.5
R5	3.681	93.5	4.469	113.5	4.469	113.5	5.256	133.5	4.508	114.5	5.295	134.5	5.984	152.0	8.346	212.0
R6	M8 x 1.25		M8 x 1.25		M10 x 1.5		M10 x 1.5		M10 x 1.5		M10 x 1.5		M12 x 1.75		M12 x 1.75	
R7	.590	15.0	.590	15.0	.472	12.0	.472	12.0	.472	12.0	.472	12.0	.591	15.0	.591	15.0
S1* MIN	.768	19.5	1.161	29.5	.984	25.0	1.378	35.0	.984	25.0	1.378	35.0	1.535	39.0	2.716	69.0
S2*	.374	9.5	.374	9.5	.591	15.0	.591	15.0	.591	15.0	.591	15.0	.748	19.0	.748	19.0
S3*	.394	10.0	.787	20.0	.394	10.0	.787	20.0	.394	10.0	.787	20.0	.787	20.0	1.968	50.0

All dimensions are reference only unless specifically toleranced.

OPTIONS & KITS: SERIES PB CLAMPS

TA STEEL SPINDLE

Steel spindles are plated steel with two hex nuts included.

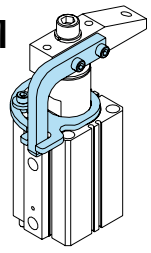


LAA PORT FITTINGS

90° swivel metal fitting for ease of air line hook up.

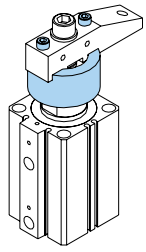
AB1 ANTI-BACKLASH ARM

Anti-backlash arm and guide are made from hardened steel and can be used to minimize the amount of arm backlash when clamping. Maximum clearance between arm and guide is .028 in [0.71 mm] resulting in a maximum total radial play of 0.8° max.



WC1 ROD WELD COVER

Weld cover is made of plated aluminum and protects the clamp rod from weld splatter during the clamp stroke. Order with -ASA or -ASB option.



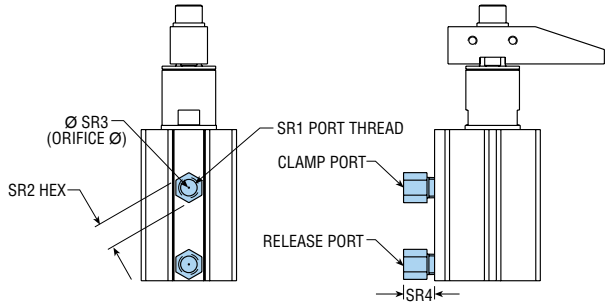
SR SPEED REDUCER FITTINGS

SR fittings provide a speed reducing orifice in a male to female hex connector. They reduce speeds so larger rotational mass moments of inertia can be accommodated. SR fittings are brass, so they are easily visible.

Use care that pipe sealant or Teflon tape does not plug the orifices.

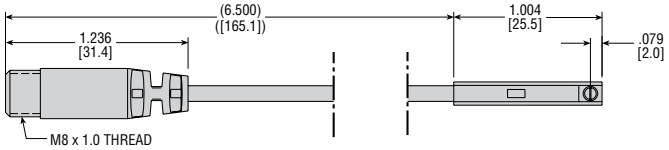
MAX MOMENT OF INERTIA

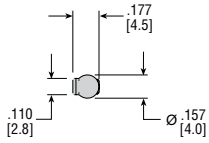
MODEL	PORTS OR FITTING	CYCLE TIME EXT OR RET sec	Jm in-lb-sec²
PBS4	Std ports	.4	.009
PBS4	SR 22	1.2	.02
PBL4	Std ports	.4	.009
PBL4	SR 22	1.2	.02
PBS5	Std ports	.4	.03
PBS5	SR 40	.7	.06
PBL5	Std ports	.7	.03
PBL5	SR 40	1.4	.06



LETTER DIM	SR22 OPTION PBx4x in	SR22 OPTION PBx4x mm	SR40 OPTION PBx5x in	SR40 OPTION PBx5x mm
SR1 PORT	1/8-27 NPT	1/8-28 BSPP	1/4-18 NPT	1/4-19 BSPP
SR2 HEX	.562	14.27	.688	17.48
Ø SR3	.022	.56	.040	1.02
SR4	.630	16.0	1.004	25.5
KIT NO.	71112-01	71124-01	71113-01	71126-01

NOTES: 1) KIT INCLUDES 2 SPEED REDUCER FITTINGS
2) SPEED REDUCER FITTINGS NOT AVAILABLE FOR PBx2x OR PBx3x





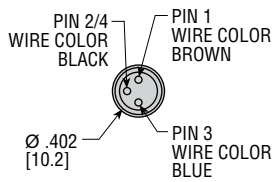
SW41 1 NPN SWITCH INSTALLED

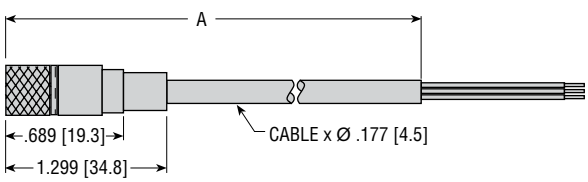
SW51 1 PNP SWITCH INSTALLED

SW42 2 NPN SWITCHES INSTALLED

SW52 2 PNP SWITCHES INSTALLED

63549-xx CORDSET WITH FEMALE QUICK CONNECT





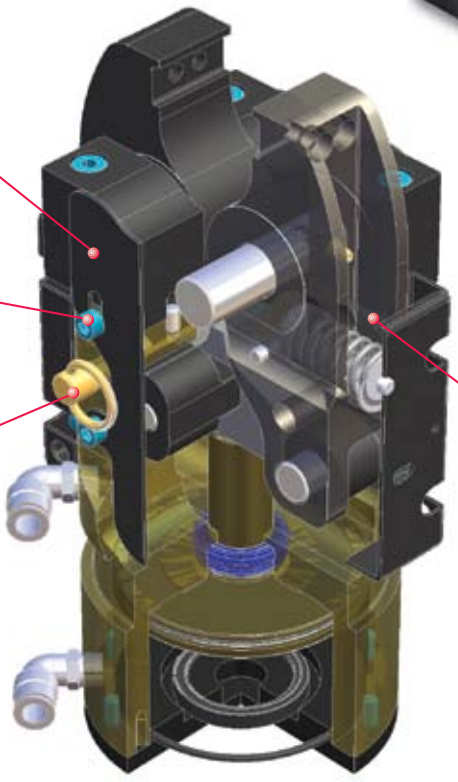
MODEL NO.	LETTER DIM. A
63549-02	78.74 [2 m]
63549-05	196.85 [5 m]

NOTE:
1) UNLESS SPECIFICALLY TOLERANCED ALL CATALOG DIMENSIONS ARE REFERENCE ONLY
2) ALL NUMBERS IN [ ] ARE METRIC AND ARE IN mm

For additional information, request a Series PB Clamp Catalog.

PNC

AUTOMATED STAMPING FOR PART IDENTIFICATION



two hardened steel plates eliminate damage from panel impact

locking threads on body eliminate the need for adhesive thread locker

lockout pin included for safety during tooling changes

patented cam mechanism produces high forces to be generated at normal pneumatic pressures

two sizes available to fit your application requirements

tandem cylinder option provides 70% increase in clamp force

welding slag shield option protects internal mechanisms from flying sparks and debris

optional switches allow for open and close sensing

HEAVY DUTY MODEL

PATENT #6,125,684
PATENT #6,324,886 B1
PATENT #6,499,331 B2

NUMBER® CRUNCHER

Major Benefits

- Provides cost effective solution for stamping identification characters into parts or metal
- High clamp force produces characters in draw quality steel at 70 psi [4.8 bar]
- Operates quietly in less than .24 seconds
- Eliminates downtime associated with changing or replacing characters
- 24 hour delivery

Industry Uses

- Metal stamping
- Assembly machine builders
- Automotive Tier II & Tier III
- Aerospace

SUPERIOR DELIVERY 24 Hour* *From receipt of order

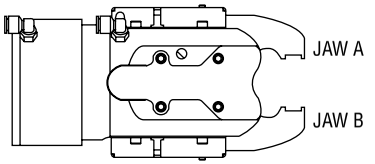
ORDERING DATA: SERIES PNC CLAMPS

TO ORDER SPECIFY:
Size, Mounting, Design No., Jaw Option (A & B), Jaw Opening (A & B), and Fitting Option if desired.

MOUNTING
N - No Mounting
P - Rear Mounting Plate
R - 1" [25.4] Non-Spherical Mounting Bracket
V - 1-1/4" [31.8] Non-Spherical Mounting Bracket
M - Side Mounting Plate

JAW OPTIONS - JAW A

JAW STYLE OPTION	JAW OPENING
S - Standard Jaw (to accept Tip Kits)	16 - 16°Opening



PNC 44 P - 1 - S16 - S16 - LAA

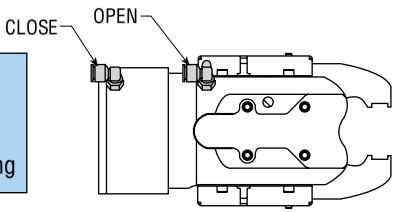
UNIT SIZE
44 - Medium Duty
55 - Heavy Duty
(See note 2)

DESIGN NO.
1 - Imperial
5 - Metric
(See note 1)

JAW OPTIONS - JAW B

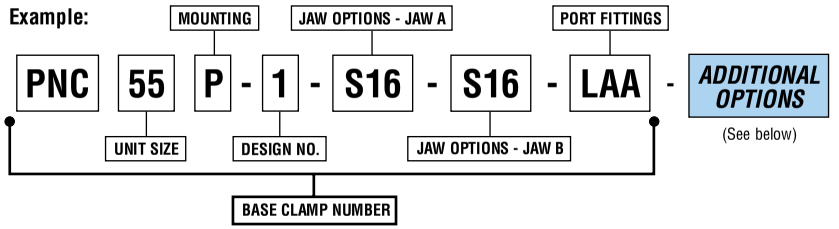
JAW STYLE OPTION	JAW OPENING
S - Standard Jaw (to accept Tip Kits)	16 - 16° Opening

PORT FITTINGS (BOTH PORTS)
BLANK - None
LAA - 90° Swivel Fitting

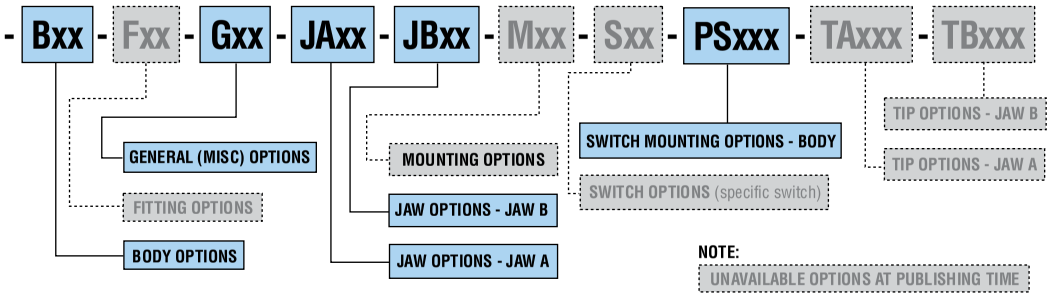


NOTES:
1) Metric units have metric ports and mounting.
2) Tandem cylinder (B01 Option) available on PNC55 units only.
3) Numbers in [ ] are for metric units and are in mm.

Example:



ADDITIONAL OPTIONS



NOTE:
UNAVAILABLE OPTIONS AT PUBLISHING TIME

SPECIFICATIONS	SERIES PNC CLAMPS
WORKING PRESSURE	70 psi min. - 100 psi max.* [5 bar min. - 7 bar max.]
BODY	Hardcoat Aluminum
JAWS	Steel
SEALS	Bidirectional Piston Seal Lip Type Rod Seal with Integral Rod Wiper
LUBRICATION	Permanent for Non-Lube Air
TEMPERATURE LIMITS	-20° to 180°F [-30° to 82°C]

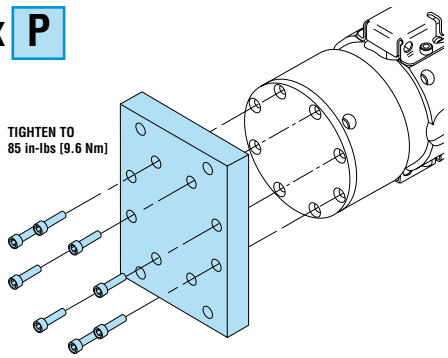
*90 psi max. [6.2 bar max.] for B01 option

PATENT #6,125,684
PATENT #6,324,886 B1
PATENT #6,499,331 B2

MODEL	UNIT WEIGHT		TOTAL CLAMP FORCE AT 87 psi [6 bar]		CLOSE OR OPEN TIME 87 psi [6 bar]	DISPLACEMENT OPEN		DISPLACEMENT CLOSE		CLAMP FORCE FACTOR (C_f)	
	lb	kg	lb	kN	sec.	in^3	cm^3	in^3	cm^3	imperial	metric
PNC44x-x-S16-S16	19.0	8.65	9000	40	0.12	19.60	321	20.87	342	103.5	6672
PNC55x-x-S16-S16	22.2	10.09	15000	66	0.12	19.60	321	20.87	342	170.0	10959

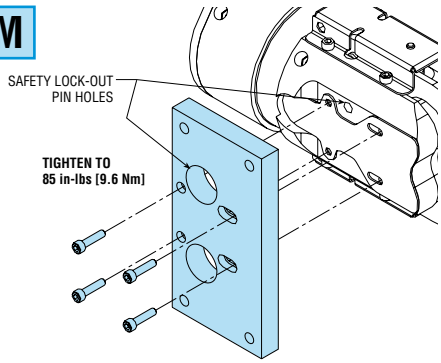
REAR MOUNTING BRACKET

PNCxx P



SIDE MOUNTING BRACKET

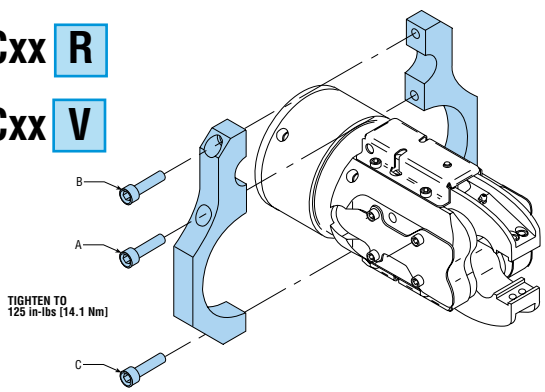
PNCxx M



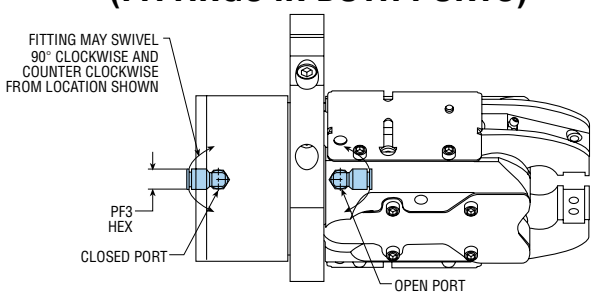
NON-SPHERICAL MOUNTING BRACKET

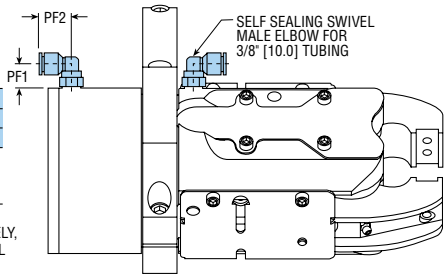
PNCxx R

PNCxx V



- LAA OPTION (FITTINGS IN BOTH PORTS)

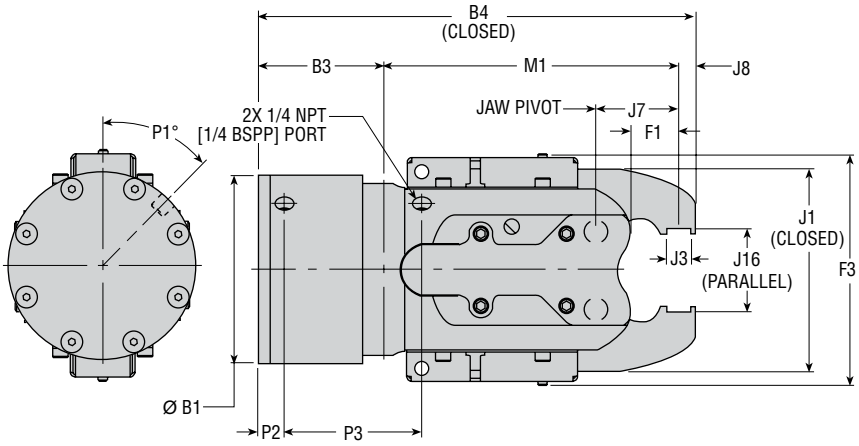


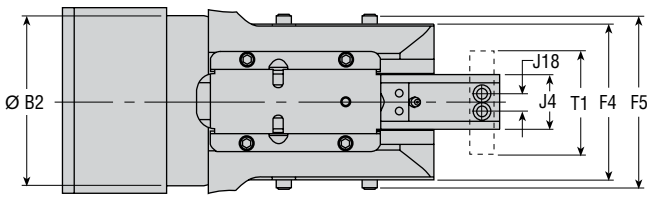


LETTER DIM	MODEL NUMBER PNCxx in	mm
PF1	.767	20.5
PF2	1.102	28.0
PF3	.551	14.0

NOTE:
TO ORDER FITTINGS SEPARATELY,
PART NO. 62178-010 -IMPERIAL
PART NO. 62195-010 -METRIC

For additional information, request a Series PNC Clamp Catalog.

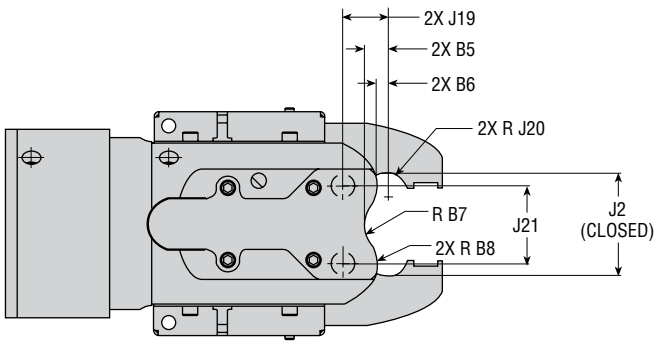




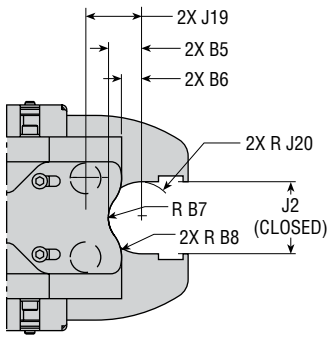
LETTER DIM	MODEL NUMBER			
	PNC44		PNC55	
	in	mm	in	mm
B1	4.902	124.5	4.902	124.5
B2	4.500	114.3	4.500	114.3
B3	3.300	83.8	3.300	83.8
B4 (CLOSED)	11.540	293.1	11.540	293.1
B5	.589	15.0	.865	22.0
B6	.247	6.3	.521	13.2
B7	.750	19.1	.750	19.1
B8	.932	23.7	.990	25.1
F1	1.273	32.3	1.273	32.3
F3	6.000	152.4	6.000	152.4
F4	4.085	103.8	4.085	103.8
F5	4.557	115.7	4.557	115.7
J1 (CLOSED)	5.284	134.2	5.284	134.2
J2 (CLOSED)	2.696	68.5	1.862	47.3
J3*	.635	16.1	.635	16.1
J4	1.440	36.6	1.440	36.6
J7	2.205	56.0	2.205	56.0
J8	.444	11.3	.444	11.3
J16 (PARALLEL)	2.161	54.9	2.161	54.9
J18	.472	12.0	.472	12.0
J19	1.179	29.9	1.453	36.9
J20	.580	14.7	1.000	25.4
J21	2.036	51.7	2.036	51.7
P1	45°	45°	45°	45°
P2	.682	17.3	.682	17.3
P3	3.602	91.5	3.602	91.5
M1	7.795	198.0	7.795	198.0
T1	2.760	70.1	2.760	70.1

* TOLERANCE FOR J3=±.003 [±.076]

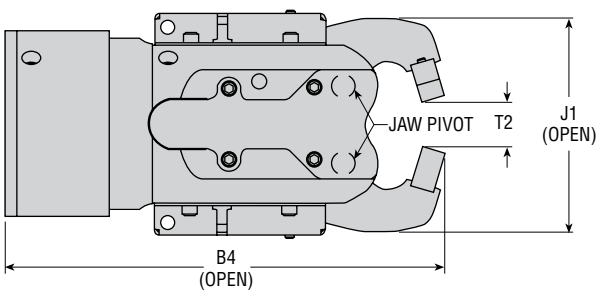
NOTES:
1) FOR MOUNTING BRACKET INFORMATION SEE PAGE 7-15.
2) NUMBERS IN [ ] ARE FOR METRIC UNITS AND ARE IN mm.



PNC44 UNITS ONLY



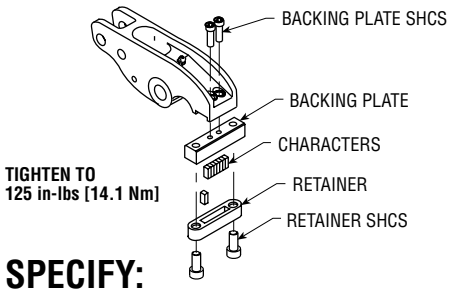
PNC55 UNITS ONLY



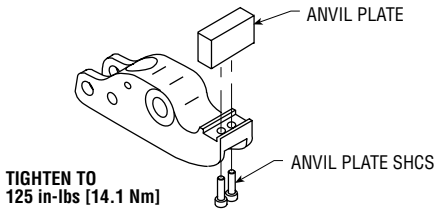
LETTER DIM	MODEL NUMBER			
	PNC44		PNC55	
	in	mm	in	mm
J1 (OPEN)	5.615	142.6	5.615	142.6
T2	1.157	29.4	1.157	29.4
B4 (OPEN)	11.590	294.4	11.590	294.4

All dimensions are reference only unless specifically toleranced.

CHARACTER MOUNTING - JAW A



ANVIL MOUNTING - JAW B



TO ORDER SPECIFY:

Based on your character **HEIGHT** and **MATERIAL THICKNESS** to be stamped. Order the correct anvil, backer, & retainer kit required.

If you need all the components: Order the anvil-backer-retainer kit. (Ex: **63140-01** for 1/8" tall char.) (Ex: **65340-01** for 3/16" tall char.)
If you have a retainer: Order the anvil-bracket kit. (Ex: **63130-01** for 1/8" tall char.) (Ex: **65330-01** for 3/16" tall char.)
Characters are ordered individually. (Ex: **63100-N6** =1/8" tall char. number 6) (Ex: **65330-N6** for 3/16" tall char. number 6)

Retainers must be filled completely with characters to work properly
Depending on the number to be stamped, order the characters and enough blanks or hyphens to fill the retainer.

Ex: With 1/8" tall character (63100 series) stamp the number 1999.
Matching retainer 63110-09 holds 9 characters.
Order: 1 of 63100-N1, 3 of 63100-N9, and 5 of 63100-BL.

Ex: With 3/16" tall character (65300 series) stamp the number 1999.
Matching retainer 65310-08 holds 8 characters.
Order: 1 of 65300-N1, 3 of 65300-N9, and 4 of 65300-BL.

KITS FOR 1/8" TALL CHARACTERS

PANEL THICKNESS			PART	KIT NUMBER	KIT NUMBER	KIT NUMBER	KIT NUMBER	KIT NUMBER
PNC44	PNC55	-B01 OPTION	COLOR	ANVIL	BACKER	RETAINER	(ANVIL & BACKER)	(ANVIL, BACKER & RETAINER)
.25 - 1.25 mm	—	.25 - 1.00 mm	GREEN	65500-00	63120-09	63110-09	63130-00	63140-00
1.25 - 2.50 mm	.25 - 1.50 mm	1.00 - 2.25 mm	BLACK	65500-01			63130-01	63140-01
2.50 - 3.75 mm	1.50 - 3.00 mm	2.25 - 3.50 mm	SILVER	65500-02			63130-02	63140-02
3.75 - 4.75 mm	3.00 - 4.25 mm	3.50 - 4.75 mm	GOLD	65500-03			63130-03	63140-03
ALL KITS INCLUDE FASTENERS REQUIRED FOR INSTALLATION								

1/8" TALL CHARACTERS

PART DESCRIPTION	PART NUMBER	PART DESCRIPTION	PART NUMBER	PART DESCRIPTION	PART NUMBER	PART DESCRIPTION	PART NUMBER
NUMBER 0	63100-N0	LETTER A	63100-LA	LETTER K	63100-LK	LETTER U	63100-LU
NUMBER 1	63100-N1	LETTER B	63100-LB	LETTER L	63100-LL	LETTER V	63100-LV
NUMBER 2	63100-N2	LETTER C	63100-LC	LETTER M	63100-LM	LETTER W	63100-LW
NUMBER 3	63100-N3	LETTER D	63100-LD	LETTER N	63100-LN	LETTER X	63100-LX
NUMBER 4	63100-N4	LETTER E	63100-LE	LETTER O	63100-LO	LETTER Y	63100-LY
NUMBER 5	63100-N5	LETTER F	63100-LF	LETTER P	63100-LP	LETTER Z	63100-LZ
NUMBER 6	63100-N6	LETTER G	63100-LG	LETTER Q	63100-LQ		
NUMBER 7	63100-N7	LETTER H	63100-LH	LETTER R	63100-LR	BLANK	63100-BL
NUMBER 8	63100-N8	LETTER I	63100-LI	LETTER S	63100-LS		
NUMBER 9	63100-N9	LETTER J	63100-LJ	LETTER T	63100-LT	HYPHEN	63100-HY
9 CHARACTERS ARE REQUIRED WHEN USING PHD RETAINER NUMBER 63110-09							

KITS FOR 3/16" TALL CHARACTERS

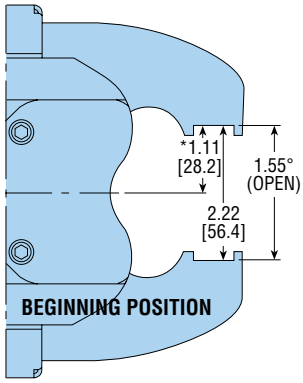
PANEL THICKNESS			PART	KIT NUMBER	KIT NUMBER	KIT NUMBER	KIT NUMBER	KIT NUMBER
PNC44	PNC55	-B01 OPTION	COLOR	ANVIL	BACKER	RETAINER	(ANVIL & BACKER)	(ANVIL, BACKER & RETAINER)
.25 - 1.25 mm	—	.25 - 1.00 mm	GREEN	65500-00	65320-08	65310-08	65330-00	65340-00
1.25 - 2.50 mm	.25 - 1.50 mm	1.00 - 2.25 mm	BLACK	65500-01			65330-01	65340-01
2.50 - 3.75 mm	1.50 - 3.00 mm	2.25 - 3.50 mm	SILVER	65500-02			65330-02	65340-02
3.75 - 4.75 mm	3.00 - 4.25 mm	3.50 - 4.75 mm	GOLD	65500-03			65330-03	65340-03
ALL KITS INCLUDE FASTENERS REQUIRED FOR INSTALLATION								

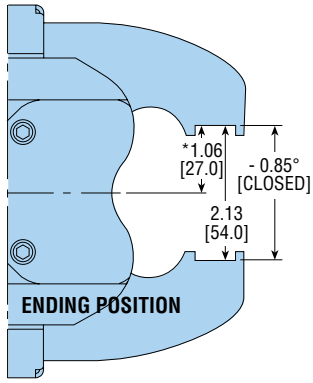
3/16" TALL CHARACTERS

PART DESCRIPTION	PART NUMBER	PART DESCRIPTION	PART NUMBER	PART DESCRIPTION	PART NUMBER	PART DESCRIPTION	PART NUMBER
NUMBER 0	65300-N0	LETTER A	65300-LA	LETTER K	65300-LK	LETTER U	65300-LU
NUMBER 1	65300-N1	LETTER B	65300-LB	LETTER L	65300-LL	LETTER V	65300-LV
NUMBER 2	65300-N2	LETTER C	65300-LC	LETTER M	65300-LM	LETTER W	65300-LW
NUMBER 3	65300-N3	LETTER D	65300-LD	LETTER N	65300-LN	LETTER X	65300-LX
NUMBER 4	65300-N4	LETTER E	65300-LE	LETTER O	65300-LO	LETTER Y	65300-LY
NUMBER 5	65300-N5	LETTER F	65300-LF	LETTER P	65300-LP	LETTER Z	65300-LZ
NUMBER 6	65300-N6	LETTER G	65300-LG	LETTER Q	65300-LQ		
NUMBER 7	65300-N7	LETTER H	65300-LH	LETTER R	65300-LR	BLANK	65300-BL
NUMBER 8	65300-N8	LETTER I	65300-LI	LETTER S	65300-LS		
NUMBER 9	65300-N9	LETTER J	65300-LJ	LETTER T	65300-LT	HYPHEN	65300-HY
8 CHARACTERS ARE REQUIRED WHEN USING PHD RETAINER NUMBER 65310-08							

EFFECTIVE STAMPING RANGE

The effective stamping range is defined as the range where the clamp develops the greatest amount of clamp force (C*f*). The effective stamping range occurs between the beginning and ending jaw positions as shown below.





NOTES:
1) NUMBERS IN [ ] ARE FOR METRIC UNITS AND ARE IN mm.
2) ANGULAR DIMENSIONS ARE MEASURED IN DEGREES.
3) *- DIMENSION MEASURED FROM CENTERLINE OF UNIT TO CENTERLINE OF TIP SLOT.

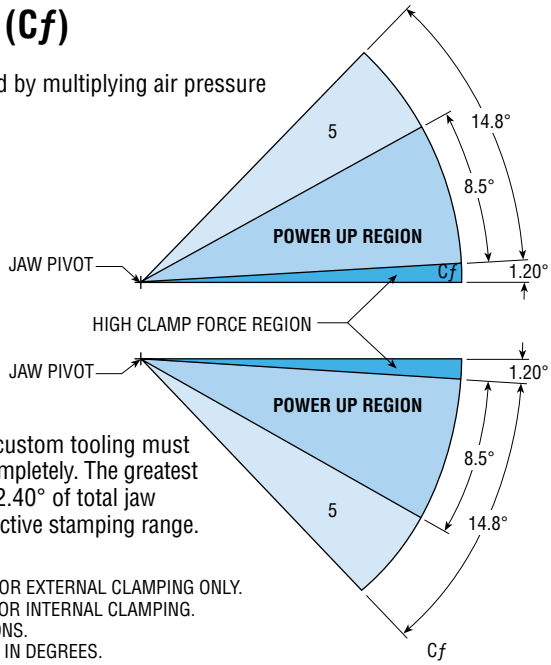
TOTAL CLAMP FORCE (C*f*)

Total clamp force can be determined by multiplying air pressure by the clamp force multiplier (C*f*).

Example:
Your air line pressure: 72 psi
Clamp force multiplier: 5
(outside effective stamping range)
72 x 5 = 360 lb

Clamp force multiplier: 103.5
(within high force region)
72 x 103.5 = 7452 lb

To achieve maximum clamp force, custom tooling must not restrict the jaws from closing completely. The greatest clamp force occurs during the last 2.40° of total jaw rotation. Refer to the picture for effective stamping range.



NOTES:
1) THE NUMBER CRUNCHER IS DESIGNED FOR EXTERNAL CLAMPING ONLY. DO NOT USE THE NUMBER CRUNCHER FOR INTERNAL CLAMPING. CONSULT PHD FOR SPECIAL APPLICATIONS.
2) ANGULAR DIMENSIONS ARE MEASURED IN DEGREES.

PNC44

AIR PRESSURE		TOTAL CLAMP FORCE (C*f*) = 103.5 [6672]		(C*f*) = 5 [322]	
psi	bar	lb	N	lb	N
30	2.06	3105	13811	150	667
40	2.76	4140	18415	200	890
50	3.45	5175	23018	250	1112
60	4.14	6210	27622	300	1334
70	4.83	7245	32226	350	1557
80	5.52	8280	36829	400	1779
90	6.21	9315	41433	450	2002
100	6.89	10350	46037	500	2224

PNC55

AIR PRESSURE		TOTAL CLAMP FORCE (C*f*) = 170.0 [10959]		(C*f*) = 5 [322]	
psi	bar	lb	N	lb	N
30	2.06	5100	22685	150	667
40	2.76	6800	30246	200	890
50	3.45	8500	37808	250	1112
60	4.14	10200	45370	300	1334
70	4.83	11900	52931	350	1557
80	5.52	13600	60493	400	1779
90	6.21	15300	68054	450	2002
100	6.89	17000	75616	500	2224

(For chart below)
Will not function in this range
Ideal stamping range

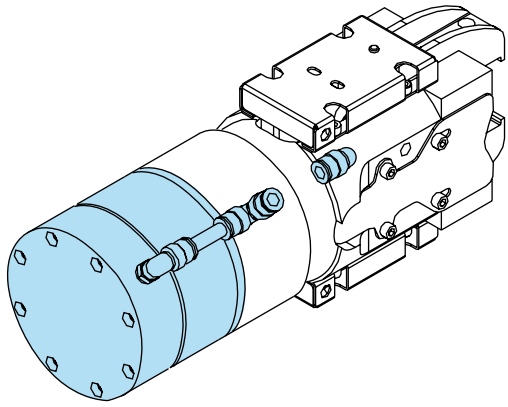
PNC44x-x-S16-S16-LAA TIP COMBINATION

DESCRIPTION	COLOR	PRESSURE psi	PRESSURE bar	PANEL THICKNESS in [mm] .000 [0]	.010 [.25]	.019 [.5]	.029 [.75]	.039 [1]	.049 [1.25]	.059 [1.5]	.069 [1.75]	.078 [2]	.089 [2.25]	.098 [2.5]	.108 [2.75]	.118 [3]	.128 [3.25]	.137 [3.50]	.148 [3.75]	.157 [4]	.167 [4.25]	.177 [4.5]	.187 [4.75]	.196 [5]	.207 [5.25]	.217 [5.5]	.226 [5.75]	.236 [6]
GREEN ANVIL	GREEN	60	4.1																									
		87	6																									
		100	6.9																									
BLACK ANVIL	BLACK	60	4.1																									
		87	6																									
		100	6.9																									
SILVER ANVIL	SILVER	60	4.1																									
		87	6																									
		100	6.9																									
GOLD ANVIL	GOLD	60	4.1																									
		87	6																									
		100	6.9																									

PNC55x-x-S16-S16-LAA TIP COMBINATION

DESCRIPTION	COLOR	PRESSURE psi	PRESSURE bar	PANEL THICKNESS in [mm] .000 [0]	.010 [.25]	.019 [.5]	.029 [.75]	.039 [1]	.049 [1.25]	.059 [1.5]	.069 [1.75]	.078 [2]	.089 [2.25]	.098 [2.5]	.108 [2.75]	.118 [3]	.128 [3.25]	.137 [3.50]	.148 [3.75]	.157 [4]	.167 [4.25]	.177 [4.5]	.187 [4.75]	.196 [5]	.207 [5.25]	.217 [5.5]	.226 [5.75]	.236 [6]
GREEN ANVIL	GREEN	60	4.1																									
		87	6																									
		100	6.9																									
BLACK ANVIL	BLACK	60	4.1																									
		87	6																									
		100	6.9																									
SILVER ANVIL	SILVER	60	4.1																									
		87	6																									
		100	6.9																									
GOLD ANVIL	GOLD	60	4.1																									
		87	6																									
		100	6.9																									

B01 TANDEM CYLINDER



This option provides up to a 70% increase in clamp force by adding a second cylinder (tandem) on a standard PNC55 clamp. The cylinder mounts directly to the back of a PNC55 clamp body. Overall length is increased by 3.59 in [91.2 mm]. Weight is increased by 5.4 lb [2.45 kg].

This option is compatible with P, R, V, and M mounts. This option will accommodate standard characters, retainers, and anvils.

Not available on PNC44 clamps.

NOTE: 90 psi [6.2 bar] max. working pressure

AVAILABLE ON	DESIGN NO.	ACCESSORY
PNC55	1 [5]	B01

Fittings are ordered separately.

Example Ordering Data:

PNC 55 N-1-S16-S16-LAA -B01

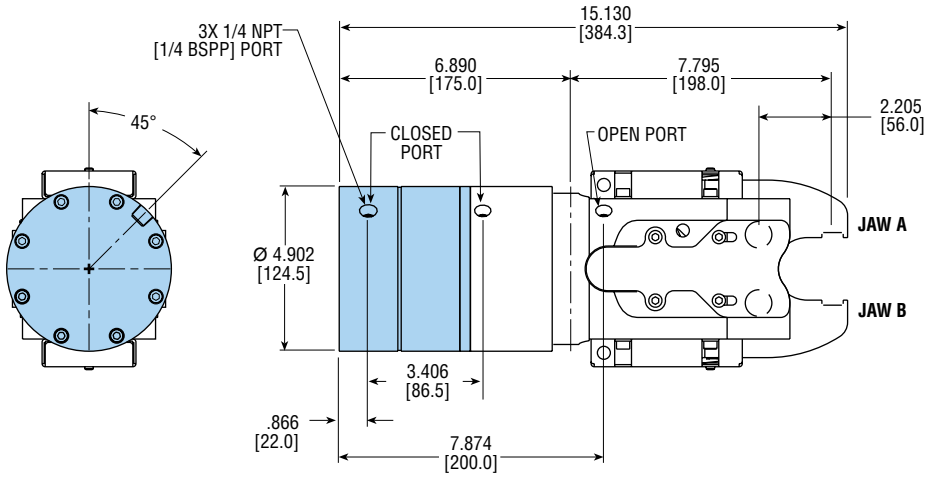
SHADED CODES are required for this option.

All unshaded model codes are example only.

For compatibility with other units, consult PHD.

SPECIFICATIONS

CLAMP SIZE	WEIGHT ADDER lb	WEIGHT ADDER Kg	LENGTH ADDER in	LENGTH ADDER mm	TOTAL CLAMP FORCE AT 87 psi [6 bar] lb	TOTAL CLAMP FORCE AT 87 psi [6 bar] N	DISPLACEMENT OPEN in^3	DISPLACEMENT OPEN cm^3	DISPLACEMENT CLOSE in^3	DISPLACEMENT CLOSE cm^3
55	5.4	2.45	3.59	91.2	25404	113002	19.60	321	41.74	684



NOTES:
1) ALL DIMENSIONS ARE REFERENCE UNLESS SPECIFICALLY TOLERANCED.
2) ALL DIMENSIONS [ ] ARE GIVEN IN MILLIMETERS
1 mm = .03937 in

(continued on next page)

EFFECTIVE STAMPING RANGE

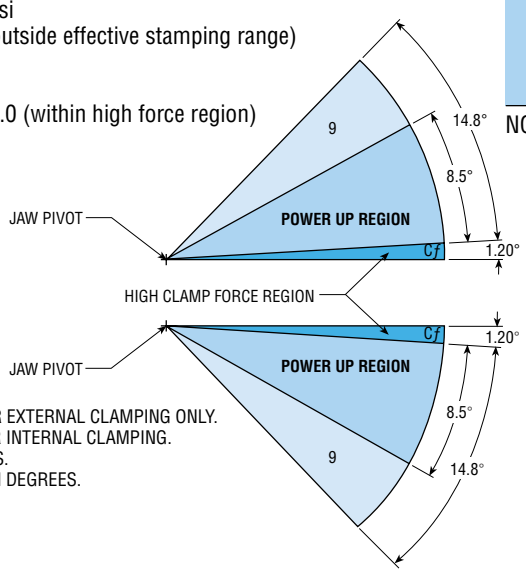
TOTAL CLAMP FORCE (C*f*)

Total clamp force can be determined by multiplying air pressure by the clamp force multiplier (C*f*).

Example: Your air line pressure: 72 psi
Clamp force multiplier: 9 (outside effective stamping range)
72 x 9 = 648 lb

Clamp force multiplier: 292.0 (within high force region)
72 x 292.0 = 21024 lb

To achieve maximum clamp force, custom tooling must not restrict the jaws from closing completely. The greatest clamp force occurs during the last 2.40° of total jaw rotation. Refer to the picture for effective stamping range.



B01

AIR PRESSURE		TOTAL CLAMP FORCE (C*f*) = 292.0 [18824]		(C*f*) = 9 [580]	
psi	bar	lb	N	lb	N
30	2.06	8760	38966	270	1201
40	2.76	11680	51955	360	1601
50	3.45	14600	64944	450	2001
60	4.14	17520	77932	540	2402
70	4.83	20440	90921	630	2802
80	5.52	23360	103910	720	3202
90	6.21	26280	116899	810	3603

NOTE: 90 psi [6.2 bar] max. working pressure

NOTES:
1) THE NUMBER CRUNCHER IS DESIGNED FOR EXTERNAL CLAMPING ONLY. DO NOT USE THE NUMBER CRUNCHER FOR INTERNAL CLAMPING. CONSULT PHD FOR SPECIAL APPLICATIONS.
2) ANGULAR DIMENSIONS ARE MEASURED IN DEGREES.

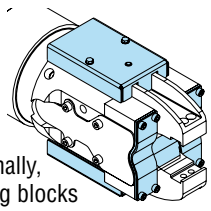
(For chart below)
Will not function in this range
Ideal stamping range

PNC55x-x-S16-S16-LAA-B01 TIP COMBINATION

DESCRIPTION	COLOR	PRESSURE psi	PRESSURE bar	PANEL THICKNESS in [mm] .000 [0]	.010 [.25]	.019 [.5]	.029 [.75]	.039 [1]	.049 [1.25]	.059 [1.5]	.069 [1.75]	.078 [2]	.089 [2.25]	.098 [2.5]	.108 [2.75]	.118 [3]	.128 [3.25]	.137 [3.50]	.148 [3.75]	.157 [4]	.167 [4.25]	.177 [4.5]	.187 [4.75]	.196 [5]	.207 [5.25]	.217 [5.5]	.226 [5.75]	.236 [6]
GREEN ANVIL	GREEN	60	4.1																									
		87	6																									
BLACK ANVIL	BLACK	60	4.1																									
		87	6																									
SILVER ANVIL	SILVER	60	4.1																									
		87	6																									
GOLD ANVIL	GOLD	60	4.1																									
		87	6																									

PNC

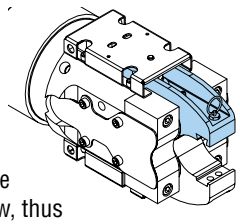
G01 WELDING SLAG SHIELDS



This option provides shields that protect the PNC55 mechanism from flying sparks and weld slag. Metal shields are assembled over the spring covers, blocking all spring cover openings. Additionally, a urethane shield is mounted on the bushing blocks covering the opening between the jaws.

Not available on PNC44 clamps.

Jx01 QUICK CHANGE TOOLING JAW (A ON JAW A, B ON JAW B)



This option provides quick change character tooling. A dovetail slot in the jaw accepts matching dovetail backing plates. A hand retractable plunger holds the character tooling in place. No fasteners or wrenches are required to mount character tooling to the jaw, thus minimizing downtime for part number/date/shift code change out. **This option is not available for anvil tooling.**

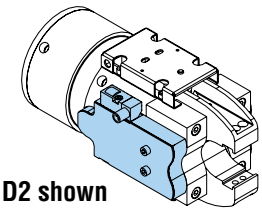
JA01 shown

PS(R)xxx POSITIONAL SENSING DETECTION

(replaces SB01 to SB04 options)

This option provides jaw open and jaw closed sensing by affixing an aluminum housing to the side of the clamp body. The adjustable switches sense the position of a target on the drive pin as the clamp opens and closes. (open range = 14° to full open, close range = 3° to full close)

PS positions satellite switch S02 to sense open and S01 to sense close. PR positions satellite switch S01 to sense open and S02 to sense close.

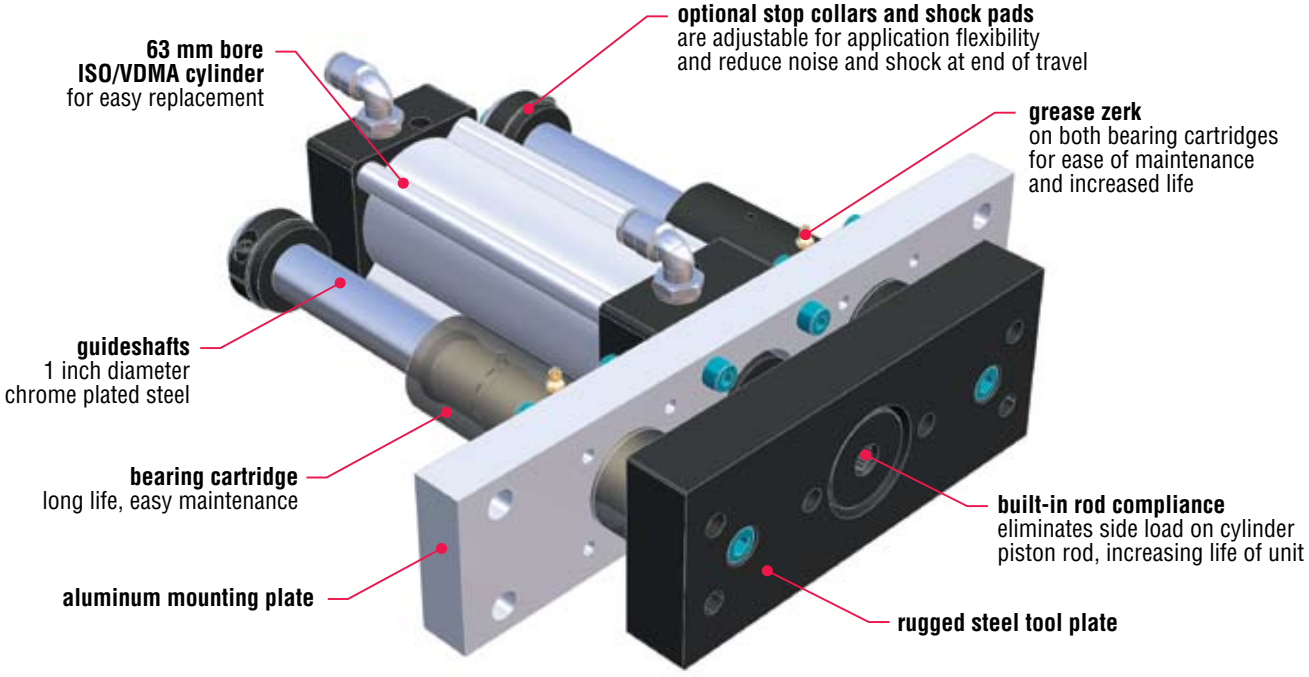


PS1D2 shown

PHL

IDEAL FOR AUTOMATED, HIGH LOAD PART LIFTING APPLICATIONS

proximity switches are available for sensing end of travel



Major Benefits

- Simple design, compact size, long life, and the ability to handle high off-center loads
- Available as drop-in replacement for General Motors Global Die Standards, (GMGDS) 90.35.05-A and B
- Built-in rod compliance eliminates side load on cylinder piston rod thus increasing life
- Fully field repairable in just 10 minutes, using metric hex wrenches
- Composite bearings with internal lubrication for long life
- Replaceable bearings eliminate costly lifter replacement

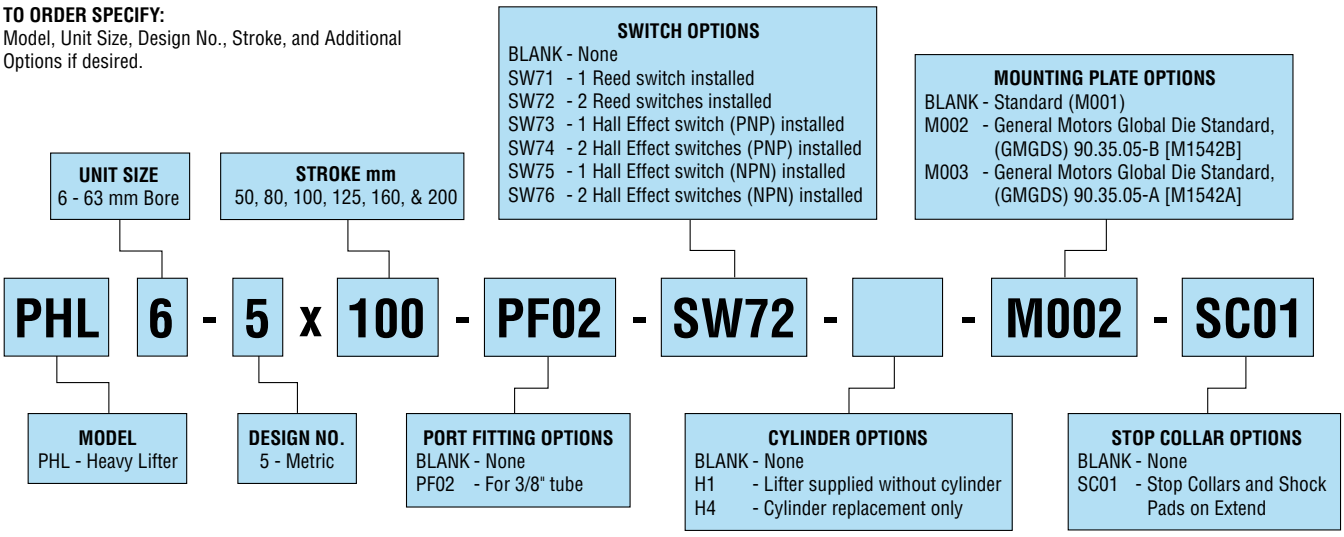
Industry Uses

- Material handling
- Automotive
- Assembly machine builders

SUPERIOR DELIVERY
24 Hour*
*From receipt of order

ORDERING DATA: SERIES PHL HEAVY LIFTER

TO ORDER SPECIFY:
Model, Unit Size, Design No., Stroke, and Additional Options if desired.



ENGINEERING DATA: SERIES PHL HEAVY LIFTER

SPECIFICATIONS	SERIES PHL
OPERATING PRESSURE	20 psi min to 140 psi [1.4 bar min to 9.7 bar max]
OPERATING TEMPERATURE	14° to +158°F [-10° to +70°C]
LUBRICATION*	Factory lubricated for life

*Periodic lubrication of bearing cartridges and thrust washers decreases wear and extends life.

SPECIFICATIONS

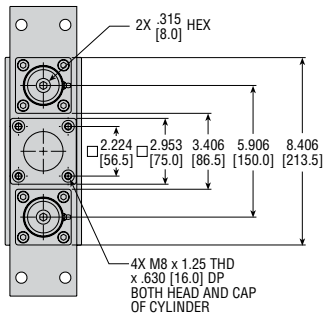
MODEL	BORE in	BORE mm	EFFECTIVE PISTON AREA in² [mm²] EXTEND	EFFECTIVE PISTON AREA in² [mm²] RETRACT	STROKE (mm) LENGTH	STROKE (mm) TOLERANCE	TYPICAL CYCLE TIME (sec) EXTEND / RETRACT	UNIT WEIGHT lb [kg] MOUNTING STYLE M001	M002	M003
PHL	2.480	63	4.83 [3117]	4.34 [2800]	50	+3.8/-0	0.18	25.5 [11.6]	26.0 [11.8]	25.9 [11.7]
					80		0.23	26.3 [11.9]	26.8 [12.2]	26.7 [12.1]
					100		0.25	27.0 [12.2]	27.5 [12.5]	27.4 [12.4]
					125		0.30	27.7 [12.6]	28.2 [12.8]	28.1 [12.7]
					160		0.35	28.7 [13.0]	29.2 [13.2]	29.1 [13.1]
					200		0.45	29.6 [13.4]	30.1 [13.7]	30.0 [13.6]

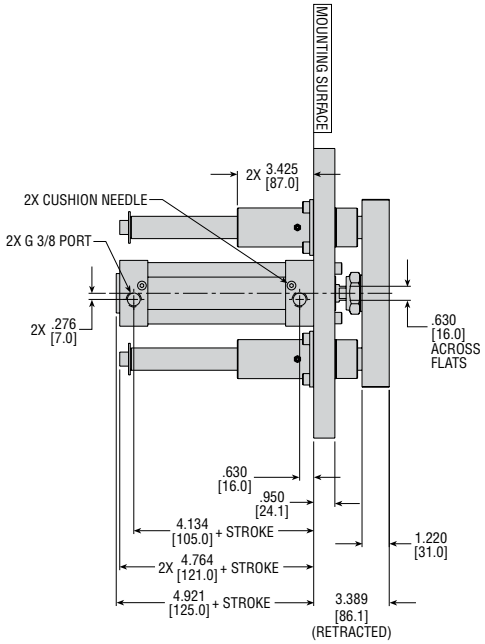
NOTES: 1) Cycle times are based on 3/8" air lines, valve of cv 5.1, and visually acceptable cushions.
2) The use of air lines greater than 3/8" will require the use of external flow controls.

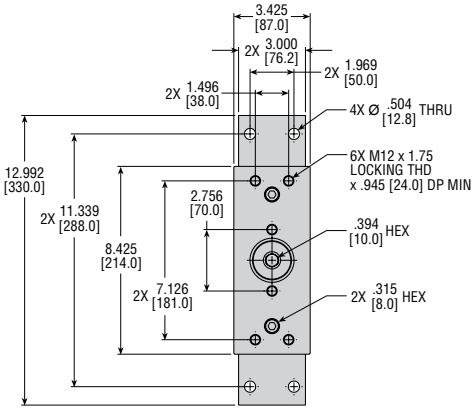
CYLINDER THRUST CALCULATION

	IMPERIAL F = P x A	METRIC F = 0.1 x P x A
F = Cylinder Thrust	lbs	N
P = Operating Pressure	psi	bar
A = Effective Area (Extend or Retract)	in²	mm²

DIMENSIONS: SERIES PHL - M001 MOUNTING STYLE

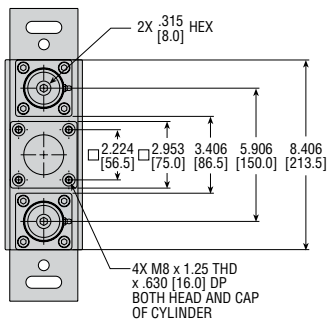


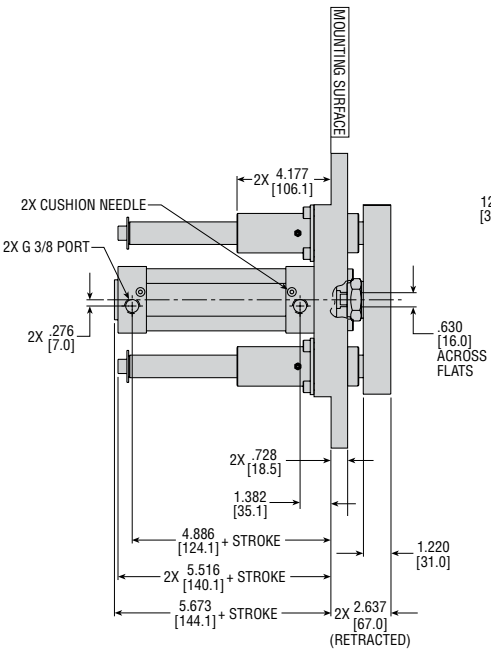


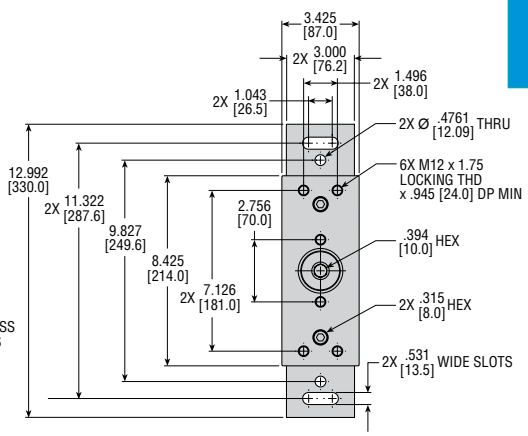


NOTES:
1) ALL DIMENSIONS ARE REFERENCE ONLY UNLESS SPECIFICALLY TOLERANCED
2) ALL METRIC DIMENSIONS [ ] ARE GIVEN IN MILLIMETERS 1 mm = .03937 in

DIMENSIONS: SERIES PHL - M002 MOUNTING STYLE







NOTES:
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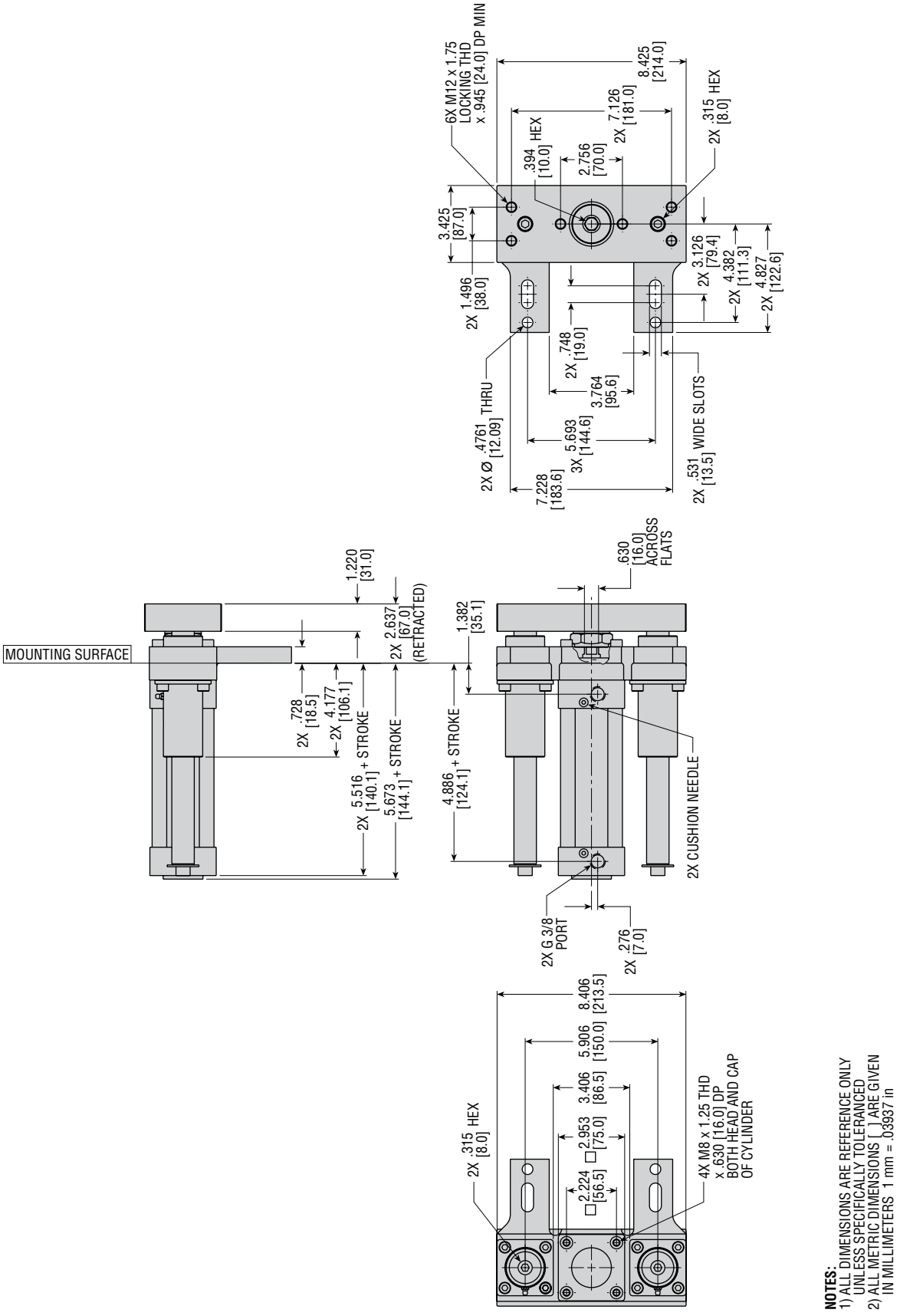


NOTES:
1) ALL DIMENSIONS ARE REFERENCE ONLY UNLESS SPECIFICALLY TOLERANCED
2) ALL METRIC DIMENSIONS [ ] ARE GIVEN IN MILLIMETERS 1 mm = .03937 in

For additional information, request a Series PHL Clamp Catalog.

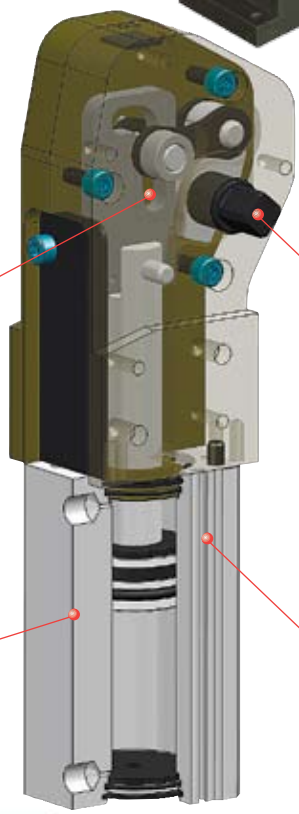
PEC

SUPERIOR PART HOLDING. PROVIDES WIDEST RANGE OF HIGH CLAMPING FORCE IN ITS CLASS.

PEC34

PEC33

weld field immune switch option provides consistent position sensing



cam design locks clamp in closed position for the last 6° of rotation, ensuring part retention if air pressure is lost and makes initial setups easier

cam design provides widest range of high clamping force in its class

multiple output shaft options available for mounting arms on either or both sides for clamping options

Patent Pending

clamps are available in **two bore sizes**: 32 mm and 40 mm

cylinder mounted switches provide a low cost solution for position sensing

PEC

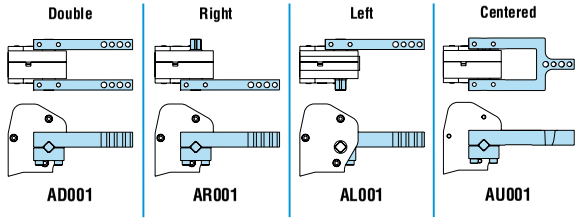
Major Benefits

- Manual release of clamp is achieved by using common tools without removing plugs while providing contamination resistance.
- Self-locking internal threads throughout eliminate need for thread locking adhesives or additional locking components.
- Flange mounting option provides a unique alternative to typical clamp mounting configurations.
- Speed reducers reduce the need for flow controls and help prevent failures due to overloading situations caused by poor flow control adjustment.
- 24 hour delivery

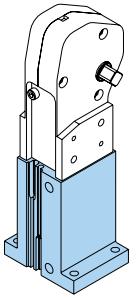
Industry Uses

- Assembly and Welding

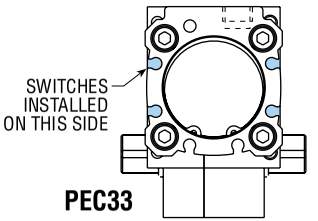
SUPERIOR DELIVERY 24 Hour* *From receipt of order



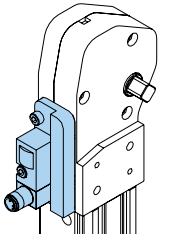
Axxx - Arm Option Location



M001 - Mounting Option



SWxx - Switch Slot Location



PSxx - Standard
PRxx - Reversed
Position Sensing

TO ORDER SPECIFY:
Model, Clamp Size, Bore Size, Output Shaft, Design No., Arm Rotation, and additional options if desired.

MOUNTING OPTIONS
BLANK - Standard, Side mounting with metric threads and dowel pin holes
M001 - Flange mounting cylinder body (Available on PEC34 only)

CYLINDER SWITCH OPTION
BLANK - None
SW41 - 1 NPN Switch Installed
SW42 - 2 NPN Switches Installed
SW51 - 1 PNP Switch Installed
SW52 - 2 PNP Switches Installed

CLAMP SIZE
3

OUTPUT SHAFT
D - Double
L - Left
R - Right

ARM ROTATION (degrees)
105° - Standard

ARM OPTIONS
BLANK - None

PORT LOCATION
BLANK is Standard Position 1
P2 - Position 2
P3 - Position 3
P4 - Position 4
P2 & P4 available on PEC33 units only.

SPEED REDUCER
BLANK - None
SR27 - Fitting for PEC33
SR36 - Fitting for PEC34

POSITIONAL SENSING
BLANK - None

SEAL OPTION
BLANK - Standard
V4 - Harsh Environment

PEC 34 D - 1 - 105 - A L 0 01 - P3 - LAA - SR36 - M001 - PS1D1 - SW42 - V4

MODEL

BORE SIZE
3 - 32 mm
4 - 40 mm

DESIGN NO.
1 - Imperial
5 - Metric

SHAPE/LOCATION
D - Straight, Both Sides
L - Straight, Left
R - Straight, Right
U - U-Style, Centered

ORIENTATION
0 - 0° Clamp
9 - 90° Clamp

MOUNTING STYLE
00 - Blank
01 - Standard Mounting

PORT FITTINGS (BOTH PORTS)
BLANK - None
LAA - 90° Swivel Elbow, Metal
LBB - 90° Swivel Elbow, Plastic

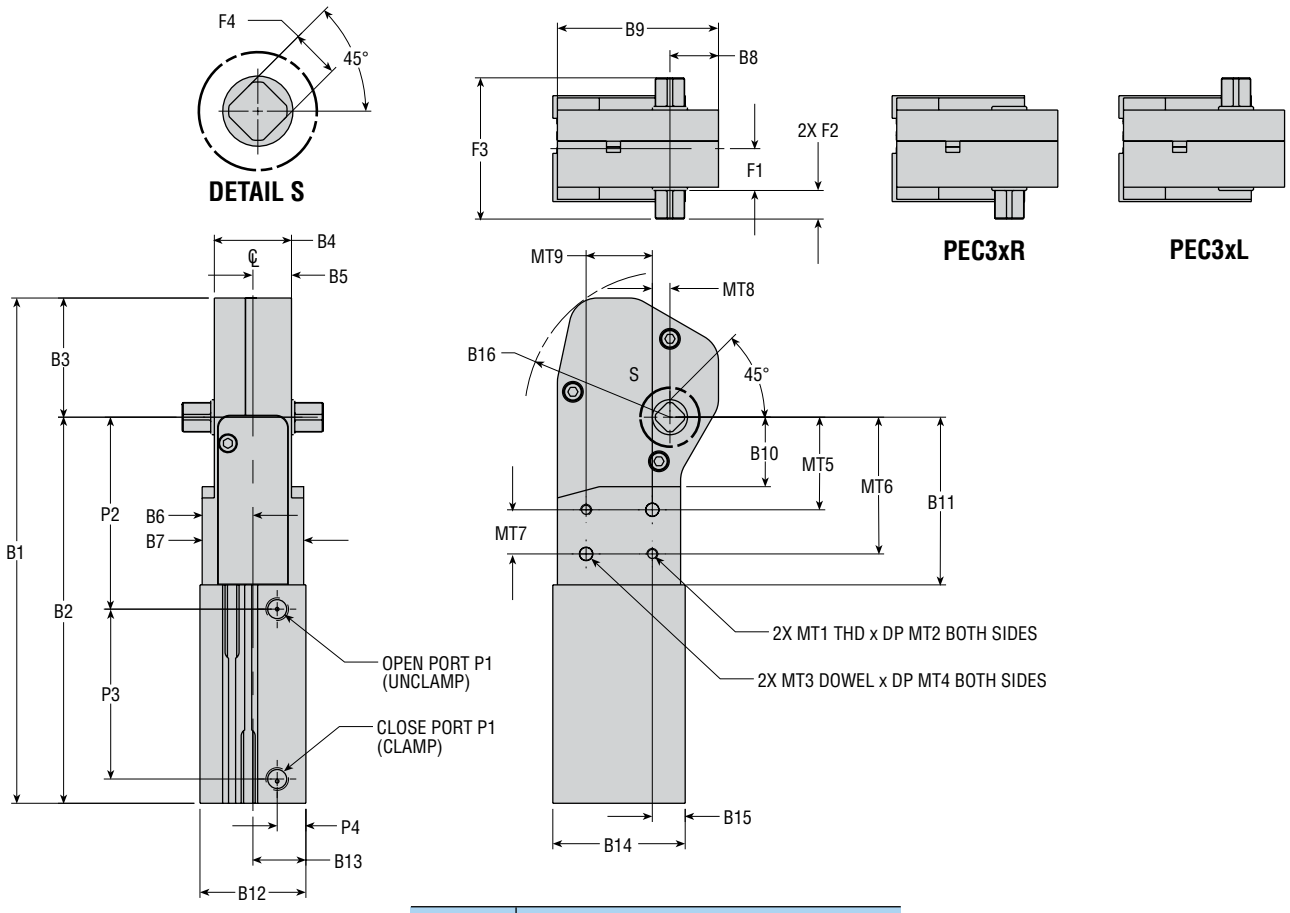
SENSING OPTION
S - Standard
R - Reversed

SWITCH HOUSING POSITION
1 - Position 1

CONNECTOR POSITION
1 - Parallel to output shaft
9 - Perpendicular to output shaft

SWITCH OPTION
N - No Switch
A - 5-pin AC/DC Switch
D - 4-pin PNP DC Switch (P + F)
E - 4-pin PNP DC Switch (Turck)
F - 4-pin PNP DC Switch (Efector)
H - 4-pin NPN DC Switch (P + F)
J - 4-pin NPN DC Switch (Turck)

NOTES:
1) All units are standard with magnet in cylinder except units with -V4 option.
2) Arm locations L and R must be ordered the same as output shaft option.
3) Switch connector position 9 is not available with switch option A.
4) Model PEC3xD must be ordered for -AUxxx arm options.



LETTER DIM	MODEL NUMBER			
	PEC33D		PEC34D	
	in	mm	in	mm
B1	9.015	229.0	9.015	229.0
B2	6.889	175.0	6.889	175.0
B3	2.126	54.0	2.126	54.0
B4	1.377	35.0	1.377	35.0
B5	.689	17.5	.689	17.5
B6	.905	23.0	.905	23.0
B7	1.811	46.0	1.811	46.0
B8	.866	22.0	.866	22.0
B9	2.874	73.0	2.874	73.0
B10	1.240	31.5	1.240	31.5
B11	2.992	76.0	2.992	76.0
B12	1.870	47.5	1.890	48.0
B13	.935	23.7	.945	24.0
B14	2.037	51.7	2.362	60.0
B15	.341	8.7	.587	14.9
B16	2.598	66.0	2.598	66.0
F1	.747	19.0	.747	19.0
F2	.510	13.0	.510	13.0
F3	2.520	64.0	2.520	64.0
F4	.432	11.0	.432	11.0
MT1	M5 x 0.8		M5 x 0.8	
MT2	.394	10.0	.394	10.0
MT3	6 mm SLIP FIT		6 mm SLIP FIT	
MT4	.236	6.0	.236	6.0
MT5	1.653	42.0	1.653	42.0
MT6	2.440	62.0	2.440	62.0
MT7	.787	20.0	.787	20.0
MT8	.315	8.0	.315	8.0
MT9	1.181	30.0	1.181	30.0
P1	1/8 NPT	1/8 BSPP	1/8 NPT	1/8 BSPP
P2	3.367	85.5	3.425	87.0
P3	3.147	79.9	3.031	77.0
P4	.610	15.5	.512	13.0

All dimensions are reference only unless specifically toleranced.

SPECIFICATIONS	SERIES PEC
SEALS	Carboxilated Nitrile, compression type
WORKING PRESSURE	40 psi min. - 100 psi max.
OPERATING TEMPERATURE	-20° to +180° F [-28° to +82° C]
LUBRICATION	Factory lubricated for life

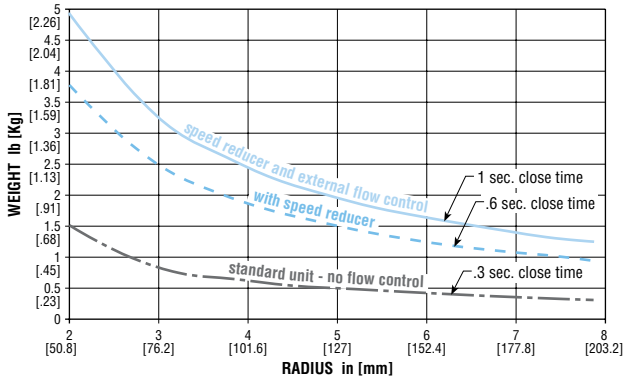
SPECIFICATIONS

MODEL SIZE	BORE mm	CLAMP TORQUE 87 psi [6 bar] in-lb	CLAMP TORQUE 87 psi [6 bar] Nm	MAX. HOLDING TORQUE in-lb	MAX. HOLDING TORQUE Nm	CLOSE OR OPEN TIME sec	DISPLACEMENT CLOSE in^3	DISPLACEMENT CLOSE cm^3	DISPLACEMENT OPEN in^3	DISPLACEMENT OPEN cm^3	WEIGHT lb	WEIGHT Kg	TYPICAL BACKLASH	MIN. VALVE RATING Cv
PEC33	32	225	25	1593	180	0.3	3.22	52.8	2.41	39.5	3.2	1.45	1° ± .5°	.08
PEC34	40	400	45	1593	180	0.3	5.03	82.4	4.22	69.2	3.5	1.59	1° ± .5°	.13

MAX. MOMENT OF INERTIA

SPEED REDUCTION STYLE	CYCLE TIME EXT OR RET sec	MAX. MOMENT OF INERTIA (Jm) in-lb-sec²	MAX. MOMENT OF INERTIA (Jm) N-m-sec²
STD PORTS	.3	.031	.00349
SR27 / SR36	.6	.095	.01069
FLOW CONTROL	1.0	.127	.01429

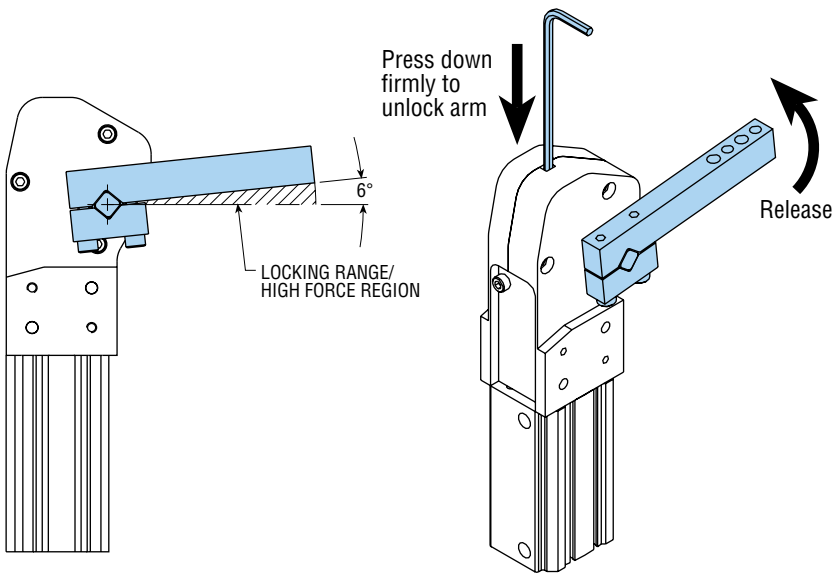
MAX. MOMENT



LOCKING MECHANISM

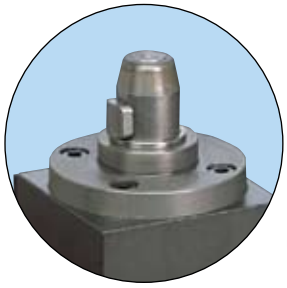
The Series PEC Clamp incorporates a cam/roller locking mechanism that prevents the arm from opening if air pressure is lost. The lock works in a range of 6 degrees from the fully closed position.

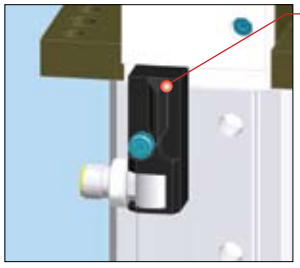
To manually unlock the clamp, first remove air pressure, then insert a small screwdriver or hex wrench (approximately 4 mm) through the slit in the lock release cover. Press down firmly and move the cam approximately 1 inch to get it out of the locking area. The lock release cover is made of a durable urethane material that will reclose and form a dust cover once the screwdriver or hex wrench is removed.



PLK

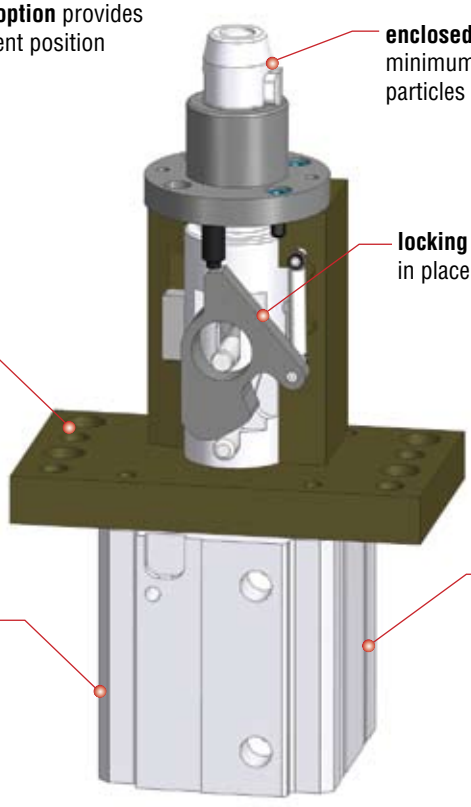
IDEAL FOR PART CLAMPING IN WELD AREAS





weld field immune switch option provides consistent position sensing

enclosed finger provides minimum opening for metal particles and weld slag to enter



locking mechanism holds panels in place if pressure is lost

NAAMS™ mounting hole pattern allows convenient mounting with shims and L blocks

cylinder mounted switches provide a low cost solution for position sensing

long life seals can withstand dirt and H_2O present in shop air

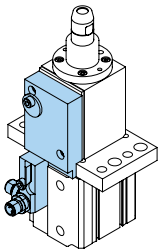
PLK

Major Benefits

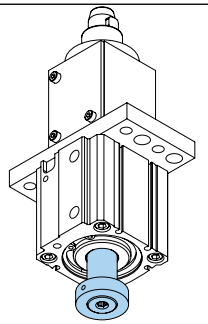
- Completely enclosed finger/pin
- Available in pin diameters from 12.5 to 24.5 mm diameter
- 5 or 10 mm clamping stroke
- NAAMS™ mounting
- Short pin length for blind applications
- Position sensing provides open or closed sensing with industry standard AC or DC weld field immune switch mounted in a protected housing
- Self-locking internal threads throughout eliminate need for thread locking adhesives or additional locking components

Industry Uses

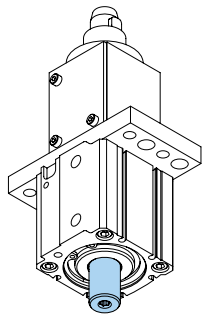
- Automotive Assembly and Welding



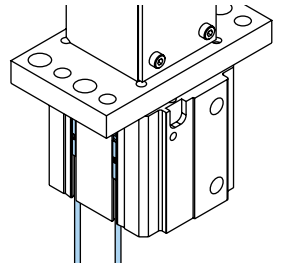
PSxxx - Standard
PRxxx - Reversed
Position Sensing



R01 - Sensor Flag



R02 - Double Rod



SWxx - Switch Locations

UNIT SIZE & CLAMP STROKE
505 - 50 mm Bore
5 mm Clamp Stroke
510 - 50 mm Bore
10 mm Clamp Stroke

DESIGN NO.
1 - Imperial
5 - Metric

MATERIAL THICKNESS LOCK ADJUSTMENT (See Note 1)
MT07 - (0.7 mm) .027 in
MT10 - (1.0 mm) .039 in
MT20 - (2.0 mm) .078 in

PORT POSITION
BLANK - (PP1) Standard Position 1
PP2 - Position 2
PP3 - Position 3
PP4 - Position 4
Ports in Position 1 required for PS/PRxxx.

SWITCH OPTIONS
BLANK - No Sensor
Pxxxx - Position Sensor (See Position Sensor Option Code)

CYLINDER SWITCH OPTION
BLANK - No Magnet (see Note 2)
SW00 - Magnet for Switches Installed
SW41 - 1 NPN Switch Installed
SW42 - 2 NPN Switches Installed
SW51 - 1 PNP Switch Installed
SW52 - 2 PNP Switches Installed

PLK 505 - 1 - 1850B - MT07 - [ ] - [ ] - LAA - PS1D9 - R01 - SW00

MODEL

PIN SIZE/STYLE
1250B - 12.50 mm dia. Pin with -.05 mm Tolerance
1550B - 15.50 mm dia. Pin with -.05 mm Tolerance
1850B - 18.50 mm dia. Pin with -.05 mm Tolerance
2450B - 24.50 mm dia. Pin with -.05 mm Tolerance

FINGER DIRECTION
BLANK - Standard Position (FD4)
FD2 - Position 2

PORT FITTINGS (BOTH PORTS)
BLANK - No Fittings
LAA - 90° Swivel Elbow, Metal
LBB - 90° Swivel Elbow, Plastic

MISCELLANEOUS OPTIONS
BLANK - None
R01 - Sensor Flag
R02 - Double Rod

NOTES:
1) a. Lock may be preset at factory for material thickness in .004 in [0.1 mm] increments.
   b. Lock range is from 0 to .156 in [0 to 4.0 mm].
   c. If MT section is left blank, clamp will be set for 1 mm material thickness.
2) Magnet will be installed if cylinder switches are ordered.
3) Metric units have metric ports, imperial units have imperial ports.

POSITION SENSOR OPTION CODE

-P S 1 D 9

SENSING OPTION
S - Standard
R - Reversed

HOUSING OPTION
P - Positional Sensing

SWITCH HOUSING POSITION
1 - Position 1

CONNECTOR POSITION
1 - Parallel to fingers
9 - Perpendicular to fingers

SWITCH OPTION
N - No Switch
A - 5-pin AC/DC Switch
D - 4-pin PNP DC Switch (P + F)
E - 4-pin PNP DC Switch (Turck)
F - 4-pin PNP DC Switch (Efector)
H - 4-pin NPN DC Switch (P + F)
J - 4-pin NPN DC Switch (Turck)

SPECIFICATIONS	SERIES PLK
SEALS	Polyurethane
OPERATING TEMPERATURE	-20° to +180°F [-28° to +82°C]
LUBRICATION	Factory lubricated for life

SPECIFICATIONS

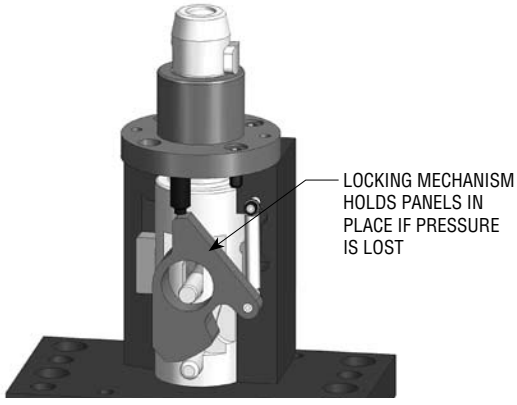
MODEL	UNIT WEIGHT lb	UNIT WEIGHT kg	CLAMP FORCE 87 psi [6 bar] lb	CLAMP FORCE 87 psi [6 bar] N	CLAMP FORCE FACTOR Cf imperial	CLAMP FORCE FACTOR Cf metric	CLOSE OR OPEN TIME 87 psi [6 bar] sec	DISPLACEMENT CLOSE in^3	DISPLACEMENT CLOSE cm^3	DISPLACEMENT OPEN in^3	DISPLACEMENT OPEN cm^3
PLK5xx-x-1250B	4.0	1.81	223	991	2.56	165	0.5	2.47	40.5	2.95	48.3
PLK5xx-x-1550B	4.0	1.81	223	991	2.56	165	0.5	2.47	40.5	2.95	48.3
PLK5xx-x-1850B	4.2	1.91	223	991	2.56	165	0.5	2.47	40.5	2.95	48.3
PLK5xx-x-2450B	4.5	2.04	223	991	2.56	165	0.5	2.47	40.5	2.95	48.3

MTxx MATERIAL THICKNESS ADJUSTMENT

Provides the clamp with the adjustable lock already set for the maximum material thickness for the application. Specify the thickest material including tolerances and add .02 inches [.5 mm] for clearance.

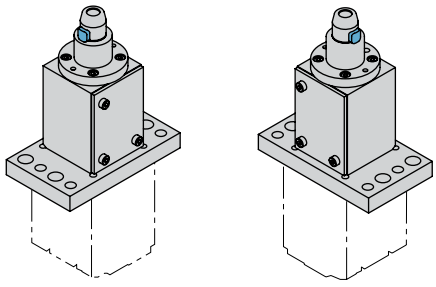
Example: 1 mm material with a tolerance of ± 0.1 mm plus 0.5 mm clearance = 1.6 mm

Specify MT16 and the clamp will arrive preset to lock at that material thickness. The sequenced design prevents the finger from retracting until the pin is fully extended. The part can move the amount of clearance between the lock bracket and adjustment screw, but the extended finger keeps the part trapped securely on the pin.



FDx FINGER DIRECTION

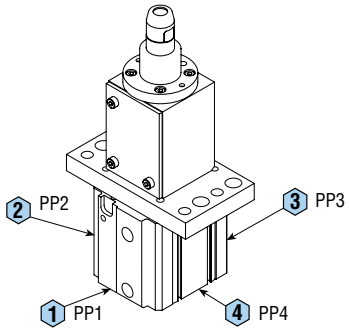
Provides alternate finger directions for flexibility and customer convenience.

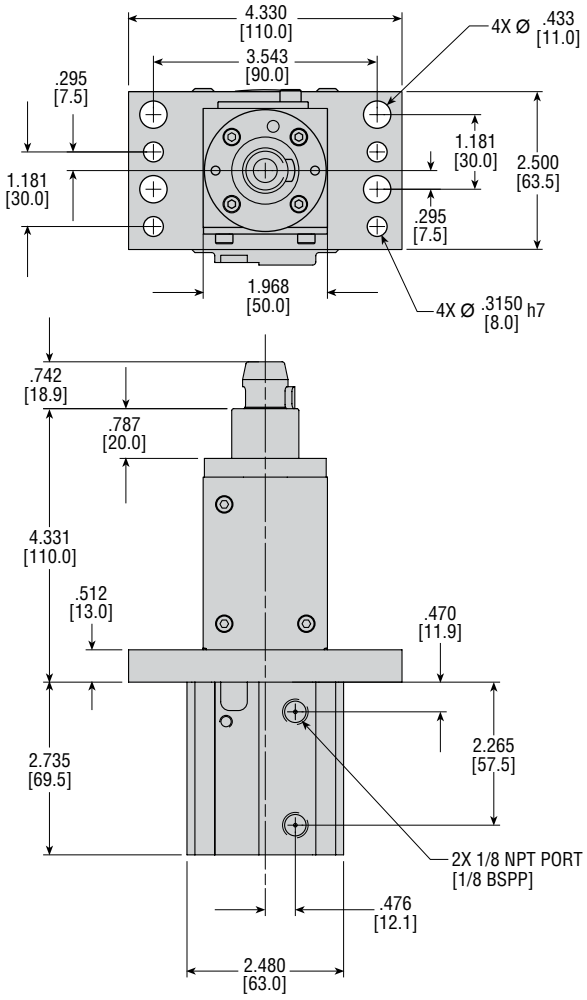


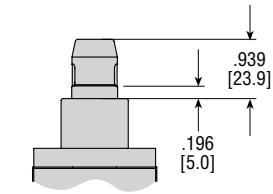
FD2 FD4 (STANDARD)

PPx PORT LOCATION

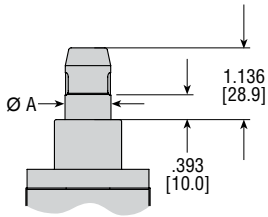
Provides alternate port locations for the cylinder providing flexibility and customer convenience.



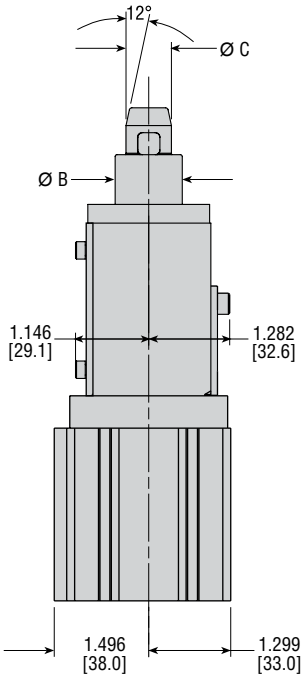


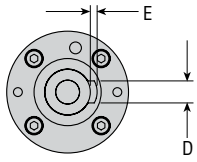


PLK505 EXTENDED



PLK510 EXTENDED





NOTE: CLAMP SHOWN RETRACTED

DIMENSION	MODEL NUMBER							
	PLK5xx-x-1250B		PLK5xx-x-1550B		PLK5xx-x-1850B		PLK5xx-x-2450B	
	in	mm	in	mm	in	mm	in	mm
A MAX	.4921	12.50	.6102	15.50	.7283	18.50	.9646	24.50
A MIN	.4902	12.45	.6083	15.45	.7264	18.45	.9626	24.45
B	.984	25.00	.984	25.00	1.063	27.00	1.378	35.00
C	.4829	12.27	.6010	15.27	.7191	18.27	.9553	24.26
D	.239	6.07	.349	8.86	.349	8.86	.349	8.86
E	.075	1.91	.108	2.75	.108	2.75	.108	2.75

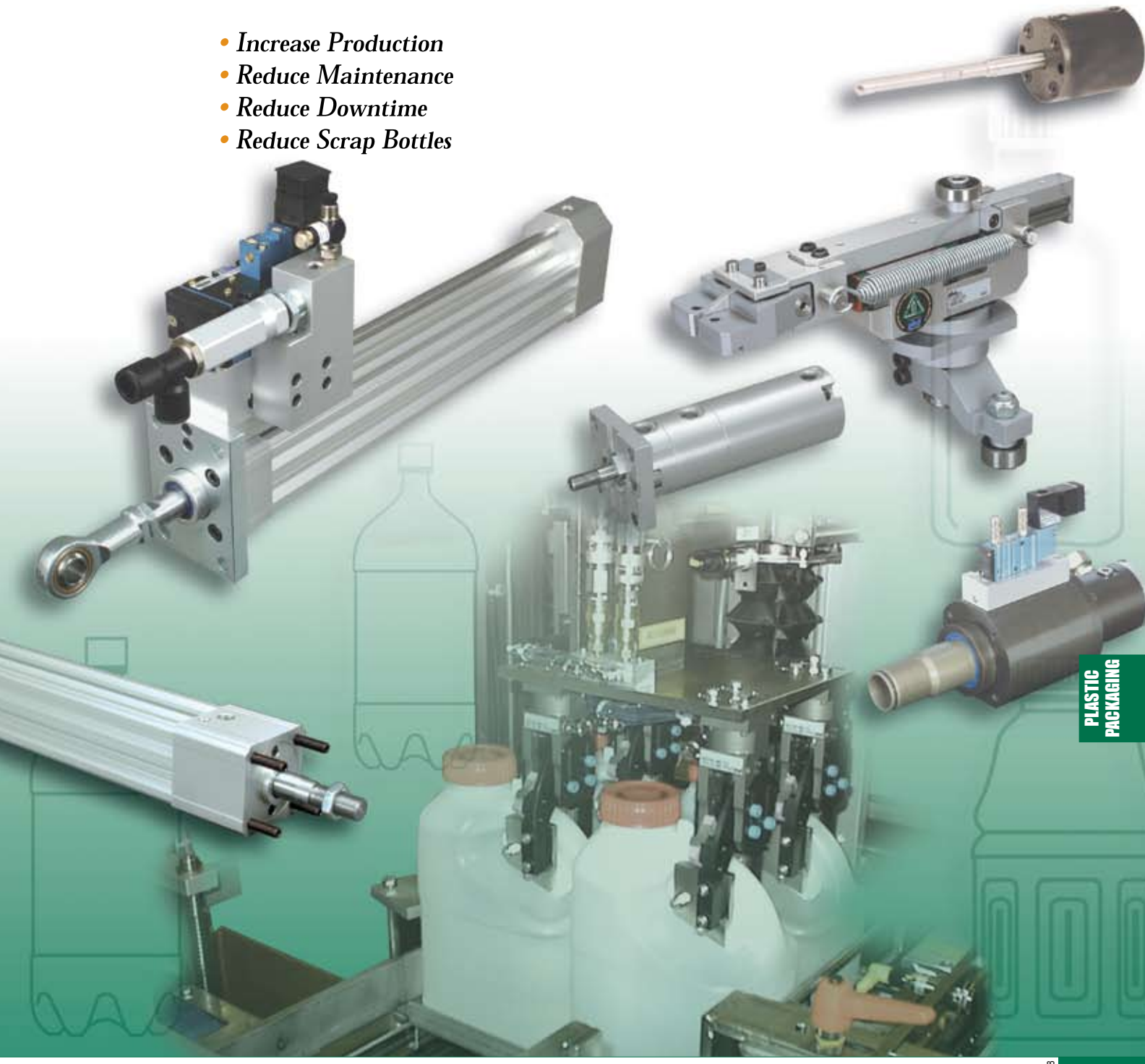
All dimensions are reference only unless specifically toleranced.

Proven!

Blow Molding Solutions

Injection Stretch and Extrusion

- *Increase Production*
- *Reduce Maintenance*
- *Reduce Downtime*
- *Reduce Scrap Bottles*



We have the solutions for your processes.

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Stretch Rod Cylinders-Series BCS

- Direct interface with your equipment
- Longer life
- Extended cushions
- Quiet operation
- Valve manifold assembled to cylinder available as standard

Nozzle Cylinders-Series BCZ

- Direct replacement
- Longer life
- Easy and fast repairs
- Internal shock pads eliminate metal-to-metal contact
- Valve manifold assembled to cylinder available as standard

Transfer Arms-Series BST

- Designed to operate for 20 million cycles
- Lighter in overall weight than competitor's unit
- Reduce maintenance and downtime
- Greater rigidity for more accurate preform and bottle placement

Order your PPC Binder, containing literature specific to the Plastic Bottle Blowing Industry at www.phdinc.com/.....

Needle Cylinders

- 2 & 3 port external mold design
- Numerous needle configurations, specials available
- Rotating and adjustable non-rotating needle option available
- Long life
- Low noise
- High flow rates
- High speed operation
- Drop-in for Graham Wheels

PLASTIC PACKAGING

Reduce Scrap

Plastic Packaging Components

Blow Molding Solutions

Series1 Pneumatic Nozzle Cylinder

Series1 Preform/ Bottle Eject

Mold Base Cylinder

Krones® Stretch Rod Cylinder

Stretch Rod & Drag Cylinders

- Directly interface on Krupps (SIG), Blowmax® machinery, Krones®
- Long life
- Factory lubricated for life
- Rebuildable
- Lower cost

Labeling & Slide Knife Actuators

- High speed
- Low profile
- Compact long travel actuators
- Precise placement
- Perfect for high speed marking and in-mold labeling applications

Filler Cylinders

- Directly interface on Krones® filling machinery
- Long life
- High precision
- Rebuildable

Packaging & Palletizing

Numerous actuators for carton filling and packaging

- Grippers
- Slides
- Clamps
- Rotaries
- Cylinders

Knock Out Cylinders & Removal Cylinders/Grippers

- Long life
- Rebuildable
- Drop in replacement
- Non-rotating
- Adjustable blade positions
- Built to length
- Customized gripper to move bottles by the tail and place them into the next process

Leak Tester Cylinders

- Long life units
- Factory lubricated for life
- Rebuildable
- Drop in replacement
- Switches available

Factory Repair & Remanufacturing available for all cylinder models. Drop-in replacement cylinders for:

- ✔ Sidel® (Series1, Series2, and Universal)
- ✔ Krones®
- ✔ SIG® (Krupp)
- ✔ Nissei® ASB
- ✔ Bekum®
- ✔ AOKI®
- ✔ Graham®
- ✔ Uniloy®
- ✔ Jomar®
- ✔ Others

Increase Production

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This dedicated division is focused totally on the specific needs of the plastic packaging industry —

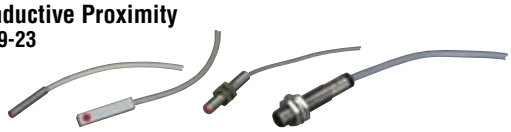
We speak your language.

We have standard component stretch rod, nozzle and needle cylinders, transfer arms, and replacement bushings. With increasing numbers of actuators in many parts of the world, PHD Plastic Packaging Components are the actuators of choice to keep your blow molding lines running while increasing productivity and reducing downtime and scrap.

PHD also offers a complete line of pneumatic and hydraulic cylinders, escapements, grippers, slides, rotary actuators, clamps, multi-motion actuators, and proximity switches which can be combined or used individually to provide the motion your downstream application requires. With millions of component variations, we can help pick, place, twist, turn, lift, grip, reach, rotate, inject, and clamp what you need to increase your productivity.

If an application requires a modified component, our Plastic Packaging Components team is ready to help. We welcome special requests for unique products, regardless of quantity or frequency of order. PHD and our local MDN partner will work closely with you to find a solution to your application needs.

The products, supported by our strong commitment to delivery and service, have made us a leader in industrial automation.

SERIES		FOR USE WITH SERIES:	TYPE	MAJOR BENEFIT
5360 page 9-6		RA, RL, 160, LC, 5300, GRC	HALL	Solid State, providing long switch life and elimination of contact bounce. Operates on DC current only.
		RA, RL	REED	Available in AC or DC models. Special current-limit model available (AC). Ideal for input to sequencers and programmable controllers.
		RA, RL	SOLID STATE	Designed specifically to provide an input signal to controllers or logic systems. Solid State for an infinite number of trouble-free operations. DC only.
6250 page 9-12		CV, RA, RL SK, SL, SG, SCV	REED	Offer 120 VAC or 10 to 30 VDC sink and source for maximum flexibility. Integral clamp mounting for easy adjustment, no need for brackets or hardware. IP67 environmental protection.
		CV, RA, RL SK, SL, SG, SCV	SOLID STATE	Available in both current sink or source for maximum flexibility. "MR" switch prevents spikes, abuse, and adverse reactions.
1750 page 9-16		AV, HV, NP, 1-8000 Rotary Actuator, 1-8000 MMA, SD, SE, SG, SK/SL Size 1	REED	Available for most Tom Thumb and PHD products for simple interfacing. Compact low profile saves space and provides mounting versatility. 10-30 VDC or 110-120 VAC models.
		AV, HV, NP, 1-8000 Rotary Actuator, 1-8000 MMA, SD, SE, SG, SK/SL Size 1	SOLID STATE	Excellent switch hysteresis characteristics and symmetry. 10-30 VDC current sinking and sourcing. Compact low profile switch attaches securely across tie rods for easy adjustment.
5580 page 9-19		GRW, RF, GRF Size 19, GRD, 190, 191, GRL, LC Size 10	HALL	To be used on most Tom Thumb/PHD products. IEC IP67 rating. Solid State for long life. Suitable for use in plant environments conducive to difficulties for electomechanical and other types of controls. Reverse voltage protection built in.
		RF, GRD, 190, 191	REED	To be used on most Tom Thumb/PHD products. IEC IP67 rating. Adjustable mounting for versatility. LED provides convenient means for positioning and troubleshooting. AC or DC service.
6790 page 9-21		GRF, GRS, RCC, RI, SHP, STP, SIP, SMx, SxL, SxH, GRB, CRS, CTS, SFP, SFM	REED	4.5-30 VDC and 65-120 VAC models for simple interfacing to sequencers and programmable controllers.
		GRF, GRS, RCC, RI, SxL, SxH, SHP, STP, SIP, SMx, GRB, CRS, CTS, SFP, SFM	SOLID STATE	Space saving, mounting versatility, fits into grooves in the body of the actuator. Protects against voltage surges and other anomalies. Excellent switch hysteresis characteristics and symmetry. 4.5-30 VDC sink and source.
DC Inductive Proximity page 9-23		SD, SE, SK, SL, SG, GRS, GRW, GRC, GRD GRT, 190, 191, 8400	SOLID STATE	High reliability, ease of mounting, and suitable for plant environments that are conducive to creating difficulties for electromechanical and other types of switches.
62002 page 9-24		GRC	REED	High reliability, ease of mounting, and suitable for plant environments that are conducive to creating difficulties for electromechanical and other types of switches. 4.5 - 24 VDC.
Sensor/Set Point Module page 9-25		1-8000 Rotary Actuator, 1-8000 MMA, 8400, 8600, 5300, 190, 191	SOLID STATE	Solid State electronics with Hall Effect sensing technology. Provides independent and fully adjustable multiple position sensing. Wide signal range capability.
NFPA Brackets page 9-30		Mount Series 1750 Switches to NFPA cylinder	BRACKET	Brackets to mount Series 1750 Switches to large bore NFPA Cylinders. Flexible design attaches bracket securely to a single tie and does not allow switch to pull away from cylinder barrel.

SWITCH SELECTION GUIDE

switches

product type

		SERIES 5360			SERIES 6250		SERIES 1750		SERIES 5580		SERIES 6790		INDUCTIVE PROXIMITY				SERIES 62002	PHD SENSR.
		(H)	(R)	(M)	(M)	(R)	(M)	(R)	(H)	(R)	(M)	(R)	4 mm RND.	6 mm SQ.	8 mm THRD.	12 mm THRD.	8 mm (R)	(S)
CYLINDERS	**A, AV, HV, EA, EL, NP, NE**						-E	-M										
	CRS										-M	-M						
	CT										-M	-M						
	CV				-M	-M												
ROTARY ACTUATORS	**1000-8000**						-E	-M										-J
	RA & RL	-E	-M	-I	-M	-M												
	RI, RCC										-M	-M						
	RF								(P)	(P)				(P)				
MULTI-MOTION ACTUATORS	**1000-8000**						-E	-M										-H (R)
SLIDES	**SCV**				-M	-M												
	SD, SE						-E	-M							(S)	(S)		
	SFM, SFP										-M	-M				(P)		
	SK, SL size 1				—	—	-E	-M							(P)			
	SK, SL size 2-6				-M	-M	—	—							(P)	(P)		
	SG size 1				—	—	-E	-M							-CB			
	SG size 2-6				-M	-M	—	—							-CB			
	SHP										-M	-M						
	STP										-M	-M						
	SIP										-M	-M						
	SMx										-M	-M			(P)			
	SxL, SxH										-M	-M						

(H) = HALL SWITCH
(S) = HALL SENSOR
(M) = MAGNETORESISTIVE/SOLID STATE SWITCH
(R) = REED SWITCH
(L) = LINEAR ONLY
(R) = ROTARY ONLY
(S) = COMPATIBLE WHEN ORDERED WITH SWITCH READY KIT
(P) = PROXIMITY KIT AVAILABLE
STD = STANDARD

Option code, kit, or specification must be specified on the unit ordering number when switches are to be used. For kit numbers or option callouts, see ordering data page in each specific product section. BLANK BOXES INDICATES NOT AVAILABLE OR NOT COMPATIBLE.

SWITCH SELECTION GUIDE

switches

product type

		SERIES 5360			SERIES 5580		SERIES 6790		INDUCTIVE PROXIMITY				SERIES 62002	PHD SENSR.
		(H)	(R)	(M)	(H)	(R)	(M)	(R)	4 mm RND.	6 mm SQ.	8 mm THRD.	12 mm THRD.	8 mm (R)	(H)
ESCAPEMENTS	**160** size 02-03	—	—	—					-2	-2				
	160 size 10-43	-1	—	—					—	—				
	LC size 10	—	—	—	-E	—			Ⓟ	Ⓟ				
	LC size 12-32	-E	—	—					Ⓟ	Ⓟ				
ANGULAR GRIPPERS	**8400**								-5 Ⓢ					-3
	8600 (3 Jaw)													-3 -4
	5300	-7	—	—										-4
	GRB (180°)						-M	-M	Ⓢ					
PARALLEL GRIPPERS	**GRD**				-2	-1			-6 Ⓢ		-7 Ⓢ	-8* Ⓢ		
	190 & 191				-5 Ⓢ					-5 Ⓢ				SENSOR OPTION -4
	5300	-7	—	—										
	GRC	-2	—	—					Ⓖ -5**		Ⓖ -5***	-6***	-3***	
	GRF size 19				-CU	—	—	—	—	-CU Ⓟ	—			
	GRF size 25-32				—	—	-CU	-CU	-CU Ⓟ	—	—			
	GRL				-E									
	GRR										Ⓟ	Ⓟ		
	GRS size 27-32						-CU	-CU	-CU Ⓟ					
	GRS size 50-63						-CU	-CU			-CU Ⓟ			
	GRT								Ⓟ -5		Ⓟ -5	Ⓟ		
	GRW				Ⓟ				Ⓟ		Ⓟ			

(H) = HALL SWITCH
(M) = MAGNETORESISTIVE/SOLID STATE SWITCH
(R) = REED SWITCH

(Ⓖ) = SHURGRIP MODEL
(Ⓢ) = COMPATIBLE WHEN ORDERED WITH SWITCH READY KIT

STD = STANDARD
(Ⓟ) = PROXIMITY KIT AVAILABLE

NOTES:
1) *=GRDx5x, GRDx6x only, **=GRCx3x only, ***=GRCx4x, x5x, x6x
2) Option code, kit, or specification must be specified on the unit ordering number when switches are to be used. For kit numbers or option callouts, see ordering data page in each specific product section. BLANK BOXES INDICATES NOT AVAILABLE OR NOT COMPATIBLE.
3) -4 option is Hall sensor ready.

CE
Most PHD switches are CE Certified.

PROXIMITY SWITCH SELECTION GUIDE

PHD Proximity Switches can be used with most PHD Cylinders and Actuators. They are used to supply input signals to programmable controllers, sequencers, relays, and in some cases, to drive valve solenoids.

Use the requirements in the chart below to determine which switch fits the application. By using the process of elimination, you should be able to choose the proper switch. See the specifications for each switch to confirm your choice.

PROXIMITY SWITCH SELECTION CHART

REQUIREMENTS	SERIES 5360				SERIES 6250		SERIES 1750			SERIES 5580		SERIES 6790		
	53603 53604 53623 53624 HALL	53605 53606 53625 53626 SOLID STATE	53602 53622 DC REED	53609 53629 AC REED	62505 62506 62515 62516 SOLID STATE	62507 62517 AC/DC REED	17503 17504 17523 17524 SOLID STATE	17502 17522 DC REED	17509 17529 AC REED	55803 55804 55823 55824 HALL	55802 55822 DC REED	67903 67904 67923 67924 SOLID STATE	67902 67922 DC REED	67929 AC REED
AC				●		●			●					●
DC	●	●	●		●	●	●	●		●	●	●	●	
MECHANICAL SWITCH			●	●		●		●	●		●		●	●
SOLID STATE SWITCH (ZERO BOUNCE)	●	●			●		●			●		●		
INPUT-PROGRAMMABLE CONTROLLER	●	●	●	●	●	●	●	●	●	●	●	●	●	●
COIL DIRECT														
LONGEST LIFE	●	●			●			●		●		●		
BUILT-IN TRANSIENT PROTECTION	●	●		●	●	●			●	●		●		●
HIGH MOISTURE ENVIRONMENT	●	●	●	●	●	●	●	●	●	●	●	●	●	●
CE CERTIFIED	●	●	●		●	●*	●	●		●	●	●	●	

*CE certification applicable to 10 to 30 VDC range only.

It is estimated that 95% of all PHD Switches are integrated with PLC's. The chart below serves as a guide in determining which categories of PHD Switches are compatible with the configuration of PLC being used.

PLC COMPATIBILITY CHART

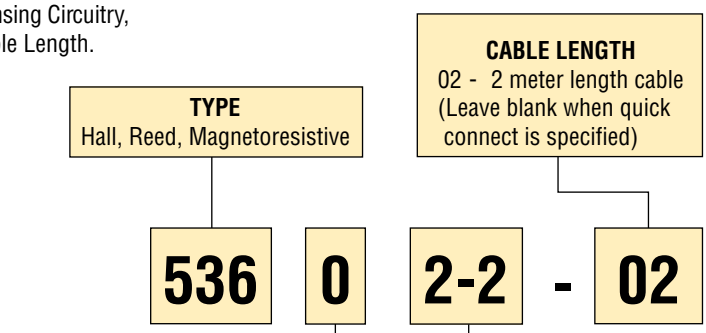
SWITCH TYPE	INPUT VOLTAGE TYPE REQUIRED		
	AC	DC	
	COMPATIBLE PHD AC SWITCHES	COMPATIBLE PHD DC NPN (SINK) SWITCHES	COMPATIBLE PHD DC PNP (SOURCE) SWITCHES
MECHANICAL REED	1750, 5360, 61065, & 6250	1750, 5360, 5580, 61065, 62002, 6250 & 6790	1750, 5360, 5580, 61065, 62002, 6250, & 6790
SOLID STATE	—	5360, 6250 & 6790	5360, 6250, & 6790
HALL EFFECT	—	1750, 5360, & 5580	1750, 5360, & 5580
INDUCTIVE PROXIMITY	15561	18430, 18431, 51422, & 15661	18430, 18431, 51422, & 15561
HALL SENSOR WITH SET POINT MODULE	—	9800-01-0100 & 0300	9800-01-0200 & 0400

NOTE: Not all types of switches are available on all PHD products. Reference charts on previous pages to determine compatibility with product being used.

PROXIMITY SWITCH SELECTION CHART

SERIES 18430	SERIES 18431	SERIES 51422	SERIES 62002	SERIES 15561	
				12 mm ROUND INDUCTIVE PROXIMITY	
4 mm ROUND INDUCTIVE PROXIMITY	6 mm SQUARE INDUCTIVE PROXIMITY	8 mm ROUND INDUCTIVE PROXIMITY	8 mm ROUND THREADED 62002 REED	15561-001 15561-002 DC	15561-003 AC
					●
●	●	●	●	●	
			●		
●	●	●		●	●
●	●	●	●	●	●
●	●	●		●	●
●	●	●		●	●
●	●	●	●	●	●
●	●	●	●	●	●

TO ORDER SPECIFY:
Type, Cord Type, Sensing Circuitry, Design No., and Cable Length.



SENSING CIRCUITRY	DESCRIPTION	SWITCH COLOR
2-2	NPN or PNP DC Reed	White
3-1	NPN DC Hall	Yellow
4-1	PNP DC Hall	Red
5-1	NPN DC Solid State	Black
6-1	PNP DC Solid State	Orange
9-2	AC Reed w/Current Limiting	Green

NOTES:
1) Cordsets for quick connect switches must be ordered separately.
2) Other cable lengths available. Consult PHD.

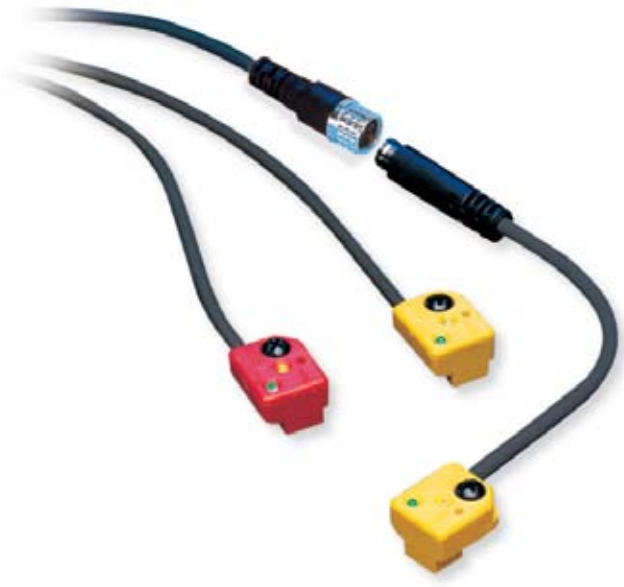
CORDSETS WITH QUICK CONNECT

PART NO.	LENGTH
63549-02	2 meter
63549-05	5 meter

BENEFITS

- Series 5360 Hall Effect Switches are available for use on selected PHD products, making it easy to interface these actuators with various electronic controls.
- Switches have no moving parts or mechanical contacts, providing long switch life and elimination of contact bounce.
- Constant amplitude output is provided for use with most digital logic systems.
- Low profile integral clamp mounting is easy to adjust over the entire piston travel of the cylinder or actuator.
- Several switches may be mounted to control or initiate any sequence or function.
- Dual LED indicators provide convenient means for positioning and troubleshooting circuits. Green LED shows that power is being received at the switch and amber shows when the switch output is on.
- Available in a Quick Connect model for easy installation and maintenance.

Series 5360 Hall Effect Switches are designed specifically to provide an input signal to various types of programmable controllers or logic systems. Since Hall Effect Switches are solid-state, there are no moving parts to wear out. They offer an infinite number of trouble-free operations. Hall Effect Switches operate on DC current only.

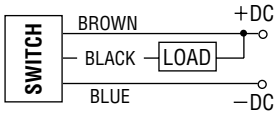


SPECIFICATIONS	53603 & 53623	53604 & 53624
OPERATING PRINCIPLE	Hall Effect	
ACTUATED BY	Moving Magnet	
INPUT VOLTAGE	4.5 to 24 VDC	
OUTPUT TYPE	NPN (Sink)	PNP (Source)
CURRENT RATING	20 mA. Max.	100 mA. Max.
VOLTAGE DROP	.5 VDC Max.	
SWITCH BURDEN	12 mA. Max.	
ENVIRONMENTAL	IP67	
OPERATING TEMP.	0° to 80°C	

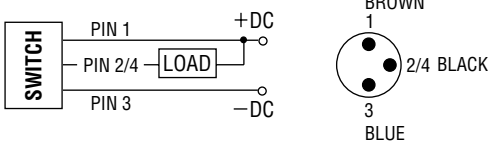
HALL EFFECT WIRING SCHEMATICS

MODEL NO. 53603 & 53623 - NPN (SINK)
INPUT - 4.5-24 VDC
LOAD CURRENT - 20 mA. MAX.
SWITCH HOUSING COLOR - YELLOW
(LED's have been omitted from the schematic for clarity.)

CABLED MODEL 53603

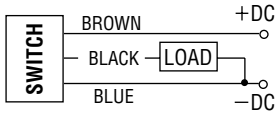


QUICK CONNECT MODEL 53623

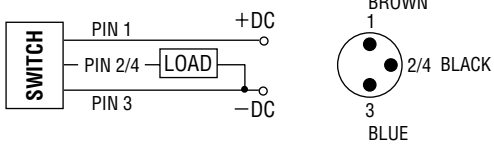


MODEL NO. 53604 & 53624 - PNP (SOURCE)
INPUT - 4.5-24 VDC
LOAD CURRENT - 100 mA. MAX.
SWITCH HOUSING COLOR - RED
(LED's have been omitted from the schematic for clarity.)

CABLED MODEL 53604



QUICK CONNECT MODEL 53624



BENEFITS

- Series 5360 Solid State Switches are available for use on selected PHD products, making it easy to interface these actuators with various electronic controls.
- Switches are solid state, having no moving parts or mechanical contacts, providing long switch life and elimination of contact bounce.
- Transient voltage protection.
- Constant amplitude output is provided for use with most digital logic systems.
- Reverse polarity protection.
- Low profile integral clamp mounting is easy to adjust over the entire piston travel of the cylinder or actuator.
- Several switches may be mounted to control or initiate any sequence or function.
- Dual LED indicators provide convenient means for positioning and troubleshooting circuits. Green LED shows that power is being received at the switch and amber shows when the switch output is on.
- Available in a Quick Connect model for easy installation and maintenance.

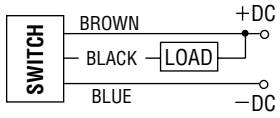
Series 5360 Solid State Switches are designed specifically to provide an input signal to various types of programmable controllers or logic systems. Since Solid State Switches have no moving parts to wear out, they offer an infinite number of trouble-free operations. Solid State Switches operate on DC current only.

SPECIFICATIONS	53605 & 53625	53606 & 53626
OPERATING PRINCIPLE	Solid State	
ACTUATED BY	Moving Magnet	
INPUT VOLTAGE	6 to 24 VDC Max.	
OUTPUT TYPE	NPN (Sink)	PNP (Source)
CURRENT RATING	20 mA. Max.	100 mA. Max.
VOLTAGE DROP	.5 VDC Max.	
SWITCH BURDEN	12 mA. Max.	
ENVIRONMENTAL	IP67*	
OPERATING TEMP.	0° to 80°C	

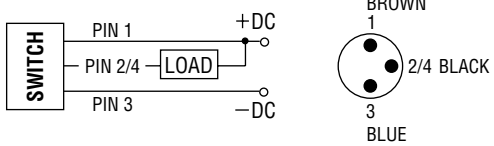
SOLID STATE WIRING SCHEMATICS

MODEL NO. 53605 & 53625 - NPN (SINK)
INPUT - 6-24 VDC
LOAD CURRENT - 20 mA. MAX.
SWITCH HOUSING COLOR - BLACK
(LED's have been omitted from the schematic for clarity.)

CABLED MODEL 53605

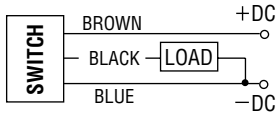


QUICK CONNECT MODEL 53625

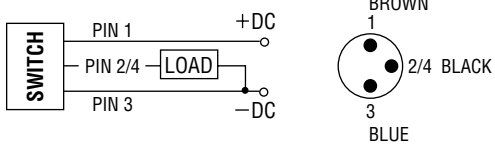


MODEL NO. 53606 & 53626 - PNP (SOURCE)
INPUT - 6-24 VDC
LOAD CURRENT - 100 mA. MAX.
SWITCH HOUSING COLOR - ORANGE
(LED's have been omitted from the schematic for clarity.)

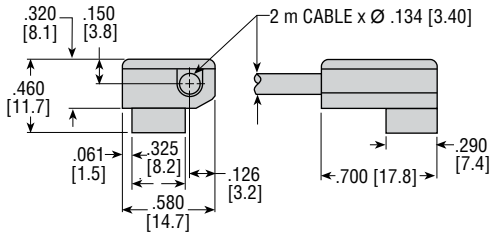
CABLED MODEL 53606



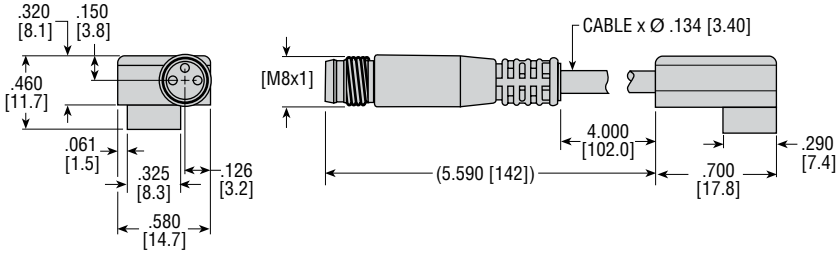
QUICK CONNECT MODEL 53626



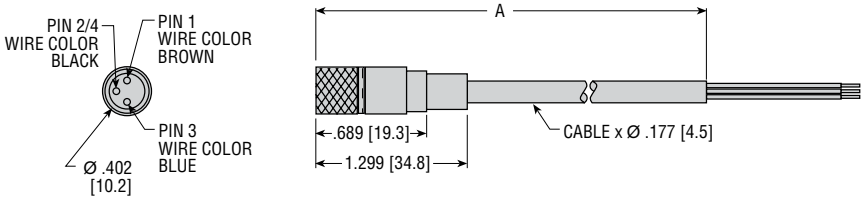
HALL EFFECT AND SOLID STATE SWITCH



HALL EFFECT AND SOLID STATE SWITCH WITH MALE QUICK CONNECT



63549-xx CORDSET WITH FEMALE QUICK CONNECT



MODEL NO.	LETTER DIM. A
63549-02	78.74 [2 m]
63549-05	196.85 [5 m]

NUMBERS IN [ ] ARE IN mm–IMPERIAL EQUIVALENTS ARE PROVIDED FOR CONVENIENCE

BENEFITS: SERIES 5360 REED SWITCHES

BENEFITS

- Series 5360 Reed Switches are available for use on selected PHD products, making it easy to interface these actuators with various electronic controls.
- Low profile integral clamp mounting is easy to adjust over the entire piston travel of the cylinder or actuator.
- Several switches may be mounted to control or initiate any sequence or function.
- An LED indicator provides convenient means for positioning and troubleshooting circuits.
- Available in a Quick Connect model for easy installation and maintenance.
- Special current limit model available for AC applications where inrush might otherwise damage the switch.

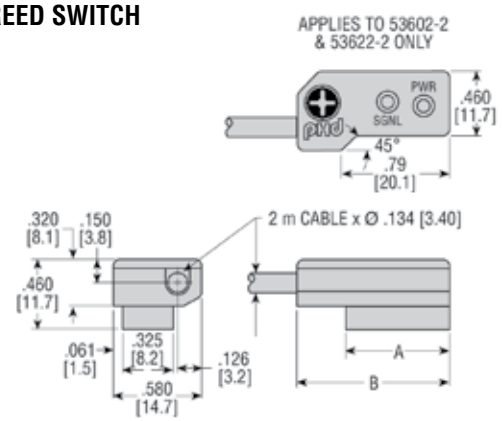
Series 5360 Reed Switches are available in either AC or DC models. They are ideal for use as inputs for many types of sequencers and programmable controllers. In some cases, they can be used to drive some relays or valve solenoids. However, electrical transients (inrush currents or line spikes) associated with inductive or capacitive loads can damage and shorten the life of the switch.

SPECIFICATIONS	53602-2 & 53622-2	53609-2* & 53629-2*
OPERATING PRINCIPLE	Magnetic Reed	
ACTUATED BY	Moving Magnet	
INPUT VOLTAGE	4.5 to 24 VDC	110 to 120 VAC
OUTPUT TYPE	Contact Closure	
POWER CAPACITY	4 Watt Max.	2.5 Watt Max.
CURRENT RATING	200 mA. Max.	Inter. Limited to 20 mA.
CONTACT RESISTANCE	.200 Ohms Max.	1.5 kOhm
ENVIRONMENTAL	IEC IP67	
OPERATING TEMP.	0° to 80°C	

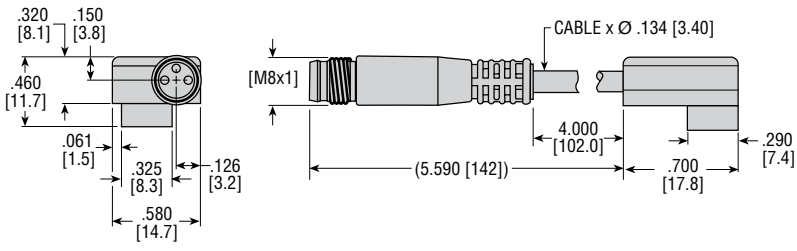
* CE certification not applicable to these switch models.

DIMENSIONS: SERIES 5360 REED SWITCHES

REED SWITCH



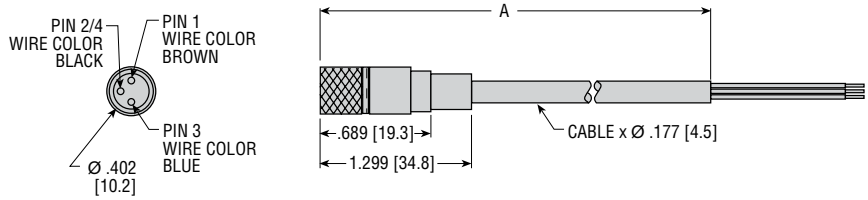
REED SWITCH WITH MALE QUICK CONNECT



MODEL NO.	LETTER DIM. A	LETTER DIM. B
53602-2 & 53622-2	.685 [17.4]	1.090 [27.7]
53609-2 & 53629-2	.895 [22.7]	1.300 [33]

NUMBERS IN [ ] ARE IN mm – IMPERIAL EQUIVALENTS ARE PROVIDED FOR CONVENIENCE

63549-xx CORDSET WITH FEMALE QUICK CONNECT



MODEL NO.	LETTER DIM. A
63549-02	78.74 [2 m]
63549-05	196.85 [5 m]

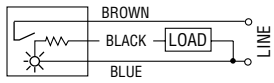
NUMBERS IN [ ] ARE IN mm – IMPERIAL EQUIVALENTS ARE PROVIDED FOR CONVENIENCE

All dimensions are reference only unless specifically toleranced.

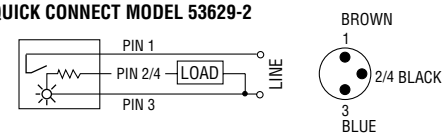
REED WIRING SCHEMATICS

MODEL NO. 53609-2 & 53629-2
INPUT - 110-120 VAC
SWITCHED POWER - 2.5 WATT MAX.
INTERNAL RESISTANCE - 1.5 kOhm
SWITCH HOUSING COLOR - GREEN

CABLED MODEL 53609-2



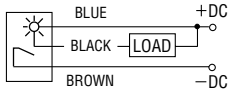
QUICK CONNECT MODEL 53629-2



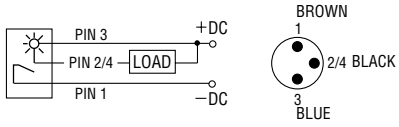
MODEL NO. 53602-2 & 53622-2 - NPN (SINK) OR PNP (SOURCE)
INPUT - 4.5-24 VDC
POWER CAPACITY - 4 WATT MAX.
LOAD CURRENT - 200 mA. MAX.

SWITCH HOUSING COLOR - WHITE
(Bi-polar LED emits a green light in the Sinking circuit and a red light in the Sourcing circuit.)

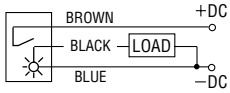
CABLED MODEL 53602-2 - NPN (SINK)



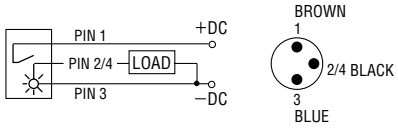
QUICK CONNECT MODEL 53622-2 - NPN (SINK)



CABLED MODEL 53602-2 - PNP (SOURCE)

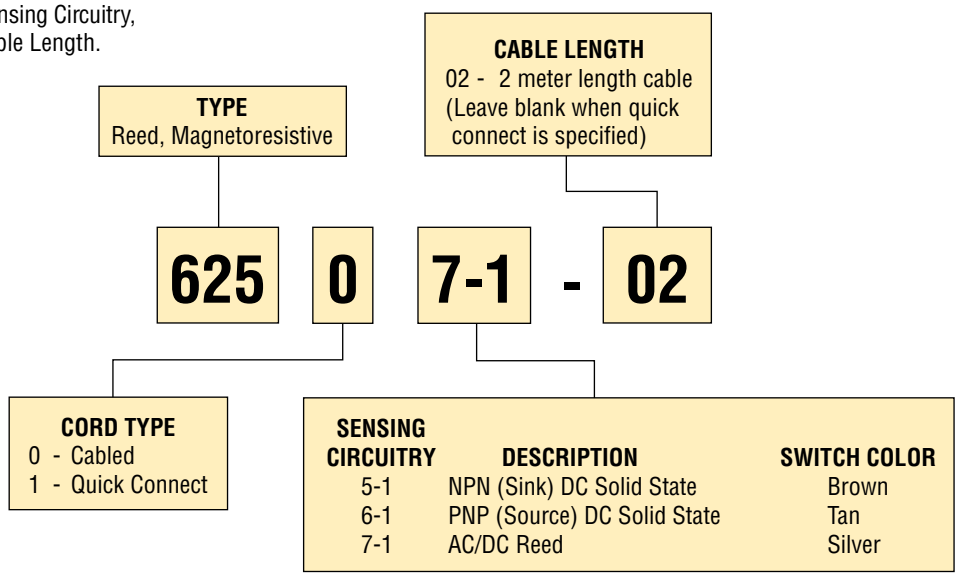


QUICK CONNECT MODEL 53622-2 - PNP (SOURCE)



SWITCHES

TO ORDER SPECIFY:
Type, Cord Type, Sensing Circuitry, Design No., and Cable Length.



NOTES:
1) Cordsets for quick connect switches must be ordered separately.
2) Other cable lengths available. Consult PHD.

CORDSETS WITH QUICK CONNECT

FOR SOLID STATE SWITCH	
PART NO.	**CABLE LENGTH**
61397-02	2 meter/3 wire
61397-05	5 meter/3 wire
FOR REED SWITCH	
PART NO.	**CABLE LENGTH**
61398-02	2 meter/2 wire
61398-05	5 meter/2 wire

BENEFITS

- Series 6250 Reed Switches are available for use with PHD ISO Cylinder and on other select PHD actuators which use the “M” magnet option.
- Series 6250 Reed Switches offer both 120 VAC or 10 to 30 VDC sink and source operation for maximum flexibility in interfacing with various electronic controls.
- Special current limiting feature is designed into each switch for protection against potential current inrush damage to switch components.
- Integral clamp mounting provides easy attachment and adjustment while eliminating the cost of brackets and additional hardware.
- Several switches may be used on an actuator to control or initiate a sequence or function.
- LED indicator provides convenient means for positioning and troubleshooting circuits.
- Switches include either a hard wired 24 AWG, Polyurethane (PUR) jacketed cable making it virtually impervious to chemical or environmental damage, or an integral 8 mm screw type connector mounted directly on the switch.
- IP67 Environmental Protection

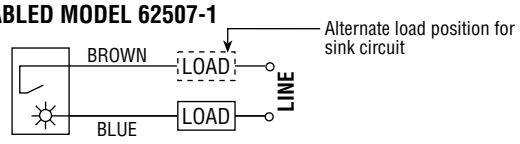
SPECIFICATIONS	62507-1	62517-1
SWITCH COLOR	Silver	
OPERATING PRINCIPLE	Magnetic Reed	
ACTUATED BY	Moving Magnet	
INPUT VOLTAGE	10 to 30 VDC or 110-120 VAC*	
OUTPUT VOLTAGE	Contact Closure	
POWER CAPACITY	2.5 Watt Max.	
CURRENT RATING	Internally Limited to 25 mA.	
IMPEDANCE	2.25 k Ohm	
ENVIRONMENTAL	IP67	
OPERATING TEMP.	0° to 80°C	

* CE certification applicable to 10 to 30 VDC range only.

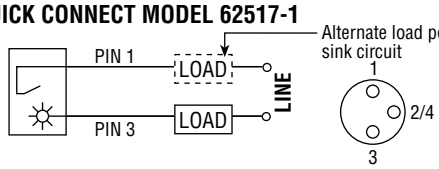
REED WIRING SCHEMATICS

MODEL NO. 62507-1 & 62517-1
INPUT - 110 - 120 VAC
POWER CAPACITY - 2.5 WATTS MAX.
LOAD CURRENT - 25 mA. MAX.
INTERNAL RESISTANCE - 2.25 k Ohm
SWITCH HOUSING COLOR - SILVER

CABLED MODEL 62507-1

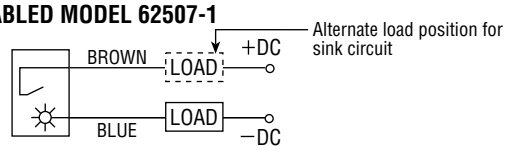


QUICK CONNECT MODEL 62517-1

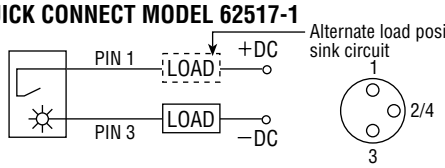


MODEL NO. 62507-1 & 62517-1
INPUT - 10 to 30 VDC
POWER CAPACITY - 2.5 WATTS MAX.
LOAD CURRENT - 25 mA. MAX.
SWITCH HOUSING COLOR - SILVER

CABLED MODEL 62507-1



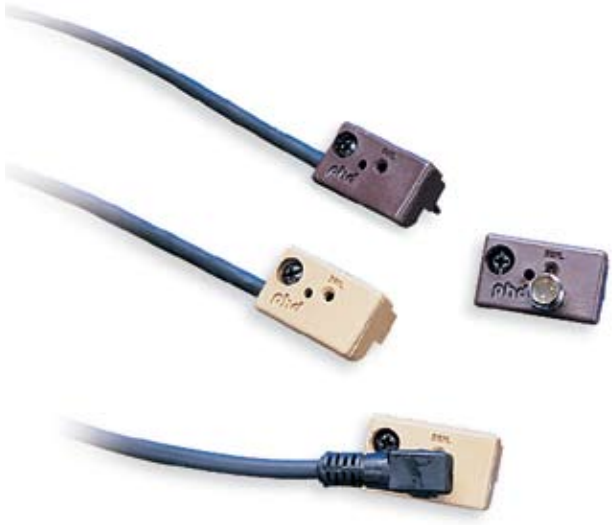
QUICK CONNECT MODEL 62517-1



BENEFITS

- Series 6250 Solid State Switches are available for use with PHD ISO Cylinders and on other select PHD actuators which use the “M” magnet option
- Available in both current sinking or current sourcing models for maximum flexibility in interfacing with various electronic controls.
- Series 6250 Solid State Switch circuitry protects against voltage surges and other electrical anomalies associated with operating systems.
- Integral clamp mounting provides easy attachment and adjustment while eliminating the cost of brackets and additional hardware.
- Several switches may be mounted to control or initiate any sequence or function.
- An LED indicator provides convenient means for positioning and troubleshooting circuits.
- Switches include either a hard wired 24 AWG, Polyurethane (PUR) jacketed cable making it virtually impervious to chemical or environmental damage, or an integral 8mm screw type connector mounted directly on the switch.
- IP67 Environmental Protection

Series 6250 Solid State Switches are designed specifically to provide an input signal to various types of programmable controllers or logic systems. Since Solid State Switches have no moving parts to wear out, they offer an infinite number of trouble-free operations. Solid State Switches operate on DC current only.

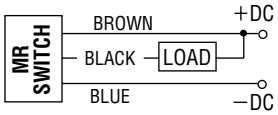


SPECIFICATIONS	62505-1 & 62515-1	62506-1 & 62516-1
SWITCH COLOR	Brown	Tan
OPERATING PRINCIPLE	Magnetoresistive	
ACTUATED BY	Moving Magnet	
INPUT VOLTAGE	10 to 30 VDC	
OUTPUT TYPE	NPN (Sink)	PNP (Source)
CURRENT RATING	100 mA. Max.	100mA. Max.
VOLTAGE DROP	.5 VDC Max.	
SWITCH BURDEN	12 mA. Max.	
ENVIRONMENTAL	IP67	
OPERATING TEMP.	0° to 80°C	

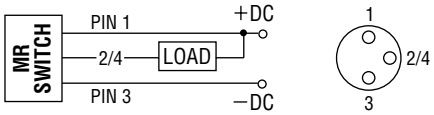
MAGNETORESISTIVE WIRING SCHEMATICS

MODEL NO. 62505-1 & 62515-1 - NPN - (SINK)
INPUT - 10-30 VDC
LOAD CURRENT - 100 mA. MAX.
SWITCH HOUSING COLOR - BROWN
(LED has been omitted from the schematic for clarity.)

CABLED MODEL 62505-1

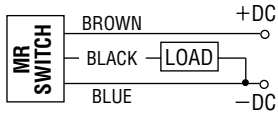


QUICK CONNECT MODEL 62515-1

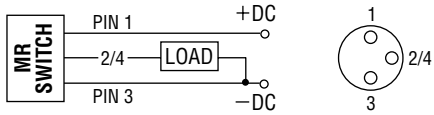


MODEL NO. 62506-1 & 62516-1 - PNP - (SOURCE)
INPUT - 10-30 VDC
LOAD CURRENT - 100 mA. MAX.
SWITCH HOUSING COLOR - TAN
(LED has been omitted from the schematic for clarity.)

CABLED MODEL 62506-1

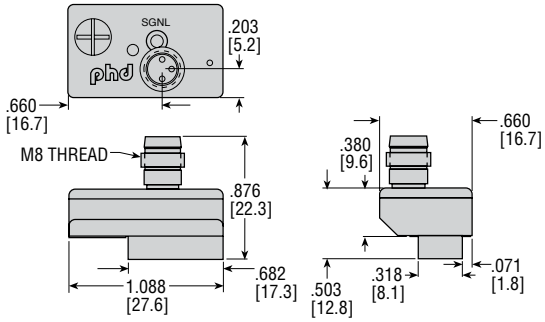


QUICK CONNECT MODEL 62516-1

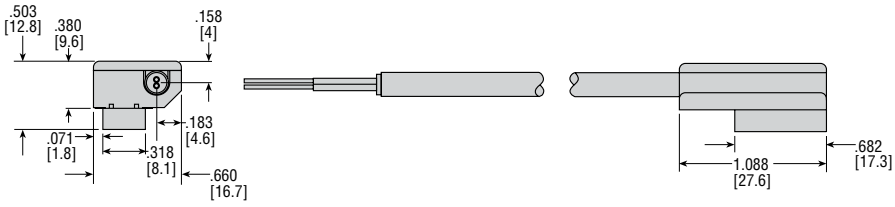


DIMENSIONS: SERIES 6250 REED/SOLID STATE SWITCHES

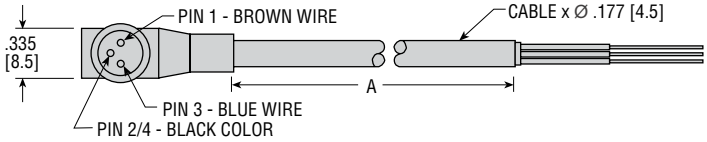
REED AND SOLID STATE SWITCH WITH QUICK CONNECT



REED AND SOLID STATE SWITCH CABLED



61397-xx CORDSET WITH FEMALE QUICK CONNECT (SOLID STATE SWITCH)



MODEL NO.	LETTER DIM. A	LETTER DIM. LENGTH
61397-02	78.7 [2000]	3 wire
61397-05	197.0 [5000]	3 wire

NUMBERS IN [ ] ARE IN mm – IMPERIAL EQUIVALENTS ARE PROVIDED FOR CONVENIENCE

NOTE: THIS CORDSET IS USED FOR BOTH 3-WIRE AND 2-WIRE APPLICATIONS. WHEN USED IN 2-WIRE APPLICATIONS, REFER TO THE SCHEMATIC AND DISREGARD THE BLACK WIRE.

ORDERING DATA

TO ORDER SPECIFY:
Type, Cord Type, Sensing Circuitry, Design No., and Cable Length.

TYPE
Solid State, Reed

CABLE LENGTH
06 - 6 ft [1.8 m] length cable
(Leave blank when quick connect is specified)

175	0	2-2	-	06

CORD TYPE
0 - Cabled
2 - Quick Connect

SENSING CIRCUITRY	DESCRIPTION	SWITCH COLOR
2-2	NPN or PNP DC Reed	White
3-2	NPN DC Solid State	Yellow
4-2	PNP DC Solid State	Red
9-3	*AC Reed w/Current Limiting	Green

CORDSETS WITH QUICK CONNECT

PART NO.	LENGTH
63549-02	2 meter
63549-05	5 meter

NOTES:
1) Cordsets for quick connect switches must be ordered separately. See page 9-17.
2) Other cable lengths available. Consult PHD.
3) *CE certification not applicable to the AC Reed with Current Limiting model.

COMMON BENEFITS

- Series 1750 switches are available for use on most Tom Thumb and PHD products for simple interfacing to many types of electrical controllers.
- The compact low profile design saves space and provides mounting versatility.
- Low profile bracket attaches securely across two tie rods and allows easy position adjustment over the entire piston travel of the cylinder or actuator.
- IP67 Environmental Protection
- Red LED indicator provides convenient method for position setting and troubleshooting.
- Available in a cabled or 8 mm threaded Quick Connect model for easy installation and maintenance.
- 24 AWG polyurethane (PUR) jacketed cable is robust and virtually impervious to chemical and environmental damage.
- Multiple switches may be mounted to control or initiate any sequence or function.

CE

SWITCHES

REED BENEFITS

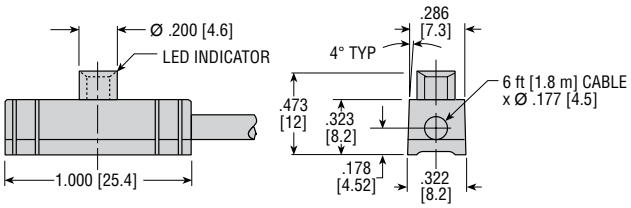
- Available as either 10-30 VDC or 110-120 VAC models for simple interfacing to sequencers and programmable controllers.
- Can be used to directly drive some types of relays or valve solenoids.

SOLID STATE BENEFITS

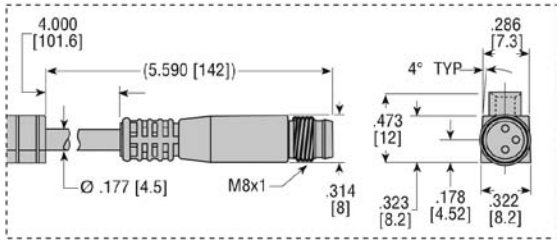
- Solid state switches afford long life. Constant amplitude output allows use with most digital logic systems.
- Switch circuitry protects against voltage surges and other electrical anomalies associated with operating systems.
- Excellent switch hysteresis characteristics and symmetry.
- Offered in 10-30 VDC current sinking and current sourcing versions for simple interfacing to electronic system controllers.

DIMENSIONS: SERIES 1750 SWITCHES

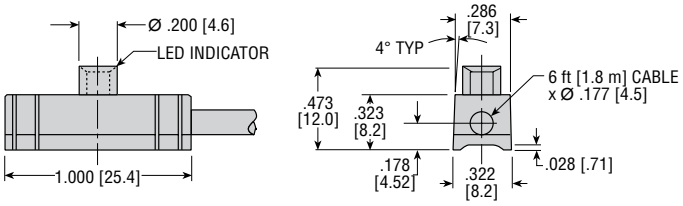
SOLID STATE SWITCH



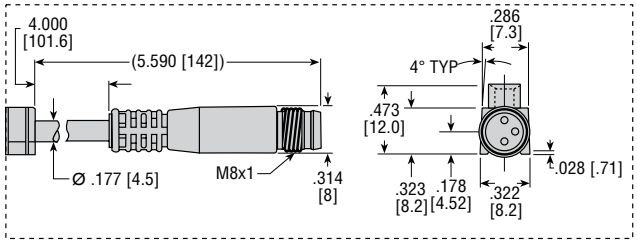
MALE QUICK CONNECT DETAIL



REED SWITCH



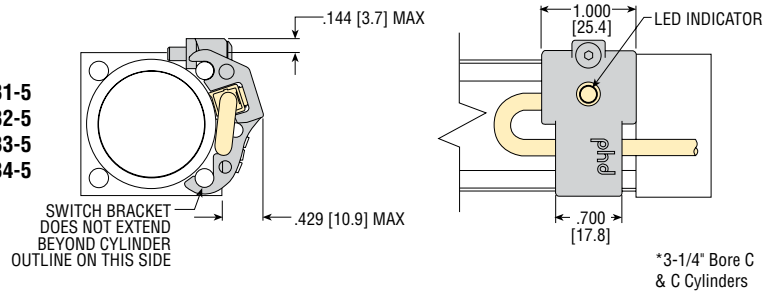
MALE QUICK CONNECT DETAIL



SWITCH BRACKETS 17000-xx-5

PART NUMBER	DESCRIPTION
17494	Strain relief kit for non -5 brackets (-35-0 through -41-0)
18412	Strain relief kit for Series SD/SE Slide size 26

17000-31-5
17000-32-5
17000-33-5
17000-34-5



*3-1/4" Bore C & C Cylinders require switch bracket 5142-54-3.

CYLINDERS

SERIES	BORE SIZE IMPERIAL	METRIC	COMPACT BRACKETS
AV & HV	3/4	19	17000-31-5
	1	25	17000-32-5
	1-1/8	29	17000-33-5
	1-3/8	35	17000-34-5
EA, EL, & NEA	3/4	19	17000-35-0
	1-1/8	29	17000-36-0
	1-3/8	35	17000-37-0
	2	51	17000-40-0
	3	75	17000-41-0
NPG	1-1/8	29	17000-33-5
	1-3/8	35	17000-36-0

IMPERIAL LARGE BORE CYLINDERS

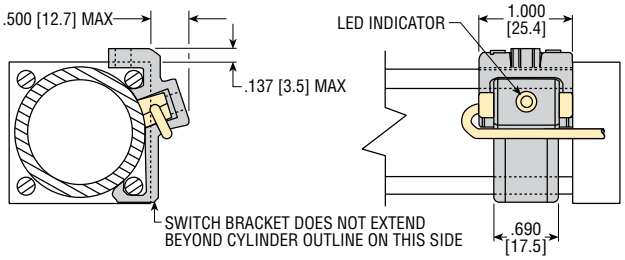
BORE SIZE	COMPACT BRACKETS*
1-1/2	17000-51-0
2	17000-51-0
2-1/2	17000-51-0
3-1/4*	17000-51-0
4	17000-51-0
5, 6, & 8	17000-57-0

SD/SE SLIDES

BORE SIZE	BRACKET
22	17000-31-5
23	17000-32-5
24	17000-33-5
25	17000-34-5
26	58050-02

17000-xx-0

17000-35-0
17000-36-0
17000-37-0
17000-40-0
17000-41-0

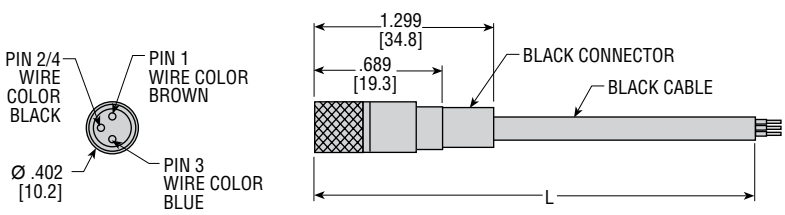


ROTARY & MULTI-MOTION ACTUATORS

SERIES	COMPACT BRACKETS LINEAR SECTION	ROTARY SECTION
1000 & 2000	17000-36-0	17000-32-5
3000 & 4000	17000-37-0	17000-34-5
5000 & 6000	17000-40-0	17000-38-0
7000 & 8000	17000-41-0	17000-39-0
MINIATURE	17000-35-0	—

NUMBERS IN [ ] ARE IN mm–IMPERIAL EQUIVALENTS ARE PROVIDED FOR CONVENIENCE

63549-xx CORDSET WITH FEMALE QUICK CONNECT



MODEL NO.	LETTER DIM. L
63549-02	78.74 [2 m]
63549-05	196.85 [5 m]

NOTES:
1) For alternative supplier part numbers, see page 9-5.
2) For earlier design switches 1752x-1 and 17529-2, use cordset 17533-00-02 or 17533-00-05.

SPECIFICATIONS: SERIES 1750 SWITCHES

SPECIFICATIONS	17503-2 & 17523-2	17504-2 & 17524-2
OPERATING PRINCIPLE	Solid State	
ACTUATED BY	Piston Magnet	
INPUT VOLTAGE	10-30 VDC	
OUTPUT TYPE	NPN (Sink)	PNP (Source)
CURRENT RATING	20 mA. Max	100 mA. Max
VOLTAGE DROP	.5 VDC	
SWITCH BURDEN	10 mA. Max.	
ENVIRONMENTAL	IP67	
OPERATING TEMP.	0° to 80°C	

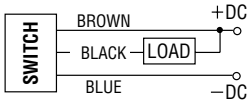
SPECIFICATIONS	17502-2 17522-2	17509-3* 17529-3*
OPERATING PRINCIPLE	Magnetic Reed	
ACTUATED BY	Piston Magnet	
INPUT VOLTAGE	10-30 VDC	110-120 VAC
POWER CAPACITY	10 Watt Max.	10 Watt Max.
OUTPUT TYPE	Contact Closure	
CURRENT RATING	200 mA. Switched	Inter. Limited to 85 mA.
CONTACT RESISTANCE	.1 Ohm Max.	.1 Ohm Max.
ENVIRONMENTAL	IP67	
OPERATING TEMP.	0° to 80°C	

* CE certification not applicable to these switch models.

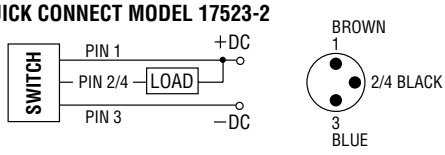
SOLID STATE WIRING SCHEMATICS

MODEL NO. 17503-2 & 17523-2 - NPN (SINK)
INPUT - 10-30 VDC
LOAD CURRENT - 20 mA. MAX.
SWITCH HOUSING COLOR - YELLOW
(LED's have been omitted from the schematic for clarity.)

CABLED MODEL 17503-2

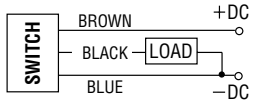


QUICK CONNECT MODEL 17523-2

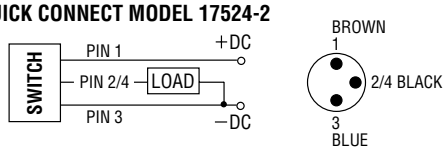


MODEL NO. 17504-2 & 17524-2 - PNP (SOURCE)
INPUT - 10-30 VDC
LOAD CURRENT - 100 mA. MAX.
SWITCH HOUSING COLOR - RED
(LED's have been omitted from the schematic for clarity.)

CABLED MODEL 17504-2



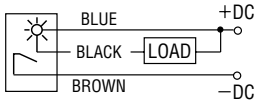
QUICK CONNECT MODEL 17524-2



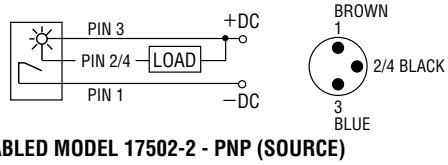
REED WIRING SCHEMATICS

MODEL NO. 17502-2 & 17522-2 - NPN (SINK) OR PNP (SOURCE)
INPUT - 10-30 VDC
POWER CAPACITY - 3 WATT MAX.
LOAD CURRENT - 200 mA. MAX.
SWITCH HOUSING COLOR - WHITE
(Bi-polar LED emits a red light.)

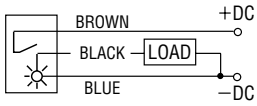
CABLED MODEL 17502-2 - NPN (SINK)



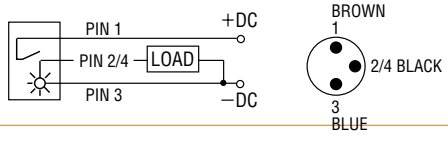
QUICK CONNECT MODEL 17522-2 - NPN (SINK)



CABLED MODEL 17502-2 - PNP (SOURCE)

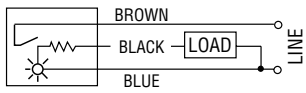


QUICK CONNECT MODEL 17522-2 - PNP (SOURCE)

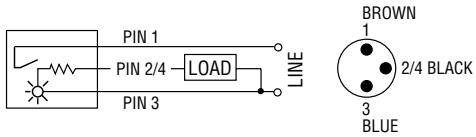


MODEL NO. 17509-3 & 17529-3
INPUT - 120 VAC
SWITCHED POWER - 3 WATT MAX.
INTERNAL RESISTANCE - 1.5 kOhm
SWITCH HOUSING COLOR - GREEN

CABLED MODEL 17509-3



QUICK CONNECT MODEL 17529-3



ORDERING DATA: SERIES 5580 PROXIMITY SWITCHES

TO ORDER SPECIFY:
Type, Cord Type, Sensing Circuitry, Design No., and Cable Length.

TYPE
Hall, Reed

CABLE LENGTH
02 - 2 meter length cable
(Leave blank when quick connect is specified)

558 0 2-1 - 02

CORD TYPE
0 - Cabled
2 - Quick Connect

SENSING CIRCUITRY	DESCRIPTION	SWITCH COLOR
2 - 1	NPN or PNP DC Reed	White
3 - 1	NPN DC Hall	Yellow
4 - 1	PNP DC Hall	Red

CORDSETS WITH QUICK CONNECT

PART NO.	LENGTH
63549-02	2 meter
63549-05	5 meter

NOTES:
1) Cordsets for quick connect switches must be ordered separately.
2) Other cable lengths available. Consult PHD.

BENEFITS

CE

- Series 5580 Proximity Switches are available for use on selected PHD products making it easy to interface these actuators with various electronic controls.
- Hall Effect Switches are solid state for long life and elimination of contact bounce. Constant amplitude output is provided for use with most digital logic systems.
- Low profile mounting is easy to adjust at the ends of travel of the slide or gripper.
- LED indicator provides convenient means for positioning and troubleshooting circuits. An LED shows when the switch output is on.
- Available in a Quick Connect model for easy installation and maintenance.

HALL EFFECT

PHD Series 5580 Hall Effect Proximity Switches are designed specifically to provide an input signal to various types of programmable controllers or logic systems. Since Hall Effect Switches are solid-state, there are no moving parts to wear out. The switches offer an infinite number of trouble-free operations. Hall Effect Switches operate on DC current only.

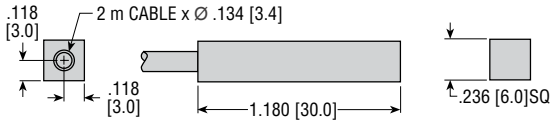
SPECIFICATIONS	55803 & 55823	55804 & 55824
OPERATING PRINCIPLE	Hall Effect	
ACTUATED BY	Target Magnet	
INPUT VOLTAGE	4.5 to 24 VDC	
OUTPUT TYPE	NPN (Sink)	PNP (Source)
CURRENT RATING	20 mA. Max.	100 mA. Max.
VOLTAGE DROP	.5 VDC Max.	
SWITCH BURDEN	12 mA. Max.	
ENVIRONMENTAL	IP67	
OPERATING TEMP.	0° to 80°C	

REED

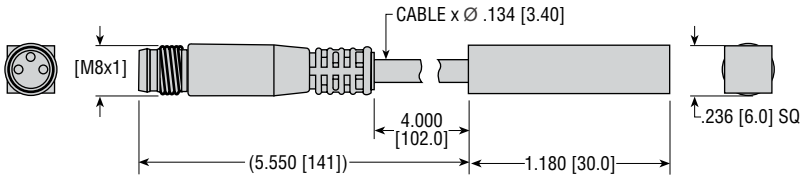
PHD Series 5580 Reed Switches are available in a DC model. They are ideal for use as inputs for many types of sequencers and programmable controllers. In some cases, they can be used to drive some relays or valve solenoids. However, electrical transients (inrush currents or line spikes) associated with inductive or capacitive loads can damage and shorten the life of the switch.

SPECIFICATIONS	55802 & 55822
OPERATING PRINCIPLE	Magnetic Reed
ACTUATED BY	Target Magnet
INPUT VOLTAGE	4.5 to 24 VDC
OUTPUT TYPE	NPN (Sink) or PNP (Source)
CURRENT RATING	200 mA. Switched
CONTACT RESISTANCE	.090 Ohm Max.
ENVIRONMENTAL	IP67
OPERATING TEMP.	0° to 80°C

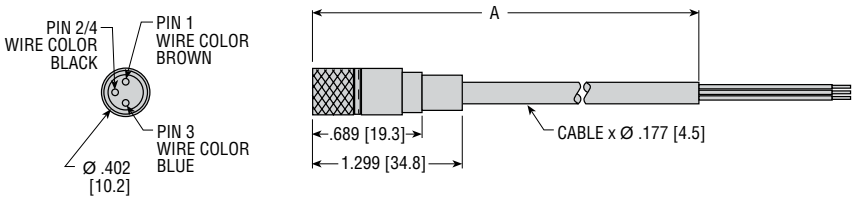
HALL EFFECT AND REED SWITCH



HALL EFFECT AND REED SWITCH WITH MALE QUICK CONNECT



63549-xx CORDSET WITH FEMALE QUICK CONNECT



MODEL NO.	LETTER DIM. A
63549-02	78.74 [2 m]
63549-05	196.85 [5 m]

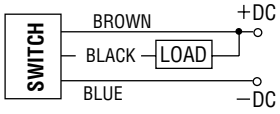
NUMBERS IN [ ] ARE IN mm–IMPERIAL EQUIVALENTS ARE PROVIDED FOR CONVENIENCE

HALL EFFECT WIRING SCHEMATICS

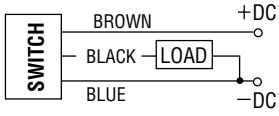
MODEL NO. 55803 & 55823 - NPN (SINK)
INPUT - 4.5-24 VDC
LOAD CURRENT - 20 mA. MAX.
SWITCH HOUSING COLOR - YELLOW
(LED has been omitted from the schematic for clarity.)

MODEL NO. 55804 & 55824 - PNP (SOURCE)
INPUT - 4.5-24 VDC
LOAD CURRENT - 100 mA. MAX.
SWITCH HOUSING COLOR - RED
(LED has been omitted from the schematic for clarity.)

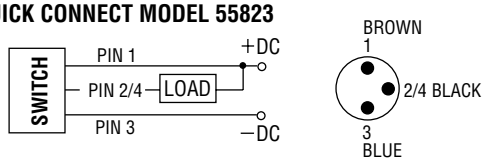
CABLED MODEL 55803



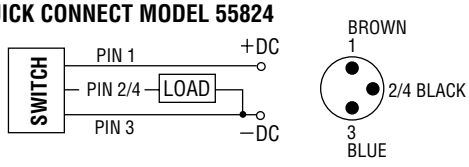
CABLED MODEL 55804



QUICK CONNECT MODEL 55823



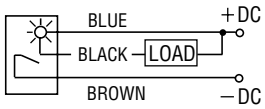
QUICK CONNECT MODEL 55824



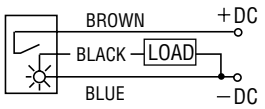
REED WIRING SCHEMATICS

MODEL NO. 55802 & 55822 - NPN (SINK) OR PNP (SOURCE)
INPUT - 4.5-24 VDC
LOAD CURRENT - 200 mA. MAX.
SWITCH HOUSING COLOR - WHITE
(Bi-polar LED emits a green light in the Sinking circuit and a red light in the Sourcing circuit.)

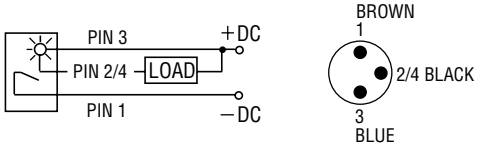
CABLED MODEL 55802 - NPN (SINK)



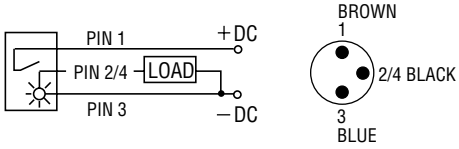
CABLED MODEL 55802 - PNP (SOURCE)



QUICK CONNECT MODEL 55822 - NPN (SINK)



QUICK CONNECT MODEL 55822 - PNP (SOURCE)



All dimensions are reference only unless specifically toleranced.

ORDERING DATA

TO ORDER SPECIFY:
Product Type, Cable Type,
Sensing Circuitry, Cable Length

CORD TYPE
0 - Cabled
2 - Quick Connect

CABLE LENGTH
02 - 2 meter length cable
05 - 5 meter length cable
(Leave blank when quick connect is specified

679 0 2-1 - 02

PRODUCT TYPE
Reed, Solid State

SENSING CIRCUITRY
2-1 PNP or NPN DC Reed
3-1 NPN DC Solid State
4-1 PNP DC Solid State
9-1 AC Reed*

CORDSETS WITH QUICK CONNECT

PART NO.	LENGTH
63549-02	2 meter
63549-05	5 meter

NOTES:
1) Cordsets for quick connect switches must be ordered separately.
2) Other cable lengths available. Consult PHD.
3) *AC Reed (9-2) available with quick connect only.

COMMON BENEFITS

- Series 6790 Switches are available for use on many actuators.
- Saving space and providing mounting versatility, the round design fits into grooves in the body of the actuator.
- IP67 Environmental Protection
- LED indicator provides convenient method for position setting and troubleshooting.
- Available in a cabled or 8 mm threaded Quick Connect model for easy installation and maintenance.
- 28 AWG Polyurethane (PUR) jacketed cable
- Multiple switches may be mounted to control or initiate any sequence or function.

SOLID STATE BENEFITS

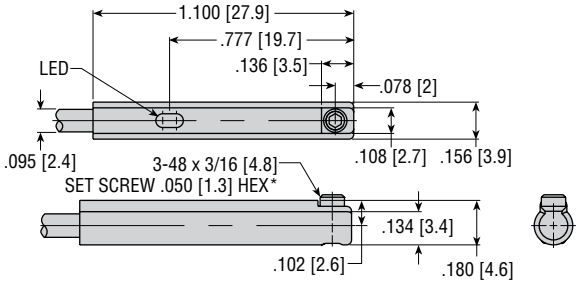
- Solid state switches afford long life. Constant amplitude output allows use with most digital logic systems.
- Switch circuitry protects against voltage surges and other electrical anomalies associated with operating systems.
- Excellent switch hysteresis characteristics and symmetry.
- Offered in 4.5 - 30 VDC current sinking and current sourcing versions for simple interfacing to electronic system controllers.

SPECIFICATIONS	67903 & 67923	67904 & 67924
OPERATING PRINCIPLE	Solid State	
ACTUATED BY	Piston Magnet	
INPUT VOLTAGE	4.5 - 30 VDC	
OUTPUT TYPE	NPN (Sink)	PNP (Source)
CURRENT RATING	50 mA. Max	
VOLTAGE DROP	.5 VDC	
SWITCH BURDEN	10 mA. Max.	
ENVIRONMENTAL	IP67	
OPERATING TEMP.	-20° to 85°C	

REED BENEFITS

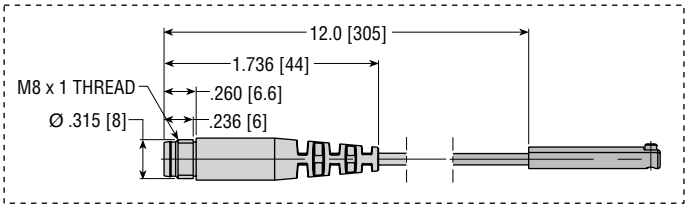
- Available as 4.5 - 30 VDC and 65 - 120 VAC models for simple interfacing to sequencers and programmable controllers.
- Can be used to directly drive some types of relays or valve solenoids within the switch specifications stated.

SPECIFICATIONS	67902 & 67922	
OPERATING PRINCIPLE	Magnetic Reed	
ACTUATED BY	Piston Magnet	
INPUT VOLTAGE	4.5 - 30 VDC	65 - 120 VAC
OUTPUT TYPE	Contact Closure	
CURRENT RATING	50 mA Max.	25 mA Max.
ENVIRONMENTAL	IP67	
OPERATING TEMP.	-20° to 85°C	
IMPEDANCE	.12 Ohm Max.	1.5 k Ohm



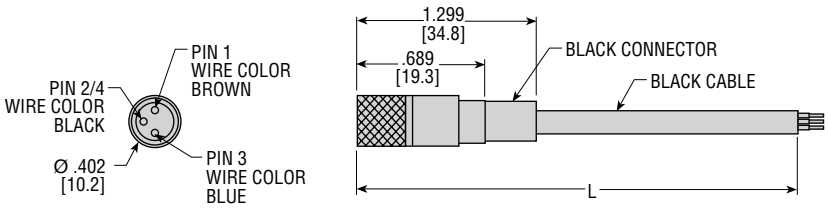
***MAX. SCREW TORQUE 1.0 in-lb [.110 Nm]**

MALE QUICK CONNECT DETAIL



METRIC INFORMATION SHOWN IN [ ]

63549-xx CORDSET WITH FEMALE QUICK CONNECT

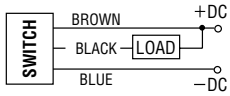


MODEL NO.	LETTER DIM. L
63549-02	78.74 [2 m]
63549-05	196.85 [5 m]

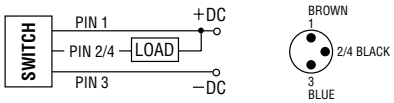
SOLID STATE WIRING SCHEMATICS

MODEL NO. 67903-1 & 67923-1 - NPN (SINK)
INPUT: 4.5 - 30 VDC
LOAD CURRENT: 50 mA. MAX.
SWITCH HOUSING COLOR: BLACK
(Bi-polar LED emits a yellow light)

CABLED MODEL 67903

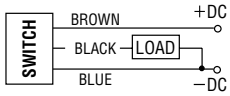


QUICK CONNECT MODEL 67923

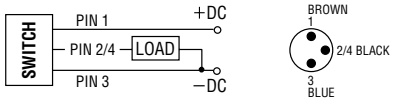


MODEL NO. 67904-1 & 67924-1 - PNP (SOURCE)
INPUT: 4.5-30 VDC
LOAD CURRENT: 50 mA. MAX.
SWITCH HOUSING COLOR: BLACK
(Bi-polar LED emits a red light.)

CABLED MODEL 67904



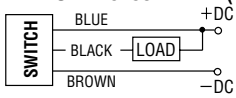
QUICK CONNECT MODEL 67924



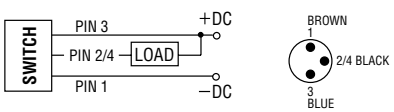
REED WIRING SCHEMATICS

MODEL NO. 67902-1 & 67922-1 - NPN (SINK) OR PNP (SOURCE)
INPUT: 4.5 - 30 VDC
LOAD CURRENT: 50 mA. MAX.
IMPEDANCE: .12 Ohm MAX.
SWITCH HOUSING COLOR: BLACK
(LED emits a red light)

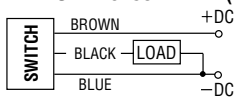
CABLED MODEL 67902 - NPN (SINK)



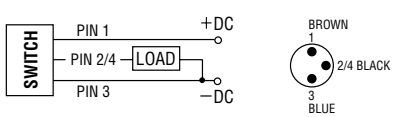
QUICK CONNECT MODEL 67922 - NPN (SINK)



CABLED MODEL 67902 - PNP (SOURCE)



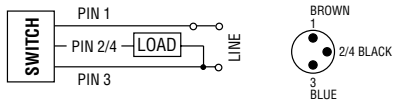
QUICK CONNECT MODEL 67922 - PNP (SOURCE)



AC REED WIRING SCHEMATICS

MODEL NO. 67909-1 & 67929-1
INPUT: 65 - 120 VDC
LOAD CURRENT: 25 mA. MAX.
IMPEDANCE: 1.5 k Ohm
SWITCH HOUSING COLOR: BLACK
(LED emits a red light)

QUICK CONNECT MODEL 67929



All dimensions are reference only unless specifically toleranced.

DC INDUCTIVE PROXIMITY SWITCHES

4 mm ROUND

PART NO.	DESCRIPTION
18430-001-02	NPN (Sink) 10-30 VDC, 2 meter cable
18430-002-02	PNP (Source) 10-30 VDC, 2 meter cable

6 mm SQUARE

PART NO.	DESCRIPTION
18431-001-02	NPN (Sink) 10-30 VDC, 2 meter cable
18431-002-02	PNP (Source) 10-30 VDC, 2 meter cable

8 mm THREADED

PART NO.	DESCRIPTION
51422-005-02	NPN (Sink) 5-30 VDC, 2 meter cable
51422-006-02	PNP (Source) 5-30 VDC, 2 meter cable

12 mm THREADED

PART NO.	DESCRIPTION
15561-001	NPN (Sink) 10-30 VDC, 3 meter cable
15561-002	PNP (Source) 10-30 VDC, 3 meter cable
15561-003	20-250 VAC, 3 meter cable

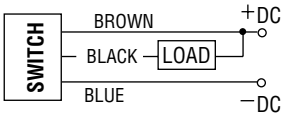
BENEFITS

- High reliability provided by solid state inductive sensing technology.
- Ease of mounting with PHD's Proximity Switch Bracket Kit and Target Kits for grippers. These kits include all hardware for mounting the switch and the target that is used to actuate the switch. (See Slide and Gripper sections for details.)
- Suitable for plant environments where dirt and contamination create difficulties for electromechanical and other types of switches.
- LED indicator circuits are standard on 4 mm round, 6 mm square, and 8 mm threaded and provide a convenient means of positioning and troubleshooting.

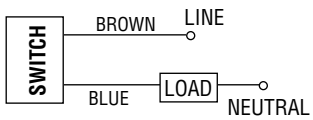
SPECIFICATIONS	18430-001-02 18431-001-02	18430-002-02 18431-002-02	51422-005-02	51422-006-02	15561-001	15561-002	15561-003
INPUT VOLTAGE	10 to 30 VDC	10 to 30 VDC	5 to 30 VDC	5 to 30 VDC	10 to 30 VDC	10 to 30 VDC	20 to 250 VAC
OUTPUT TYPE	NPN (Sink)	PNP (Source)	NPN (Sink)	PNP (Source)	NPN (Sink)	PNP (Source)	Solid State
SENSING RANGE	0.8 mm Max.	0.8 mm Max.	1.5 mm Max.	1.5 mm Max.	1.6 mm Max.	1.6 mm Max.	1.6 mm Max.
OUTPUT CURRENT RATING	100 mA. Max.	100 mA. Max.	200 mA. Max.	200 mA. Max.	200 mA Max.	200 mA Max.	130 mA Max.
SWITCH BURDEN	10 mA. Max.	10 mA. Max.	10 mA. Max.	10 mA. Max.	8 mA Max.	8 mA Max.	—
VOLTAGE DROP	2.5 VDC Max.	2.5 VDC Max.	1.0 VDC Max.	1.0 VDC Max.	1.5 V Max.	1.5 V Max.	11 V Max.
CIRCUIT PROTECTION	Yes	Yes	No	No	Yes	Yes	No
REVERSE VOLTAGE	Yes					Yes	
OUTPUT STATE	Normally Open					Normally Open	
ENVIRONMENTAL	IP67					IP68	

WIRING SCHEMATICS

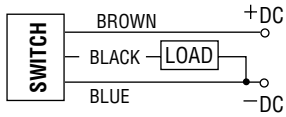
DC NPN (Sink)
MODEL 15561-001
18430-001-02
18431-001-02
51422-005-02



AC
MODEL 15561-003



DC PNP (Source)
MODEL 15561-002
18430-002-02
18431-002-02
51422-006-02

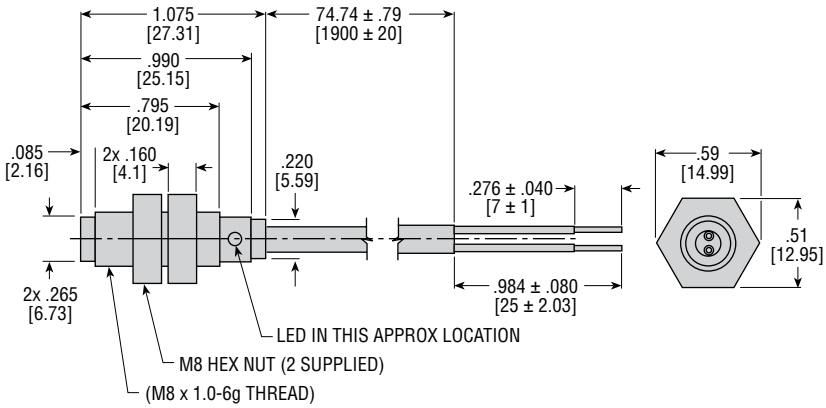


SWITCHES

SERIES 62002 8 mm ROUND THREADED PROXIMITY SWITCH

PART NO.	DESCRIPTION
62002-1-02	8 mm Threaded Reed Switch with 2 meter cable

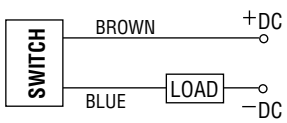
SPECIFICATIONS	62002-1-02
OPERATING PRINCIPLE	Magnetic Reed
ACTUATED BY	Target Magnet
INPUT VOLTAGE	4.5 to 24 VDC
OUTPUT VOLTAGE	Contact Closure
POWER CAPACITY	1.0 Watt Max.
CURRENT RATING	40 mA Max.
CONTACT RESISTANCE	.200 Ohm Max.
ENVIRONMENTAL	IP67
OPERATING TEMP.	0° to 70°C



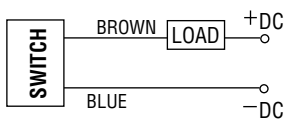
SERIES 62002 PROXIMITY WIRING SCHEMATICS

MODEL NO. 62002-1-02 - NPN (SINK) OR PNP (SOURCE)
INPUT - 4.5-24 VDC
POWER CAPACITY - 1.0 WATT MAX.
LOAD CURRENT - 40 mA MAX.

CABLED MODEL 62002 - PNP (SOURCE)



CABLED MODEL 62002 - NPN (SINK)



NUMBERS IN [ ] ARE IN mm – IMPERIAL EQUIVALENTS ARE PROVIDED FOR CONVENIENCE

All dimensions are reference only unless specifically toleranced.

BENEFITS: HALL SENSOR WITH SET POINT MODULE

BENEFITS

- Provides independent and fully adjustable multiple position sensing on Series 8400 Angular Grippers, Series 190 & 191 Parallel and 190 Angular Grippers, Series 5300 Oval Grippers, and all Rotary Actuators and Multi-Motion Actuators.
- Independent adjustment of two set point positions from two sensors allows one set point module to interface with two actuators. Or, can be used with a single unit providing 4 adjustable set points throughout jaw travel or rotation.
- Solid state electronics with Hall Effect sensing technology for an infinite number of trouble-free cycles.
- Wide signal range capability permits interfacing with most programmable controllers and other logic systems.
- LED indicators for visual confirmation of each output state.
- Set Point Module is available for either current sinking or current sourcing models with 4.5 to 24 VDC output capability.

SPECIFICATIONS	9800-01-0300	9800-01-0400
OPERATING PRINCIPLE	Linear Hall Effect	
INPUT VOLTAGE	18 to 24 VDC	
OUTPUT TYPE	NPN (Sink) Open Collector	PNP (Source) Collector Output
OUTPUT VOLTAGE	4.5 to 24 VDC	
OUTPUT CURRENT RATING	200 mA. Max.	
OUTPUT VOLTAGE DROP	.4 VDC Max. at Rated Current	.5 VDC Max. at 50 mA.
SWITCH BURDEN	150 mA. Max.	
OPERATING TEMP.	0° to 60°C (32° to 140°F)	
HUMIDITY (NON CONDENSING)	5 to 95%	

ORDERING DATA: HALL SENSOR WITH SET POINT MODULE

DUAL INPUT SET POINT MODULE

PART NO.	DESCRIPTION
9800-01-0300	NPN (Sink) 4.5-24 VDC
9800-01-0400	PNP (Source) 4.5-24 VDC

HALL SENSOR KIT

FOR SERIES 190, 191, & 8400 MINIATURE GRIPPERS

PART NO.		DESCRIPTION
IMPERIAL	METRIC	
18674-04	18057-04	Size 6 Models 19x60, 19x61, & 19x62 Parallel
18675-04	18058-04	Size 7 Models 19x70, 19x71, & 19x72 Parallel
18676-04	18059-04	Size 8 Models 19x80, 19x81, & 19x82 Parallel
18677-04	18060-04	Size 9 Models 19x90, 19x91, & 19x92 Parallel
—	18057-04	Size 0 Model 19x02 Angular
—	18058-04	Size 1 Model 19x12 Angular
—	18059-04	Size 2 Model 19x22 Angular
—	18060-04	Size 3 Model 19x32 Angular
10906-12	—	8400 Gripper Angular
10907-12	—	8410 Gripper Angular
10908-12	—	8420 Gripper Angular
18686-04	—	8430 Gripper Angular

INDIVIDUAL REPLACEMENT SENSORS

PART NO.	DESCRIPTION
10688-2-12	Sensor for all 8600, 7900, and 5300 Angular Grippers, and 8600 Parallel Grippers
10832-1-1-12	Sensor for all Rotary Actuators and Multi-Motion Actuators

NOTE: All sensors come with 12 ft [3 m] minimum of shielded cable.

HALL EFFECT SENSOR/TRANSDUCER

The Sensor/Transducer must be ordered as part of the Gripper or Actuator assembly. The Sensor/Transducer will be mounted to the unit with a transition plate. See individual unit Ordering Data for availability and ordering information. Individual replacement sensors are available as shown.

APPLICATIONS

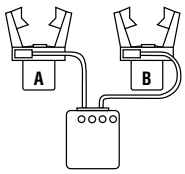
GRIPPERS

- Provides two adjustable sensing positions throughout jaw travel for two grippers (through a single set point module).
- Allows the assurance of part presence by ensuring the jaws have closed or opened to the proper size.
- Permits “go, no go” type gauging to occur as parts are gripped.

ROTARY ACTUATORS & MULTI-MOTION ACTUATORS

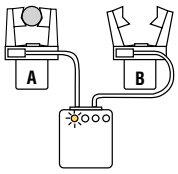
- Provides two adjustable sensing positions throughout the 180° rotation of two rotary actuators or multi-motion actuators.
- Can be used to signal ends of rotation of two units.

DUAL INPUT SET POINT LOGIC EXAMPLE



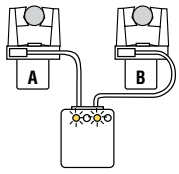
CASE 1

Both gripper jaws are wide open. No set points are made.



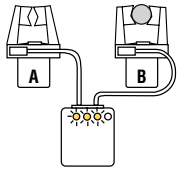
CASE 2

The jaws of gripper A are closed to grip a part and are wide open on gripper B. One set point is made for gripper A.



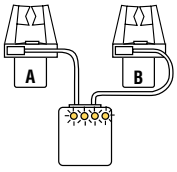
CASE 3

Both gripper jaws are closed to grip a part. Two set points are made, one for gripper A and one for gripper B.



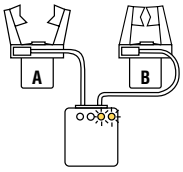
CASE 4

Gripper A jaws are closed all the way (no parts) and Gripper B jaws are closed to grip a part. Two set points for gripper A and one set point for gripper B are made.



CASE 5

Both gripper jaws are closed all the way (no parts). Two set points are made for both grippers A and B.

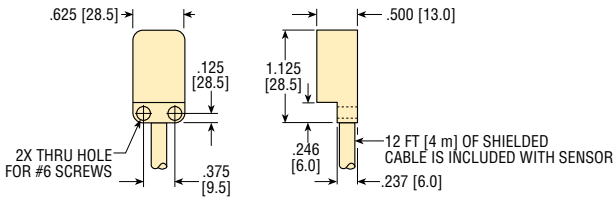


CASE 6

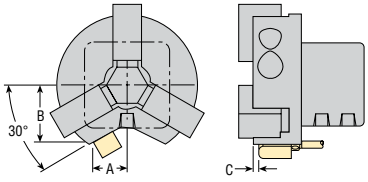
In the event one gripper is wide open (A) and the other is closed all the way (B), only the two set points for the closed gripper would be made.

CASE	SET POINT OUTPUT			
	A1	A2	B1	B2
1	0	0	0	0
2	1	0	0	0
3	1	0	1	0
4	1	1	1	0
5	1	1	1	1
6	0	0	1	1

10688-2-012 BASIC HALL SENSOR

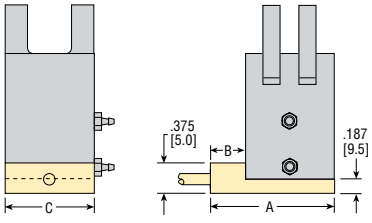


SERIES 7900, 8600 3-JAW, & 5300 ANGULAR GRIPPERS



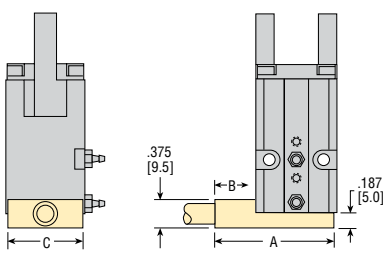
GRIPPER MODEL NO.	LETTER DIMENSION		
	A	B	C
792x, 862x, & 1532x	.854 [21.5]	1.257 [32.0]	0.00 [0.0]
793x, 863x, & 1533x	.917 [23.5]	1.540 [39.0]	.122 [3.0]
794x, 864x, & 1534x	1.112 [28.5]	1.945 [49.5]	.247 [6.0]
795x, 865x, & 1535x	1.586 [40.5]	2.500 [63.5]	.441 [11.0]

SERIES 8400 & 190 ANGULAR GRIPPERS



GRIPPER MODEL NO.		LETTER DIMENSION		
IMPERIAL	METRIC	A	B	C
840x	19002	1.354 [36.5]	.654 [16.5]	.700 [20.0]
841x	19012	1.454 [39.5]	.554 [14.0]	.900 [25.0]
842x	19022	1.704 [46.0]	.304 [7.6]	1.400 [38.0]
843x	19032	2.237 [58.0]	.300 [7.6]	1.910 [50.0]

SERIES 190 & 191 PARALLEL GRIPPERS

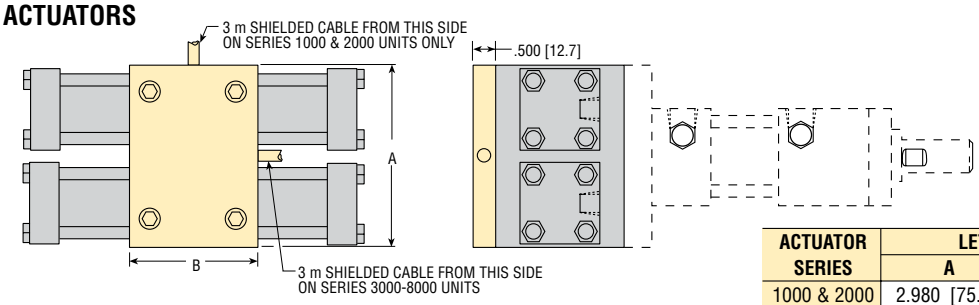


GRIPPER MODEL NO.	LETTER DIMENSION		
	A	B	C
19x6x	1.437 [36.5]	.650 [16.5]	.787 [20.0]
19x7x	1.555 [39.5]	.550 [14.0]	.985 [25.0]
19x8x	1.810 [46.0]	.295 [7.5]	1.496 [38.0]
19x9x	2.283 [58.0]	.295 [7.5]	1.968 [50.0]

All dimensions are reference only unless specifically toleranced.

DIMENSIONS: HALL SENSOR & SET POINT MODULE

SERIES 1000-8000 ROTARY ACTUATORS & MULTI-MOTION ACTUATORS

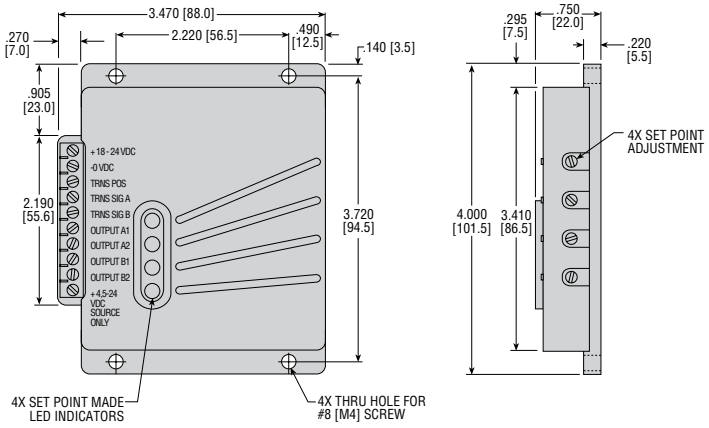


LIMITATIONS: SENSOR MAY BE USED ON UNITS WITH MAXIMUM ROTATION UP TO AND INCLUDING 180°

ACTUATOR SERIES	LETTER DIM. A	B
1000 & 2000	2.980 [75.7]	2.000 [50.8]
3000 & 4000	4.230 [107.4]	3.000 [76.2]
5000 & 6000	4.980 [126.5]	4.000 [101.6]
7000 & 8000	7.980 [202.7]	5.000 [127.0]

NUMBERS IN [ ] ARE IN mm – IMPERIAL EQUIVALENTS ARE PROVIDED FOR CONVENIENCE

SET POINT MODULE #9800-01-0x00



NUMBERS IN [ ] ARE IN mm – IMPERIAL EQUIVALENTS ARE PROVIDED FOR CONVENIENCE

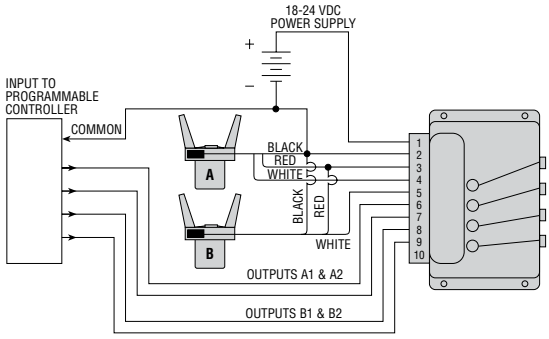
ENGINEERING DATA: HALL SENSOR WITH SET POINT MODULE

WIRING SCHEMATICS

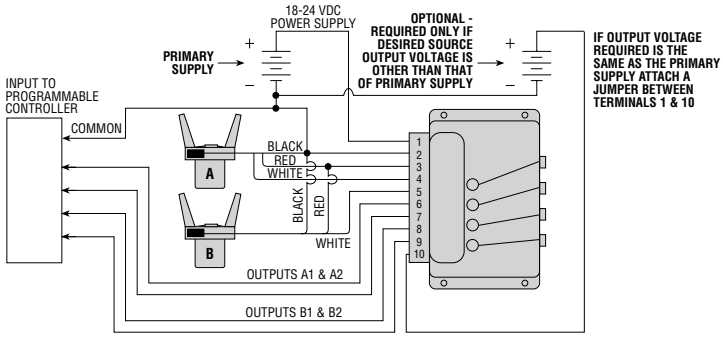
Diagrams are typical for many programmable controller interface applications. Modules may also be used to signal TTL. CMOS, relays or solenoids within rated electrical specifications.

NOTE: For single applications where four outputs are desired, install a jumper between terminals 4 & 5.

MODEL 9800-01-0300
NPN (SINK)



MODEL 9800-01-0400
PNP (SOURCE)



All dimensions are reference only unless specifically toleranced.

BENEFITS & DIMENSIONS: *BRACKETS FOR NFPA CYLINDERS*

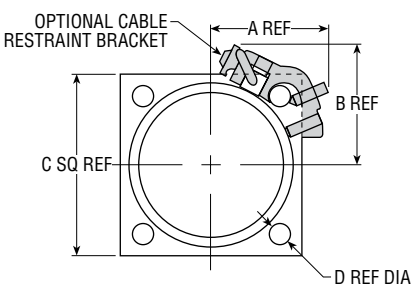
BENEFITS

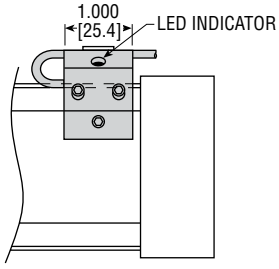
- Allows PHD Series 1750 Reed and Hall Effect Switches to be mounted to 1-1/2" [38.1 mm] to 8" [203.2 mm] bore NFPA Cylinders.
- The brackets' flexible design means only two brackets are required to cover 8 sizes of NFPA Cylinders.
- The extruded aluminum bracket attaches securely to a single tierod and does not allow the switch to pull away from the cylinder barrel.
- The low profile of the switch and bracket saves space and provides additional mounting flexibility.
- Optional strain relief clamp may be used to protect the switch cable from damage at the switch due to flexing.

PHD SWITCH MODELS		NFPA CYLINDER BORE	SWITCH BRACKET NUMBER	STRAIN RELIEF BRACKET
PART NO.	DESCRIPTION			
17509-3-06	AC Reed	1-1/2, 2, 2-1/2, 3-1/4, & 4	17000-51-0	18412
17502-2-06	DC Reed			
17529-3	AC Reed, Quick Connect			
17522-2	DC Reed, Quick Connect			
17503-2-06	Hall Effect NPN (Sink)	5, 6, & 8	17000-57-0	18412
17504-2-06	Hall Effect PNP (Source)			
17523-2	Hall Effect NPN (Sink), Quick Connect			
17524-2	Hall Effect PNP (Source), Quick Connect			

See pages 9-16 to 9-18 for switch information. NFPA cylinder must have the proper magnetic piston for the PHD Switches to function correctly.

17000-xx-0 NFPA SWITCH BRACKET
18412 CABLE RESTRAINT KIT





PHD SWITCH MODELS

DESCRIPTION	PART NO.
DC Reed NPN/PNP (White)	17502-2-06
AC Reed (Green)	17509-3-06
Solid State NPN (Yellow)	17503-2-06
Solid State PNP (Red)	17504-2-06

BORE SIZE	LETTER DIMENSION			
	A	B	C	D
1-1/2	1.375	1.500	2.000	.250
2	1.500	1.750	2.500	.312
2-1/2	1.750	1.875	3.000	.312
3-1/4	2.000	2.187	3.750	.375
4	2.375	2.500	4.500	.375
5	3.000	3.125	5.500	.500
6	3.375	3.375	6.500	.500
8	4.000	4.125	8.500	.625

product index

(BY ORDERING DATA CODES)

All dimensions are reference only unless specifically toleranced.

PHD is represented in over 45 countries around the world, so you'll be sure to receive the service, delivery, and local support your business deserves.

Contact PHD for the location of your nearest distributor. Or check our website's distributor location guide. Finding your distributor is as easy as keying in a zip code.

www.phdinc.com
1-800-624-8511

corporate offices

To meet the needs of the global market, corporate offices are located in the U.S.A. and Germany. PHD also offers some product catalogs in Spanish, German, French, and Italian.

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