HEAVY DUTY PNEUMATIC AND HYDRAULIC ROTARY ACTUATOR

Major Benefits
- Heavy duty
- Wide variety of options and accessories
- Versatile design
- High torque

OUTPUT TORQUES TO 31,800 in-lb [3595 Nm]
ORDERING DATA: SERIES 1000-8000 ROTARY ACTUATORS

UNITS WITH IMPERIAL SHAFTS AND KEYWAY

TO ORDER SPECIFY:
Type, Design No., Series, Angle of Rotation, and Options.

SERIES
1 (000) 1” Bore Single Rack
2 (000) 1” Bore Double Rack
3 (000) 1-3/8” Bore Single Rack
4 (000) 2” Bore Single Rack
5 (000) 2” Bore Double Rack
6 (000) 3” Bore Single Rack
7 (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)

DESIGN NO.
1 - Imperial
2 - Metric
3 - Metric - Ports and mounting are metric.
Pinion shafts and keyway are imperial.
4 - Metric Complete

R1 1 A 2 180 - P - D - A - K-M-V

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

STANDARD OPTIONS
E - Magnetic Piston for Solid State Switch
I - Port Position 1 on top rack
Port Position 3 on bottom rack
(Magnetic Piston for Reed Switch)
M - Magnetic Piston for Reed Switch
R - Clockwise Unidirectional Clutch
S - SAE Ports (Hydraulic Design 1 Units Only)

ANGLE ADJUSTMENT
STANDARD ANGLES
45°, 90°, 180°, 270°, 360°, and 450°
For other available rotations, consult PHD.

FLUID MEDIA
A - Pneumatic
H - Hydraulic

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°
K - Preload Keyway Pinion Shaft (required for use with hub adaptor)
L - Counterclockwise Unidirectional Clutch
M - Magnetic Piston for Reed Switch
N - Pilot Valve Actuator (PUA)
R - Clockwise Unidirectional Clutch
S - SAE Ports (Hydraulic Design 1 Units Only)

OPTIONS MAY AFFECT UNIT LENGTH. SEE DIMENSIONAL PAGES AND OPTION INFORMATION DETAILS.

TO ORDER SPECIFY:
Type, Design No., Series, Angle of Rotation, and Options.

PHDV2

NOTES:
1) Sensor must be used with a PHD Set Point Module. See Switches and Sensors section for information and ordering data.
2) Mounting ranges must be ordered separately.
3) SAE Ports available. Consult PHD for sizes.

PHDV2

1000-8000

RH40W

SWITCH BRACKETS

SERIES                   PART NO.
1000 & 2000            17000-32-5
3000 & 4000            17000-34-5
5000 & 6000            17000-38-0
7000 & 8000            17000-39-0

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

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

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.

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

NOTES:
1) Sensor must be used with a PHD Set Point Module. See Switches and Sensors section for information and ordering data.
2) Mounting ranges must be ordered separately.
3) SAE Ports available. Consult PHD for sizes.

PHDV2

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17503-2-06      Yellow    NPN (Sink) Type 4.5-24 VDC, 6 foot cable
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17524-2         Red       PNP (Source) Type 4.5-24 VDC, Quick Connect

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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

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.

SERIES 1750 REED SWITCHES

PART NO.      DESCRIPTION
17502-2-06    White NPN (Sink) or PNP (Source) 4.5-24 VDC, 6 foot cable
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SET POINT MODULE

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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.

SERIES 1750 SOLID STATE SWITCHES

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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.
### Engineering Data: Series 1000-8000 Rotary Actuators

#### Specifications

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<th>Size</th>
<th>Base Weight (lb)</th>
<th>Adder Weight (lb)</th>
<th>Diameter (in)</th>
<th>Displacement (cm³)</th>
<th>Theoretical Torque (N·m/bar)</th>
<th>Max Axial Torque (lb·in)</th>
<th>Max Radial Torque (lb)</th>
<th>Max Axial Torque (N)</th>
<th>Max Radial Torque (N)</th>
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#### 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.

### Mounting Flange (Hardware Included)

#### Bottom Mounting Flange

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<thead>
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<th>Letter Dimension</th>
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<tr>
<td>7000 &amp; 8000</td>
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**NOTE:** **All hydraulic ratings are based on non-shock hydraulic service.**
DIMENSIONS: SERIES 1000-8000 ROTARY ACTUATORS

1000-8000
www.phdinc.com/18000r  •  (800) 624-8511

DIMENSIONS: SERIES 1000-8000 ROTARY ACTUATORS
METRIC NUMBERS ARE FOR METRIC UNITS AND ARE IN mm.

* BOTH IMPERIAL AND METRIC SHAFT OPTIONS AVAILABLE ON METRIC BODY MTG. HOLES:

SHAFT KEYWAY: SHOWN AT MID-ROTATION PORT POSITION: INDICATED BY CIRCLED NUMBERS
TUBES III & IV: INCLUDED ON SERIES 1000, 3000, 5000, & 7000 ONLY
MTG. HOLES: CENTERED ON CENTERLINE OF ACTUATOR BODY CUSHIONS: SERIES 1800-2000 ACTUATORS

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

OPTION LOCATION REFERENCE
PORT & NEEDLE LOCATIONS REFERENCED BY CIRCLED NUMBERS

OPTION LOCATION REFERENCE
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OPTION LOCATION REFERENCE
PORT & NEEDLE LOCATIONS REFERENCED BY CIRCLED NUMBERS

* 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.

* Dimensions calculated using plain cap style. Add .250 to dimension for each -A style cap used on Series 1000/2000 only.

* Dimensions calculated using plain cap style. Add 6.3 to dimension for each -A style cap used on Series 1000/2000 only.

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

All dimensions are reference only unless specifically tolerated.

www.phdinc.com/18000r  •  (800) 624-8511
OPTIONS: SERIES 1000-8000 ROTARY ACTUATORS

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.

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°.

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.

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.

K PRELOADED KEYWAY SHAFT

Not available on Rx6x

Required when use with hub adaptor is desired.

C CROSS KEY SHAFT

Not available on Rx6x

H HOLLOW SHAFT

Not available on Rx6x

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.

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

Refer to this product’s online catalog in the product section for complete information including related dimensions and additional specifications. See link at bottom of this page.
OPTIONS: SERIES 1000-8000 ROTARY ACTUATORS

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.

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.

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.

SENSOR/SET POINT MODULE

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.

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.

COUNTERCLOCKWISE UNIDIRECTIONAL CLUTCH

Not available on Rx6x or 7/8000 units
Output hub will only rotate in counterclockwise direction at specific rotation ordered.

CLOCKWISE UNIDIRECTIONAL CLUTCH

Not available on Rx6x or 7/8000 units
Output hub will only rotate in clockwise direction at specific rotation ordered.

PILOT VALVE ACTUATOR

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.

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.

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.

PORTS POSITION 1
(N/A on 2, 4, 6, and 8000 units)

PORTS POSITION 3
(N/A on 2, 4, 6, and 8000 units)

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.

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

Refer to this product’s online catalog in the product section for complete information including related dimensions and additional specifications. See link at bottom of this page.
OPTIONS: SERIES 1000-8000 ROTARY ACTUATORS

PORT CONTROL®
• BOTH DIRECTIONS

PORT CONTROL®
• CLOCKWISE

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.

ADJUSTABLE CUSHIONS
• BOTH DIRECTIONS

ADJUSTABLE CUSHIONS
• CLOCKWISE

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.

ANGLE ADJUSTMENT
• BOTH DIRECTIONS

ANGLE ADJUSTMENT
• CLOCKWISE

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°.

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.

<table>
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<th>SERIES</th>
<th>LETTER DIMENSION</th>
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NUMBERS IN [ ] ARE FOR METRIC UNITS AND ARE IN mm.

All dimensions are reference only unless specifically toleranced.

www.phdinc.com/18000r  • (800) 624-8511
**OPTIONS: SERIES 1000-8000 ROTARY ACTUATORS**

**SHOCK PADS**

**BOTH DIRECTIONS**

**SHOCK PADS CLOCKWISE**

**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.

**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.

**OPTIONS: SERIES 1000-8000 ROTARY ACTUATORS**

**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.

**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.
OPTIONS: SERIES 1000-8000 ROTARY ACTUATORS

BASIC SHAFT DIMENSIONS: R1xx and R2xx

PRELOADED KEYWAY SHAFT
Not available on Rx6x

CROSS KEY SHAFT
Not available on Rx6x

HOLLOW SHAFT
Not available on Rx6x

All dimensions are reference only unless specifically tolerated.

www.phdinc.com/18000r  •  (800) 624-8511
OPTIONS: SERIES 1000-8000 ROTARY ACTUATORS

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.

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.

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 SOLID STATE SWITCHES

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<tr>
<th>PART NO.</th>
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<th>DESCRIPTION</th>
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<td>17503-2-06</td>
<td>Yellow</td>
<td>NPN (Sink) Type 4.5-24 VDC, 6 foot cable</td>
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<tr>
<td>17504-2-06</td>
<td>Red</td>
<td>PNP (Source) Type 4.5-24 VDC, 6 foot cable</td>
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<td>17523-2</td>
<td>Yellow</td>
<td>NPN (Sink) Type 4.5-24 VDC, Quick Connect</td>
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<tr>
<td>17524-2</td>
<td>Red</td>
<td>PNP (Source) Type 4.5-24 VDC, Quick Connect</td>
</tr>
</tbody>
</table>

SERIES 1750 REED SWITCHES

<table>
<thead>
<tr>
<th>PART NO.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>17502-2-06</td>
<td>White NPN (Sink) or PNP (Source) 4.5-24 VDC, 6 foot cable</td>
</tr>
<tr>
<td>17509-3-06</td>
<td>Green AC Type 110-120 VAC with Current Limit, 6 foot cable</td>
</tr>
<tr>
<td>17522-2</td>
<td>White NPN (Sink) or PNP (Source) 4.5-24 VDC, Quick Connect</td>
</tr>
<tr>
<td>17529-3</td>
<td>Green AC Type 110-120 VAC, Quick Connect with Current Limit</td>
</tr>
</tbody>
</table>

SWITCH BRACKETS

<table>
<thead>
<tr>
<th>SERIES</th>
<th>PART NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000 &amp; 2000</td>
<td>17000-32-5</td>
</tr>
<tr>
<td>3000 &amp; 4000</td>
<td>17000-34-5</td>
</tr>
<tr>
<td>5000 &amp; 6000</td>
<td>17000-38-0</td>
</tr>
<tr>
<td>7000 &amp; 8000</td>
<td>17000-39-0</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>PART NO.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>9800-01-0300</td>
<td>NPN (Sink) 4.5-24 VDC</td>
</tr>
<tr>
<td>9800-01-0400</td>
<td>PNP (Source) 4.5-24 VDC</td>
</tr>
</tbody>
</table>

See Switches and Sensors section for information.
OPTIONS: SERIES 1000-8000 ROTARY ACTUATORS

COUNTERCLOCKWISE UNIDIRECTIONAL CLUTCH
Not available on Rx6x or 7/8000 units
Output hub will only rotate in counterclockwise direction at specific rotation ordered.

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.

PILOT VALVE ACTUATOR
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.

All dimensions are reference only unless specifically tolerated.

www.phdinc.com/18000r • (800) 624-8511
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 the same position as ports.

**PORT POSITION 1 TOP 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 ports on the “Top” and “Bottom” sides of the actuator.

**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.

**PORTS POSITION 1**

(N/A on 2, 4, 6, and 8000 units)

This option positions the ports in position 1.

**PORTS POSITION 4**

This option positions the ports in position 4. This allows access to ports from the back.

**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.

**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.

**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.
SAE PORTS FOR HYDRAULIC FLUID
Not available on Rx5x, 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.

<table>
<thead>
<tr>
<th>SERIES</th>
<th>PORT SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000 &amp; 2000</td>
<td>7/16 - 20 SAE</td>
</tr>
<tr>
<td>3000 &amp; 4000</td>
<td>7/16 - 20 SAE</td>
</tr>
<tr>
<td>5000 &amp; 6000</td>
<td>9/16 - 18 SAE</td>
</tr>
<tr>
<td>7000 &amp; 8000</td>
<td>3/4 - 16 SAE</td>
</tr>
</tbody>
</table>

All dimensions are reference only unless specifically tolerated.

www.phdinc.com/18000r • (800) 624-8511
2000-8000
air/oil tandem

ROTARY ACTUATOR

Major Benefits

• Smooth rotation throughout rotation
• Controlled velocity

OUTPUT TORQUES TO 1,590 in-lb [179 Nm]
**ORDERING DATA: AIR/OIL TANDEM ROTARY ACTUATORS**

**UNITS WITH IMPERIAL SHAFTS AND KEYWAY**
To order specify:
- Type, Design No., Series,
- Angle of Rotation, and Options.

**3 ROTARY POSITIONS**
Use this digit for 3 Position Tandems only.
- 3 - Imperial - Ports and mounting holes are imperial
- 8 - Metric - Ports and mounting holes are metric
- 9 - Metric Complete

**DESIGN NO.**
- 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
- 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

**PORT CONTROL**
- BUILT-IN METER OUT
- FLOW CONTROL VALVE
  Port Control is standard on all Air/Oil Tandem Actuators.

**SERIES 1750 SOLID STATE SWITCHES**

<table>
<thead>
<tr>
<th>PART NO.</th>
<th>COLOR</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>17503-2-06</td>
<td>Yellow</td>
<td>NPN (Sink) Type 4.5-24 VDC, 6 foot cable</td>
</tr>
<tr>
<td>17504-2-06</td>
<td>Red</td>
<td>PNP (Source) Type 4.5-24 VDC, 6 foot cable</td>
</tr>
<tr>
<td>17523-2</td>
<td>Yellow</td>
<td>NPN (Sink) Type 4.5-24 VDC, Quick Connect</td>
</tr>
<tr>
<td>17524-2</td>
<td>Red</td>
<td>PNP (Source) Type 4.5-24 VDC, Quick Connect</td>
</tr>
</tbody>
</table>

**NOTES:**
- Switches and Sensors section for additional switch information and complete specification.
- Switches must be ordered separately.

**SERIES 1750 REED SWITCHES**

<table>
<thead>
<tr>
<th>PART NO.</th>
<th>COLOR</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>17502-2-06</td>
<td>White</td>
<td>NPN (Sink) or PNP (Source) 4.5-24 VDC, 6 foot cable</td>
</tr>
<tr>
<td>17509-3-06</td>
<td>Green</td>
<td>AC Type 110-120 VAC with Current Limit, 6 foot cable</td>
</tr>
<tr>
<td>17522-2</td>
<td>White</td>
<td>NPN (Sink) or PNP (Source) 4.5-24 VDC, Quick Connect</td>
</tr>
<tr>
<td>17529-3</td>
<td>Green</td>
<td>AC Type 110-120 VAC, Quick Connect with Current Limit</td>
</tr>
</tbody>
</table>

**SET POINT MODULE**

<table>
<thead>
<tr>
<th>PART NO.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>9800-01-0300</td>
<td>NPN (Sink) 4.5-24 VDC</td>
</tr>
<tr>
<td>9800-01-0400</td>
<td>PNP (Source) 4.5-24 VDC</td>
</tr>
</tbody>
</table>

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

**Powered by Designer’s Resource myphd**

www.phdinc.com/28000r • (800) 624-8511
ENGINEERING DATA: AIR/OIL TANDEM ROTARY ACTUATORS

<table>
<thead>
<tr>
<th>SIZE</th>
<th>WEIGHT BASE lb</th>
<th>WEIGHT ADDER lb</th>
<th>DIAMETER in</th>
<th>DISPLACEMENT DEG  VOLUME cm³/deg in-lb/psi</th>
<th>THEORETICAL TORQUE lb in</th>
<th>OUTPUT speed deg/sec</th>
<th>MAX SPEED AT 80 psi deg/sec</th>
<th>MAX AXIAL BEARING LOAD lb</th>
<th>MAX RADIAL BEARING LOAD lb</th>
<th>DISTANCE BETWEEN SHAFT BEARINGS mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>2(000)</td>
<td>4.5</td>
<td>2.0</td>
<td>1.00</td>
<td>.007</td>
<td>.39</td>
<td>366°</td>
<td>120</td>
<td>300</td>
<td>1334</td>
<td>1.375</td>
</tr>
<tr>
<td>4(000)</td>
<td>11.5</td>
<td>5.2</td>
<td>1.375</td>
<td>.019</td>
<td>1.11</td>
<td>348°</td>
<td>240</td>
<td>600</td>
<td>2669</td>
<td>2.188</td>
</tr>
<tr>
<td>6(000)</td>
<td>18.1</td>
<td>8.2</td>
<td>2.00</td>
<td>.041</td>
<td>.672</td>
<td>216°</td>
<td>370</td>
<td>925</td>
<td>4114</td>
<td>2.235</td>
</tr>
<tr>
<td>8(000)</td>
<td>41.0</td>
<td>18.6</td>
<td>3.00</td>
<td>.185</td>
<td>3.032</td>
<td>156°</td>
<td>800</td>
<td>2000</td>
<td>8896</td>
<td>3.750</td>
</tr>
</tbody>
</table>

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.

MOUNTING FLANGE (HARDWARE INCLUDED)

3-POSITION MID-POSITION TOLERANCES & BACKLASH

<table>
<thead>
<tr>
<th>SERIES</th>
<th>TOLERANCE</th>
<th>BACKLASH</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>±1°</td>
<td>±0° 30°</td>
</tr>
<tr>
<td>4000 &amp; 6000</td>
<td>±0° 30'</td>
<td>±0° 30'</td>
</tr>
<tr>
<td>8000</td>
<td>±0° 15'</td>
<td>±0° 15'</td>
</tr>
</tbody>
</table>

BOTTOM MOUNTING FLANGE

<table>
<thead>
<tr>
<th>SERIES</th>
<th>KIT NO.</th>
<th>LETTER DIMENSION</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>13756</td>
<td>A 216 C 348 D 70</td>
</tr>
<tr>
<td>4000</td>
<td>13757</td>
<td>A 216 C 348 D 70</td>
</tr>
<tr>
<td>6000</td>
<td>13758</td>
<td>A 216 C 348 D 70</td>
</tr>
<tr>
<td>8000</td>
<td>13760</td>
<td>A 216 C 348 D 70</td>
</tr>
</tbody>
</table>

SIDE MOUNTING FLANGE

<table>
<thead>
<tr>
<th>SERIES</th>
<th>KIT NO.</th>
<th>LETTER DIMENSION</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>13759</td>
<td>A 216 C 348 D 70</td>
</tr>
<tr>
<td>4000</td>
<td>13760</td>
<td>A 216 C 348 D 70</td>
</tr>
<tr>
<td>6000</td>
<td>13761</td>
<td>A 216 C 348 D 70</td>
</tr>
<tr>
<td>8000</td>
<td>13762</td>
<td>A 216 C 348 D 70</td>
</tr>
</tbody>
</table>

Sizing & Application Assistance

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

**Reservoir Assembly** is included with unit. Series 2000, 4000, & 8000 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.*

<table>
<thead>
<tr>
<th>Reservoir Part No.</th>
<th>AB</th>
<th>AC</th>
<th>AD</th>
<th>AE</th>
<th>AF</th>
</tr>
</thead>
<tbody>
<tr>
<td>13459-02-2</td>
<td>.647</td>
<td>2.500</td>
<td>5.500</td>
<td>5.125</td>
<td>2.331</td>
</tr>
<tr>
<td>13459-02-3</td>
<td>.545</td>
<td>1.500</td>
<td>3.875</td>
<td>3.500</td>
<td>1.331</td>
</tr>
</tbody>
</table>

---

**Dimensions: Air/Oil Tandem Rotary Actuators**

<table>
<thead>
<tr>
<th>Series</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000-8000</td>
<td>Air/Oil Tandem</td>
</tr>
</tbody>
</table>

---

**Reservoir Assembly Reference**

- **TANK DIMENSIONS**
- **RESERVOIR DIMENSIONS**
- **SERIES 2000, 4000, & 6000 UNITS USE PART NO. 13459-03-2.**
- **SERIES 8000 UNITS USE PART NO. 13459-02-2.**

---

**Option Location Reference**

- **Cap Style**
  - Plain
  - Both

---

**Shaft Keyway**:

- Shown at mid-rotation

**Port Location**:

- Indicated by circled numbers

**Mounting Holes**:

- Centered on centerline of actuator body

---

**Quick Reference for: A - (T x B)**

<table>
<thead>
<tr>
<th>Series</th>
<th>Degree of Rotation</th>
</tr>
</thead>
<tbody>
<tr>
<td>8000</td>
<td>13.468 15.808 20.448 25.168 29.848 34.528</td>
</tr>
</tbody>
</table>

*Dimensions calculated using plain cap style. Add .250 to dimension for each -A style cap used on Series 2000 only.*
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.
Note: The reservoir should have 20 psi pressure at all times to ensure the system remains purged.

All dimensions are reference only, unless specifically tolerated.

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
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.

All dimensions are reference only unless specifically tolerated.

LETTER DIMENSION

<table>
<thead>
<tr>
<th>SERIES</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>FA</th>
<th>GA</th>
<th>H</th>
<th>JA</th>
<th>KA</th>
<th>L</th>
<th>LB</th>
<th>M</th>
<th>NB</th>
<th>O</th>
<th>PA</th>
<th>Q</th>
<th>R</th>
<th>S</th>
<th>TA</th>
<th>U1</th>
<th>U2</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>76</td>
<td>51</td>
<td>38.1</td>
<td>13</td>
<td>13</td>
<td>19</td>
<td>19</td>
<td>0</td>
<td>19</td>
<td>35</td>
<td>36</td>
<td>73.0</td>
<td>44.5</td>
<td>M6 x 1.0 x 8</td>
<td>28.58 x 1.4 DP</td>
<td>50.8</td>
<td>22</td>
<td>50.8</td>
<td>13</td>
<td>6</td>
<td>38.1</td>
</tr>
<tr>
<td>4000</td>
<td>108</td>
<td>76</td>
<td>50.8</td>
<td>9</td>
<td>10</td>
<td>17</td>
<td>18</td>
<td>6</td>
<td>29</td>
<td>48</td>
<td>53</td>
<td>106.4</td>
<td>69.9</td>
<td>M8 x 1.25 x 12</td>
<td>50.80 x 1.0 DP</td>
<td>76.2</td>
<td>48</td>
<td>76.2</td>
<td>16</td>
<td>13</td>
<td>50.8</td>
</tr>
<tr>
<td>6000</td>
<td>127</td>
<td>102</td>
<td>63.5</td>
<td>10</td>
<td>19</td>
<td>18</td>
<td>5</td>
<td>29</td>
<td>57</td>
<td>58</td>
<td>119.1</td>
<td>69.9</td>
<td>M10 x 1.5 x 16</td>
<td>55.00 x 1.3 DP</td>
<td>76.2</td>
<td>48</td>
<td>88.9</td>
<td>19</td>
<td>13</td>
<td>50.8</td>
<td>3</td>
</tr>
<tr>
<td>8000</td>
<td>203</td>
<td>127</td>
<td>76.2</td>
<td>12</td>
<td>12</td>
<td>24</td>
<td>27</td>
<td>11</td>
<td>48</td>
<td>99</td>
<td>92</td>
<td>155.6</td>
<td>76.2</td>
<td>M20 x 2.5 x 32</td>
<td>85.00 x 3.0 DP</td>
<td>127.0</td>
<td>89</td>
<td>127.0</td>
<td>38</td>
<td>32</td>
<td>63.5</td>
</tr>
</tbody>
</table>

IMPERIAL SHAFTS*

- D1: 4.75 x 2.36 x 38
- D2: 5.15 x 2.5 x 15
- D3: 5.625 x 3.125 x 38
- D4: 6.000 x 3.500 x 38
- D5: 6.250 x 3.750 x 38
- D6: 7.000 x 4.000 x 38

METRIC SHAFTS*

- D1: 12.00/11.97
- D2: 22.00/21.96
- D3: 28.58/28.55
- D4: 44.42/44.4
- D5: 12.69/12.71
- D6: 29.29/29.29

* 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

<table>
<thead>
<tr>
<th>ACTUATOR TYPE</th>
<th>LETTER OPTION REFERENCED BY TUBE NUMBER</th>
<th>PORT &amp; NEEDLE LOCATIONS REFERENCED BY CIRCLED NUMBERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>3R1xR &amp; 3R2xR</td>
<td>STANDARD</td>
<td>STANDARD</td>
</tr>
<tr>
<td></td>
<td>I &amp; III, I &amp; II</td>
<td>I &amp; III, I &amp; II</td>
</tr>
<tr>
<td></td>
<td>PORT - P, PORT - D</td>
<td>PORT - D, PORT - P</td>
</tr>
<tr>
<td></td>
<td>PORT - P, PORT - D</td>
<td>PORT - D, PORT - P</td>
</tr>
</tbody>
</table>

SHAF 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 tolerated.
ELECTROLESS NICKEL PLATING

Electroless nickel plating is done on all externally exposed ferrous parts except the pinion shaft.

MAGNETIC PISTON FOR USE WITH PHD PROXIMITY SWITCHES

See engineering data page for Hydraulic Pressure Ratings with these options. Switches and brackets must be ordered separately.

SOLID STATE SWITCHES

Series 2000-8000 Rotary Actuators may be equipped with a magnetic band on the pistons which activates externally mounted PHD Switches.

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 on the pistons activates the externally mounted PHD Reed Switches.

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.

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.

PORTS POSITION 4

See engineering data page for Hydraulic Pressure Ratings with these options. Switches and brackets must be ordered separately.
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.

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.

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°.

Shaft seal covers are 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.
OPTIONS: AIR/OIL TANDEM ROTARY ACTUATORS

BASIC SHAFT DIMENSIONS: R1xR and R2xR

PHDV2

PRELOADED KEYWAY SHAFT
Not available on Rx9R

Required when use of hub adaptor is desired.

CROSS KEY SHAFT
Not available on Rx9R

HOLLOW SHAFT
Not available on Rx9R

All dimensions are reference only unless specifically toleranced.

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

**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 SOLID STATE SWITCHES**

<table>
<thead>
<tr>
<th>PART NO.</th>
<th>COLOR</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>17503-2-06</td>
<td>Yellow</td>
<td>NPN (Sink) Type 4.5-24 VDC, 6 foot cable</td>
</tr>
<tr>
<td>17504-2-06</td>
<td>Red</td>
<td>PNP (Source) Type 4.5-24 VDC, 6 foot cable</td>
</tr>
<tr>
<td>17523-2</td>
<td>Yellow</td>
<td>NPN (Sink) Type 4.5-24 VDC, Quick Connect</td>
</tr>
<tr>
<td>17524-2</td>
<td>Red</td>
<td>PNP (Source) Type 4.5-24 VDC, Quick Connect</td>
</tr>
</tbody>
</table>

**SWITCH BRACKETS**

<table>
<thead>
<tr>
<th>SERIES</th>
<th>PART NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>17000-32-5</td>
</tr>
<tr>
<td>4000</td>
<td>17000-34-5</td>
</tr>
<tr>
<td>6000</td>
<td>17000-38-0</td>
</tr>
<tr>
<td>8000</td>
<td>17000-39-0</td>
</tr>
</tbody>
</table>

**SERIES 1750 REED SWITCHES**

<table>
<thead>
<tr>
<th>PART NO.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>17502-2-06</td>
<td>White NPN (Sink) or PNP (Source) 4.5-24 VDC, 6 foot cable</td>
</tr>
<tr>
<td>17509-3-06</td>
<td>Green AC Type 110-120 VAC with Current Limit, 6 foot cable</td>
</tr>
<tr>
<td>17522-2</td>
<td>White NPN (Sink) or PNP (Source) 4.5-24 VDC, Quick Connect</td>
</tr>
<tr>
<td>17529-3</td>
<td>Green AC Type 110-120 VAC, Quick Connect with Current Limit</td>
</tr>
</tbody>
</table>

**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**

<table>
<thead>
<tr>
<th>PART NO.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>9800-01-0300</td>
<td>NPN (Sink) 4.5-24 VDC</td>
</tr>
<tr>
<td>9800-01-0400</td>
<td>PNP (Source) 4.5-24 VDC</td>
</tr>
</tbody>
</table>

See Switches and Sensors section for information.

All dimensions are reference only unless specifically tolerated.

www.phdinc.com/28000r  ·  (800) 624-8511
OPTIONS: AIR/OIL TANDEM ROTARY ACTUATORS

COUNTERCLOCKWISE UNIDIRECTIONAL CLUTCH
Not available on Rx9R or 7/8000
Output hub will only rotate in counterclockwise direction at specific rotation ordered.

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.

All dimensions are reference only unless specifically tolerated.

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

**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.

**PORT POSITION 4**

This option positions the ports in position 4 on tubes I and III.

**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.

**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.

**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.

**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.

All dimensions are reference only unless specifically tolerated.

www.phdinc.com/28000r • (800) 624-8511
**2000-8000 multi-position**

**Pneumatic and Hydraulic Rotary Actuator**

**Major Benefits**

- Three, four, or five rotary positions

---

**4 Position Unit**

- 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
- High strength alloy steel racks and pinions ensure long life
- Heavy duty sealed ball bearings ensure shaft stability under heavy and high impact loading
- Angle adjustments are standard
- 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

---

Visit [www.phdinc.com/multir](http://www.phdinc.com/multir) • Call (800) 624-8511
ORDERING DATA: MULTI-POSITION ROTARY ACTUATORS

TO ORDER SPECIFY:
No. of Rotary Positions, Type, Design No., Fluid Media, Series, and Options.

<table>
<thead>
<tr>
<th>NO. OF ROTARY POSITIONS</th>
<th>DESIGN NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 - 3 Position</td>
<td>1 - Imperial</td>
</tr>
<tr>
<td>4 - 4 Position</td>
<td>5 - Metric - Port and mounting metric. Pinion and keyways are imperial.</td>
</tr>
<tr>
<td>5 - 5 Position</td>
<td>6 - Metric Complete</td>
</tr>
</tbody>
</table>

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
- 45

ANGLE OF ROTATION FROM POSITION I TO POSITION III. USED ON 4 & 5 POSITION ONLY.
- 90

ANGLE OF ROTATION FROM POSITION I TO POSITION IV. USED ON 5 POSITION ONLY.
- 135

TYPE
- R1 - Single Shaft
- R2 - Double Shaft

FLUID MEDIA
- A - Pneumatic
- H - Hydraulic

TOTAL ANGLE OF ROTATION

STANDARD ANGLES

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 dimensional pages and option information details.

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

SERIES 1750 SOLID STATE SWITCHES

<table>
<thead>
<tr>
<th>PART NO.</th>
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NOTE: See Switches and Sensors section for additional switch information and complete specification. Switches must be ordered separately.

SERIES 1750 REED SWITCHES

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<td>Green AC Type 110-120 VAC, Quick Connect with Current Limit</td>
</tr>
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SWITCH BRACKETS

<table>
<thead>
<tr>
<th>SERIES</th>
<th>SERIES 1750 SWITCH</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>17000-32-5</td>
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<tr>
<td>4000</td>
<td>17000-34-5</td>
</tr>
<tr>
<td>6000</td>
<td>17000-38-0</td>
</tr>
<tr>
<td>8000</td>
<td>17000-39-0</td>
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</table>

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</tbody>
</table>

See Switches and Sensors section for information.

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

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

<table>
<thead>
<tr>
<th>HYD SERIES</th>
<th>OPTION psi [bar]</th>
<th>MAX PRESSURE RATING</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>-</td>
<td>8000, 6000, 4000</td>
</tr>
<tr>
<td>4000</td>
<td>-</td>
<td>8000, 6000, 4000</td>
</tr>
<tr>
<td>6000</td>
<td>-</td>
<td>8000, 6000, 4000</td>
</tr>
<tr>
<td>8000</td>
<td>-</td>
<td>8000, 6000, 4000</td>
</tr>
</tbody>
</table>

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.

### BACKLASH & INTERMEDIATE POSITION TOLERANCES

<table>
<thead>
<tr>
<th>SERIES</th>
<th>ROTATIONAL TOLERANCE</th>
<th>BACKLASH</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>±1°</td>
<td>0°</td>
</tr>
<tr>
<td>4000 &amp; 6000</td>
<td>±0° 30'</td>
<td>1° 15'</td>
</tr>
</tbody>
</table>

*° Backlash and Intermediate Position Tolerances (measured at centers of backlash).

### MOUNTING FLANGE (HARDWARE INCLUDED)

Sizing & Application Assistance

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

**Backlash & Intermediate Position Tolerances**

<table>
<thead>
<tr>
<th>SERIES</th>
<th>ROTATIONAL TOLERANCE</th>
<th>BACKLASH</th>
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<tbody>
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<td>±1°</td>
<td>0°</td>
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<tr>
<td>4000 &amp; 6000</td>
<td>±0° 30'</td>
<td>1° 15'</td>
</tr>
</tbody>
</table>

*° Backlash and Intermediate Position Tolerances (measured at centers of backlash).
### Dimensions: 3 Position Rotary Actuators

<table>
<thead>
<tr>
<th>CAP STYLE</th>
<th>SERIES</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>JA</th>
<th>KA</th>
<th>L</th>
<th>M</th>
<th>NB</th>
<th>O</th>
<th>PA</th>
<th>Q</th>
<th>R</th>
<th>S</th>
<th>TA</th>
<th>U</th>
<th>V</th>
<th>W</th>
<th>X</th>
<th>Y</th>
<th>Z</th>
<th>ZA</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLAIN</td>
<td>2000</td>
<td>6.598</td>
<td>0.174</td>
<td>3.000</td>
<td>2.000</td>
<td>1.500</td>
<td>0.250</td>
<td>0.500</td>
<td>0.00</td>
<td>0.750</td>
<td>1.375</td>
<td>1.437</td>
<td>1/4-20 x 3</td>
<td>312</td>
<td>0.498</td>
<td>0.503</td>
<td>1/8 x 1/16 x 0.625</td>
<td>1/8</td>
<td>2.284</td>
<td>0.087</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>A</td>
<td>2000</td>
<td>6.188</td>
<td>0.174</td>
<td>3.000</td>
<td>2.000</td>
<td>1.500</td>
<td>0.250</td>
<td>0.500</td>
<td>0.00</td>
<td>0.750</td>
<td>1.375</td>
<td>1.437</td>
<td>1/4-20 x 3</td>
<td>312</td>
<td>0.498</td>
<td>0.503</td>
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<td>1/8</td>
<td>3.099</td>
<td>0.087</td>
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<tr>
<td>BOTH</td>
<td>4000</td>
<td>7.706</td>
<td>0.026</td>
<td>4.250</td>
<td>3.000</td>
<td>2.000</td>
<td>0.344</td>
<td>0.688</td>
<td>0.250</td>
<td>1.156</td>
<td>1.875</td>
<td>2.094</td>
<td>5/16-18 x 0.500</td>
<td>2.000</td>
<td>0.039</td>
<td>0.057</td>
<td>0.625 x 0.250</td>
<td>1.500</td>
<td>0.062</td>
<td>0.874</td>
<td>0.875</td>
<td>3/16 x 3/32 x 1.500</td>
<td>1/4</td>
<td>3.953</td>
<td>0.13</td>
<td>1.500</td>
<td></td>
</tr>
<tr>
<td>BOTH</td>
<td>6000</td>
<td>9.125</td>
<td>0.026</td>
<td>5.000</td>
<td>4.000</td>
<td>2.500</td>
<td>0.375</td>
<td>0.750</td>
<td>0.203</td>
<td>1.156</td>
<td>2.250</td>
<td>2.281</td>
<td>3/8-16 x 0.625</td>
<td>2.1654</td>
<td>0.052</td>
<td>0.075</td>
<td>0.625 x 0.250</td>
<td>2.000</td>
<td>0.057</td>
<td>1.124</td>
<td>1.125</td>
<td>0.625 x 0.250</td>
<td>1/4</td>
<td>4.563</td>
<td>0.13</td>
<td>1.875</td>
<td></td>
</tr>
<tr>
<td>BOTH</td>
<td>8000</td>
<td>12.160</td>
<td>0.052</td>
<td>8.000</td>
<td>5.000</td>
<td>3.000</td>
<td>0.463</td>
<td>1.062</td>
<td>0.437</td>
<td>1.875</td>
<td>3.000</td>
<td>3.000</td>
<td>3/4-10 x 0.500</td>
<td>3.3463</td>
<td>0.120</td>
<td>0.500</td>
<td>0.625 x 0.250</td>
<td>5.000</td>
<td>0.080</td>
<td>1.749</td>
<td>1.750</td>
<td>0.625 x 0.250</td>
<td>3/8</td>
<td>6.580</td>
<td>0.26</td>
<td>2.875</td>
<td></td>
</tr>
</tbody>
</table>

#### Option Location Reference

**ACTUATOR**

<table>
<thead>
<tr>
<th>LETTER OPTION REFERENCED BY TUBE NUMBER</th>
<th>PORT &amp; NEEDLE LOCATIONS REFERENCED BY CIRCLED NUMBERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>-A - B - D - P - M - E - T - I - D</td>
<td></td>
</tr>
<tr>
<td>3R11A &amp; 3R21A</td>
<td>STANDARD I &amp; II &amp; II &amp; ALL &amp; ALL &amp; 2 &amp; 1 &amp; 3 &amp; 1 &amp; 4 &amp; 1 &amp; 3 &amp; 1 &amp; 4 &amp; 4</td>
</tr>
<tr>
<td>3R11H &amp; 3R21H</td>
<td>STANDARD N/A &amp; II &amp; ALL &amp; ALL &amp; 2 &amp; 1 &amp; 3 &amp; 1 &amp; 4 &amp; 1 &amp; 3 &amp; 1 &amp; 4 &amp; 4</td>
</tr>
</tbody>
</table>

**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

#### Quick Reference: For A + (T x B)

<table>
<thead>
<tr>
<th>DEGREE OF ROTATION</th>
<th>SERIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAND.</td>
<td>45</td>
</tr>
<tr>
<td>3R1 &amp; 3R2</td>
<td>90</td>
</tr>
<tr>
<td>3R1 &amp; 3R2</td>
<td>180</td>
</tr>
<tr>
<td>3R1 &amp; 3R2</td>
<td>270</td>
</tr>
<tr>
<td>3R1 &amp; 3R2</td>
<td>360</td>
</tr>
<tr>
<td>3R1 &amp; 3R2</td>
<td>450</td>
</tr>
</tbody>
</table>

*Dimensions calculated using plain cap style. Add 0.250" for each -A style cap used on Series 2000 only.*

---

**CAD & Sizing Assistance**

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

**All dimensions are reference only unless specifically tolerated.**

---

**Designer’s Resource**

Use PHD’s free online Product Sizing and CAD Configurator at www.phdinc.com/myphd
**DIMENSIONS: 3 POSITION ROTARY ACTUATORS**

**LETTER DIMENSION**

| CAP STYLE | SERIES | A | B | C | D | E | F | G | H | JA | KA | SQ | L | M | NB | O | PA | Q | R | S | TA | U | V | W | X | Y | Z | VA |
|-----------|--------|---|---|---|---|---|---|---|---|----|----|----|---|---|----|---|---|---|---|---|---|---|---|---|---|---|
| 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 x 12.71 | 3.15 x 1.59 x 16 | 12.00 x 11.97 | 4 x 2.5 x 15 | G1/8 | 72 | 0.22 | 0 |
| -A | 2000 | 157 | 0.44 | 76 | 51 | 38.1 | 13 | 0 | 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 x 12.71 | 3.15 x 1.59 x 16 | 12.00 x 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 x 22.23 | 4.75 x 2.36 x 38 | 22.00 x 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 x 28.58 | 6.35 x 3.18 x 38 | 28.00 x 27.96 | 8 x 5.40 | G1/4 | 116 | 0.33 | 48 |

* 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.

<table>
<thead>
<tr>
<th>SHAFT KEYWAY</th>
<th>SHOWN AT MID-ROTATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>PORT POSITIONS</td>
<td>INDICATED BY CIRCLED NUMBERS</td>
</tr>
<tr>
<td>CUSHIONS</td>
<td>SERIES 2000 ACTUATORS: ADD 13.0 mm TO RESPECTIVE &quot;A&quot; AND &quot;Y&quot; DIMENSION FOR EACH CUSHION</td>
</tr>
<tr>
<td>MGT. HOLES</td>
<td>CENTERED ON CENTERLINE OF ACTUATOR BODY</td>
</tr>
<tr>
<td>STOP TUBES</td>
<td>LOCATED IN TUBES I &amp; II</td>
</tr>
<tr>
<td>PLUMBING SCHEMATIC</td>
<td>LOCATED IN PHD PRODUCT SIZING CATALOG</td>
</tr>
</tbody>
</table>

*Dimensions calculated using plain cap style. Add 6.3 to dimension for each -A style cap used on Series 2000 only.
DIMENSIONS: 4 POSITION ROTARY ACTUATORS

All dimensions are reference only, unless specifically tolerated.

شاフト كلي: Shown at Mid-Rotation

مراتب التوصيل: Indicated by circled numbers

الإطار مثبت: Centered on Centerline of Actuator Body

إطار التهجين: Located in tubes I & II

إطار التخطيط المائي: Located in PHD Product Sizing Catalog

CAD & Sizing Assistance
Use PHD's free online Product Sizing and Configurator at www.phdinc.com/myphd
DIMENSIONS: 4 POSITION ROTARY ACTUATORS

All dimensions are reference only unless specifically tolerated.

METRIC

DIMENSIONS: 4 POSITION ROTARY ACTUATORS

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.

**LETTER DIMENSION**

**IMPERIAL SHAFTS**

**METRIC SHAFTS**

**OPTION LOCATION REFERENCE**

**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.
DIMENSIONS: 5 POSITION ROTARY ACTUATORS

**M THREAD**
4X EACH FRONT, BACK & BOTTOM

**SHAF T KEYWAY:** SHOWN AT MID-RO TATION

**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

---

**LETTER DIMENSION**

**OPTION LOCATION REFERENCE**

**ACTUATOR TYPE**

**LETTER OPTION REFERENCED BY TUBE NUMBER**

**PORT & NEEDLE LOCATIONS REFERENCED BY CIRCLED NUMBERS**

**STANDARD**

**-A**

**-B**

**-D**

**-F**

**-M**

**-E**

**-T**

**-P**

**-D**

**-I**

---

**PORTS PRESSURIZED - C & D**

**PORTS PRESSURIZED - A & E**

**PORT PRESSURIZED - E**

**FULL CCW POSITION**

**PORT PRESSURIZED - B**

**FULL CW POSITION**

---

**All dimensions are reference only unless specifically tolerated.**

**CAD & Sizing Assistance**

Use PHD's free online Product Sizing and CAD Configurator at www.phdinc.com/myphd
### DIMENSIONS: 5 POSITION ROTARY ACTUATORS

**LETTER DIMENSION**

| SERIES | C   | D   | E   | F   | GA  | GA  | H   | JA  | KA  | L   | M   | NB  | O   | PA  | Q   | R   | S   | TA  | U   |
|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 4000   | 108 | 76  | 50.8| 9   | 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 |
| 6000   | 127 | 102 | 63.5| 10  | 19  | 19  | 5   | 29  | 57  | 58  | M10 x 1.5 x 16 | 55.00 x 1.3 DP | 76.2 | 48 | 89.9 | 19 | 13 | 50.8 | 10 |
| 8000   | 203 | 127 | 76.2| 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 |

**IMPERIAL SHAFTS***

<table>
<thead>
<tr>
<th>V</th>
<th>W</th>
<th>X</th>
<th>VR</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>22.22/22.23</td>
<td>4.75 x 2.36 x 38</td>
<td>22.00/21.96</td>
<td>6 x 3.5 x 32 G1/4</td>
<td>171</td>
</tr>
<tr>
<td>28.55/28.58</td>
<td>6.35 x 3.18 x 48</td>
<td>28.00/27.96</td>
<td>8 x 5 x 40 G1/4</td>
<td>186</td>
</tr>
</tbody>
</table>

**METRIC SHAFTS***

<table>
<thead>
<tr>
<th>V</th>
<th>W</th>
<th>X</th>
<th>VR</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>44.42/44.45</td>
<td>9.53 x 2.36 x 78</td>
<td>44.00/43.96</td>
<td>12 x 5 x 56 G3/8</td>
<td>251</td>
</tr>
</tbody>
</table>

* BOTH IMPERIAL AND METRIC SHAFT OPTIONS AVAILABLE ON METRIC BODY.
  (IMPERIAL SHAFT = DESIGN 5, AND METRIC SHAFT = DESIGN 6).

**OPTION LOCATION REFERENCE**

<table>
<thead>
<tr>
<th>ACTUATOR</th>
<th>LETTER OPTION REFERENCED BY TUBE NUMBER</th>
<th>PORT &amp; NEEDLE LOCATIONS REFERENCED BY CIRCLED NUMBERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>5R1xA &amp; 5R2xA</td>
<td>STANDARD</td>
<td>E: 1 &amp; 3 1 4 1 &amp; 3 1 1 &amp; 3 4 4</td>
</tr>
<tr>
<td>5R1xH &amp; 5R2xH</td>
<td>STANDARD</td>
<td>E: 1 &amp; 3 1 4 1 &amp; 3 1 1 &amp; 3 4 4</td>
</tr>
</tbody>
</table>

**SHARED 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.

**CAD & Sizing Assistance**

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

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.

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.

PRELOADED KEYWAY SHAFT

Not available on Rx6x

Required when use of hub adaptor is desired.

CROSS KEY SHAFT

Not available on Rx6x

HOLLOW SHAFT

Not available on Rx6x

FLUORO-ELASTOMER SEALS

ELECTROLESS NICKEL PLATING

Electroless nickel plating is done on all externally exposed ferrous parts except the pinion shaft.

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.

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.

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.

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.

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.

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.
OPTIONS: MULTI-POSITION ROTARY ACTUATORS

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.

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.

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.

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.

<table>
<thead>
<tr>
<th>SERIES</th>
<th>LETTER</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>1.875</td>
<td>.688</td>
<td></td>
</tr>
<tr>
<td>4000</td>
<td>3.000</td>
<td>1.883</td>
<td></td>
</tr>
<tr>
<td>6000</td>
<td>3.250</td>
<td>1.888</td>
<td></td>
</tr>
<tr>
<td>8000</td>
<td>4.480</td>
<td>3.312</td>
<td></td>
</tr>
</tbody>
</table>

NUMBERS IN [ ] ARE FOR METRIC UNITS AND ARE IN mm.

All dimensions are reference only unless specifically tolerated.

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PHDV2
BASIC SHAFT DIMENSIONS: R1xx and R2xx

- **W KEYWAY**
- **V DIA**
- **R2xx DOUBLE SHAFT EXTENSION**
  - (FRONT & BACK OF UNIT)
- **R1xx SINGLE SHAFT EXTENSION**
  - (FRONT OF UNIT)

PRELOADED KEYWAY SHAFT
Not available on Rx6x

- **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

CROSS KEY SHAFT
Not available on Rx6x

- **A SLOT DEPTH**
- **F SLOT WIDTH**

HOLLOW SHAFT
Not available on Rx6x

- **WA KEYWAY THRU**
- **WA**

Options: Multi-Position Rotary Actuators

**LETTER DIMENSION**

<table>
<thead>
<tr>
<th>SERIES</th>
<th>IMPERIAL</th>
<th>METRIC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>W</td>
<td>V</td>
</tr>
<tr>
<td>2000</td>
<td>8.75 (.4998/5.003)</td>
<td>1/8 x 1/16 x .625</td>
</tr>
<tr>
<td>4000</td>
<td>2.875 (.8748/8.753)</td>
<td>3/16 x 3/32 x 1.500</td>
</tr>
<tr>
<td>6000</td>
<td>1.875 (1/1.125)</td>
<td>1/4 x 1/16 x 1.500</td>
</tr>
<tr>
<td>8000</td>
<td>2.000 (1.740/1.750)</td>
<td>3/8 x 3/16 x 3.000</td>
</tr>
</tbody>
</table>

**NOTES:**
1) SHAFT KEYWAY: SHOWN AT MID-ROTATION
2) *IMPERIAL SHAFT UNITS (Rx1x, Rx5x)
3) **METRIC SHAFT UNITS (Rx6x)

All dimensions are reference only unless specifically tolerated.

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OPTIONS: MULTI-POSITION ROTARY ACTUATORS

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.

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.

<table>
<thead>
<tr>
<th>PART NO.</th>
<th>COLOR</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>17503-2-06</td>
<td>Yellow</td>
<td>NPN (Sink) Type 4.5-24 VDC, 6 foot cable</td>
</tr>
<tr>
<td>17504-2-06</td>
<td>Red</td>
<td>PNP (Source) Type 4.5-24 VDC, 6 foot cable</td>
</tr>
<tr>
<td>17523-2</td>
<td>Yellow</td>
<td>NPN (Sink) Type 4.5-24 VDC, Quick Connect</td>
</tr>
<tr>
<td>17524-2</td>
<td>Red</td>
<td>PNP (Source) Type 4.5-24 VDC, Quick Connect</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>PART NO.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>17502-2-06</td>
<td>White NPN (Sink) or PNP (Source) 4.5-24 VDC, 6 foot cable</td>
</tr>
<tr>
<td>17509-3-06</td>
<td>Green AC Type 110-120 VAC with Current Limit, 6 foot cable</td>
</tr>
<tr>
<td>17522-2</td>
<td>White NPN (Sink) or PNP (Source) 4.5-24 VDC, Quick Connect</td>
</tr>
<tr>
<td>17529-3</td>
<td>Green AC Type 110-120 VAC, Quick Connect with Current Limit</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>PART NO.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>9800-01-0300</td>
<td>NPN (Sink) 4.5-24 VDC</td>
</tr>
<tr>
<td>9800-01-0400</td>
<td>PNP (Source) 4.5-24 VDC</td>
</tr>
</tbody>
</table>

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.

- PORT POSITION 1 TOP RACK
- PORT POSITION 3 BOTTOM RACK
- PORT POSITION 4

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.

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

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.

All dimensions are reference only unless specifically tolerated.