Numatics®

R Series
Rack and Pinion Style Rotary Actuator Line

www.numatics.com
## R Series

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The **R Series** is a heavy-duty rack and pinion style rotary actuator that is designed to excel in the most rigid applications. The R Series includes a high torque-to-size ratio as well as accurate positioning.

**Rack and Pinion**
The rack and pinion is made from high-strength alloy steel. It is induction hardened for long life. The geometry factors of the rack and pinion have been balanced to ensure equal wear, which provides maximum gear life. The pinion shaft includes a male key as a standard offering.

**Ball Bearings**
The ball bearings are sealed and pre-lubed in an effort to prevent contamination from negatively affecting the operation. They are sized to accept high loads and still retain smooth maintenance free operation.

**Rack Bushing**
The rack bushing is made from bearing bronze. The durability of the bushing enables it to support nearly the full length of the rack. Furthermore, we have included a small gap to allow grease/lubrication to be added.

**Tube**
The profile tube is hard coat anodized. The hard coating is an electro-chemical process, which produces a very dense surface of aluminum oxide. This surface has extreme hardness (60 RC.), excellent wear and corrosion resistance, and low coefficient of friction.

**End Caps**
The end caps are accurately machined from (6061-T6) solid aluminum bar stock. They are anodized for corrosion resistance. Additionally, port positioning is extremely flexible.

**Piston**
The solid aluminum alloy piston is strong and durable. A magnet groove is standard allowing for easy field conversion.

**Piston Seal**
The piston seal is a carboxilated nitrile with PTFE compound for self-lubricating. The U-cup type seal construction is proven and durable.

**Wear Band**
The wear band is a stable, lubricating strip located on the piston.

**Grease Opening**
A 1/4-28 tapped hole (which is plugged) is provided for future installation of an optional grease fitting. Note that the unit is pre-lubed.

**Standard Specifications:**
- Bore sizes from 1” through 3-1/4”
- Maximum pressure rating is 150 psi air
- Standard rotations are: 45°, 90°, 180°, 270°, and 360°
- Standard temperature -10°F to 165°F (-23°C to 74°C)
- NPTF ports
- Flexible port locating

The keyway at position 12:00, is always the mid-rotation of the actuator unless otherwise specified.
R SERIES

Rotary Actuator

How to Order

Mounting
F = Front Flange
R = Rear Flange
P = Pilot Ring
B = Bottom Flange
S = Standard Mount

Type
AR = Single Rack
BR = Double Rack
CR = 3 Position Single Rack
DR* = 4 Position Single Rack
ER** = 5 Position Single Rack
* Must specify X dimension.
** Must specify X and Y dimensions.

Size
E = 1” Bore
K = 1-1/2” Bore
L = 2” Bore
M = 2-1/2” Bore
P = 3-1/4” Bore

Degrees Rotation
045 = 45º
090 = 90º
180 = 180º
270 = 270º
360 = 360º
Any degree of rotation can be specified.

Consult factory for rotations of or greater than 1000º

Rod End Code
1 = Single Male Keyed (Std)
2 = Single Female Keyed
3 = Double Male Keyed
4 = Preloaded Keyway

Magnetic Piston
0 = No Magnet
2 = Magnet

Options
AA = No Options
BA = Bumpers Both Directions
BC = Bumpers Counterclockwise
BH = Bumpers Clockwise
KA* = Angle Adjustment Both Directions
KC* = Angle Adjustment Counterclockwise
KH = Angle Adjustment Clockwise
PP = Polypak Piston Seals
SA = Shock Absorbers Both Directions
SC = Shock Absorbers Counter-clockwise
SH = Shock Absorbers Clockwise
SS = Shaft Seal Covers
VA = FKM Seals
*N/A with the SA, SC, and SH options

Cushions
Position Standard
No Cushion A A A A
CW and CCW B C D E
CW F G H J
CCW K L M N

Ports
Position Size Code
1/8 1/4 3/8 1/2
1 B C D E
2 H I J K
3 N O P Q
4 T U V W

Cushion and Port Positions

NOTE: Consult factory for repair kit information.
# Standard Specifications

Maximum operating pressure: 150 psi pneumatic

Standard rotations: 45°, 90°, 180°, 270°, 360° and other rotations optional

Operating temperature: 0° F to 180° F (standard seals)
0° F to 400° F (FKM seals)

## Standard Mount

<table>
<thead>
<tr>
<th>Bore</th>
<th>Number of Racks</th>
<th>Model</th>
<th>Theoretical Torque Output (in-lbs)</th>
<th>Displacement Cu. In./Deg. of Rotation</th>
<th>&quot;Max. Angular Backlash, Minutes&quot;</th>
<th>Max. Rotational Total (Degrees)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>50 psi</td>
<td>100 psi</td>
<td>150 psi</td>
<td></td>
</tr>
<tr>
<td>1&quot;</td>
<td>1</td>
<td>SARE</td>
<td>19</td>
<td>39</td>
<td>59</td>
<td>0.007</td>
</tr>
<tr>
<td>1&quot;</td>
<td>2</td>
<td>SBRE</td>
<td>39</td>
<td>79</td>
<td>118</td>
<td>0.014</td>
</tr>
<tr>
<td>1 1/2&quot;</td>
<td>1</td>
<td>SARK</td>
<td>59</td>
<td>118</td>
<td>177</td>
<td>0.021</td>
</tr>
<tr>
<td>1 1/2&quot;</td>
<td>2</td>
<td>SBRK</td>
<td>118</td>
<td>236</td>
<td>353</td>
<td>0.042</td>
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<tr>
<td>2&quot;</td>
<td>1</td>
<td>SARL</td>
<td>141</td>
<td>282</td>
<td>424</td>
<td>0.049</td>
</tr>
<tr>
<td>2&quot;</td>
<td>2</td>
<td>SBRL</td>
<td>282</td>
<td>565</td>
<td>848</td>
<td>0.099</td>
</tr>
<tr>
<td>2 1/2&quot;</td>
<td>1</td>
<td>SARM</td>
<td>276</td>
<td>552</td>
<td>828</td>
<td>0.096</td>
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<tr>
<td>2 1/2&quot;</td>
<td>2</td>
<td>SBRM</td>
<td>552</td>
<td>1104</td>
<td>1656</td>
<td>0.193</td>
</tr>
<tr>
<td>3 1/4&quot;</td>
<td>1</td>
<td>SARP</td>
<td>570</td>
<td>1141</td>
<td>1711</td>
<td>0.199</td>
</tr>
<tr>
<td>3 1/4&quot;</td>
<td>2</td>
<td>SBRP</td>
<td>1141</td>
<td>2281</td>
<td>3422</td>
<td>0.398</td>
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</table>

## Dimensions: Inches

### Standard Mount

<table>
<thead>
<tr>
<th>Bore</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>J</th>
<th>K</th>
<th>L</th>
<th>M</th>
<th>N</th>
<th>O</th>
<th>P</th>
<th>R</th>
<th>T</th>
<th>U</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&quot;</td>
<td>7.50</td>
<td>2.00</td>
<td>3.00</td>
<td>3.00</td>
<td>1.50</td>
<td>2.00</td>
<td>0.01746</td>
<td>1.50</td>
<td>1/4-20 X 3/8 DEEP</td>
<td>.500/.499</td>
<td>0.88</td>
<td>.125/.127</td>
<td>.430/.425</td>
<td>.625</td>
<td>0.59</td>
<td>1.44</td>
<td>0.75</td>
<td>1/8</td>
<td>0.75</td>
</tr>
<tr>
<td>1 1/2&quot;</td>
<td>8.50</td>
<td>3.00</td>
<td>4.25</td>
<td>3.00</td>
<td>2.00</td>
<td>3.00</td>
<td>0.02328</td>
<td>2.00</td>
<td>5/16-18 X 1/2 DEEP</td>
<td>.875/.874</td>
<td>1.88</td>
<td>.188/.190</td>
<td>.771/.761</td>
<td>1.50</td>
<td>0.98</td>
<td>2.00</td>
<td>0.75</td>
<td>1/4</td>
<td>1.13</td>
</tr>
<tr>
<td>2&quot;</td>
<td>9.50</td>
<td>3.00</td>
<td>5.00</td>
<td>4.00</td>
<td>2.50</td>
<td>3.50</td>
<td>0.03124</td>
<td>2.00</td>
<td>3/8-16 X 1/2 DEEP</td>
<td>1.125/1.124</td>
<td>1.88</td>
<td>.250/.252</td>
<td>.986/.976</td>
<td>1.50</td>
<td>1.18</td>
<td>2.44</td>
<td>0.75</td>
<td>1/4</td>
<td>1.25</td>
</tr>
<tr>
<td>2 1/2&quot;</td>
<td>9.75</td>
<td>3.50</td>
<td>6.00</td>
<td>4.00</td>
<td>2.50</td>
<td>4.50</td>
<td>0.03926</td>
<td>2.00</td>
<td>1/2-13 X 3/4 DEEP</td>
<td>1.375/1.374</td>
<td>2.25</td>
<td>.313/315</td>
<td>1.201/1.191</td>
<td>1.75</td>
<td>1.57</td>
<td>2.94</td>
<td>0.75</td>
<td>1/4</td>
<td>1.50</td>
</tr>
<tr>
<td>3&quot;-1/4&quot;</td>
<td>11.25</td>
<td>5.00</td>
<td>8.00</td>
<td>6.00</td>
<td>3.00</td>
<td>5.00</td>
<td>0.04800</td>
<td>2.50</td>
<td>3/4-10 X 1 DEEP</td>
<td>1.750/1.749</td>
<td>3.50</td>
<td>.375/377</td>
<td>1.542/1.532</td>
<td>3.00</td>
<td>1.77</td>
<td>3.75</td>
<td>0.88</td>
<td>3/8</td>
<td>1.94</td>
</tr>
</tbody>
</table>
Options
Rotation Adjust

Rotation adjusting knobs can be added to control rotation more precisely. They can be used on both ends or on either end individually. Rotation adjusters can be used in conjunction with cushions. Their “high tech” style makes rotation adjustment easy to do without tools. The metric set screw in the side of the knob securely locks the rotation setting. Thus, the rotation is very easy to adjust, but cannot be changed without a metric Allen wrench. When used with cushions, maximum rotation adjustment will still allow at least 20° of rotation to be in cushion.

<table>
<thead>
<tr>
<th>Bore</th>
<th>A</th>
<th>B</th>
<th>Degree of Rotation Per End</th>
</tr>
</thead>
<tbody>
<tr>
<td>1”</td>
<td>1.43</td>
<td>1.13</td>
<td>43</td>
</tr>
<tr>
<td>1 1/2”</td>
<td>1.43</td>
<td>1.13</td>
<td>32</td>
</tr>
<tr>
<td>2”</td>
<td>2.22</td>
<td>1.75</td>
<td>40</td>
</tr>
<tr>
<td>2 1/2”</td>
<td>2.22</td>
<td>1.75</td>
<td>32</td>
</tr>
<tr>
<td>3 1/4”</td>
<td>2.67</td>
<td>2.35</td>
<td>32</td>
</tr>
</tbody>
</table>

Cushions

Our cushion seal has a built-in function. It seals in one direction and permits full flow in the opposite direction.

Cushions can be added to meter deceleration. Cushion adjustment needles can be put in any quadrant. Normally, cushions will be added to only one half of the double rack unit. The cushion and its operation are very similar to our current A series design. Rotation adjust can be used in conjunction with cushions. Cushions and shock absorbers together are not available.

Bumpers

Bumper seals can be added to reduce impact. The bumper and seal are one piece. Bumpers can be used in conjunction with cushions if necessary.

NOTE: Cannot be used with rotation adjustment.
NOTE: Silencer Bumper does not add length to the cylinder, but a minimum force of 100PSI must be applied to collapse the seals to reach the full extend and retract positions.

Shock Absorbers

Hydraulic shock absorbers can be added to reduce noise and large impacts. Shocks are fixed orifice self-compensating type. The 3 1/4” bore rotary actuator will not have this option. Cushions and shock absorbers together are not available.

NOTE: Shock cannot be adjusted.
Mounting Options

Flanges

The pilot ring and the shaft seal cover are dimensionally the same. Pilot rings are used to help center the shaft to the work piece. Shaft seal covers are used to prevent contamination to the ball bearings. They can only be used on single and double male shafts.

Shaft Options

Double Male Keyed

Single Female Keyed
Kinetic Energy Basic Formula

KE = 1/2 Jω²

ω = 0.035 x

- Angle traveled (degrees)
- Rotation time (seconds)

Where:

- KE = Kinetic Energy (in-lb)
- J = Rotational mass moment of inertia (in-lb-sec²)
  (Dependent on physical size of object and weight)
- ω = Peak Velocity (rad/sec)
  (Assuming twice average velocity)
- W = Weight of load (lb)
- g = Gravitational constant = 386.4 in/sec²
- r = Radius of gyration (in)

Moments of Inertia

Maximum Kinetic Energy Rating for Models Based on Configuration (in-lb)

<table>
<thead>
<tr>
<th>Bore</th>
<th>Standard</th>
<th>Rotation Adjusters</th>
<th>Cushions</th>
<th>Shock Absorbers (Per Cycle/Per Hour)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&quot;</td>
<td>0.50</td>
<td>0.50</td>
<td>5</td>
<td>150/300,000</td>
</tr>
<tr>
<td>1 1/2&quot;</td>
<td>2.00</td>
<td>2.00</td>
<td>20</td>
<td>225/400,000</td>
</tr>
<tr>
<td>2&quot;</td>
<td>4.00</td>
<td>4.00</td>
<td>40</td>
<td>600/600,000</td>
</tr>
<tr>
<td>2 1/2&quot;</td>
<td>7.00</td>
<td>7.00</td>
<td>70</td>
<td>600/600,000</td>
</tr>
<tr>
<td>3 1/4&quot;</td>
<td>15.00</td>
<td>15.00</td>
<td>150</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Thin Disk-End mounted on center

J = \( \frac{W}{g} \times \frac{r^2}{4} \)

Thin Disk-Mounted on center

J = \( \frac{W}{g} \times \frac{r^2}{2} \)

Point Load

Thin Rectangular Plate-Mounted on center

J = \( \frac{W}{g} \times \frac{a^2}{12} \)

Thin Rectangular Plate

J = \( \frac{W_1}{g} \times \frac{4a^2 + c^2}{12} + \frac{W_2}{g} \times \frac{4b^2 + c^2}{12} \)

Slender Rod

J = \( \frac{W_1}{g} \times \frac{a^2}{3} + \frac{W_2}{g} \times \frac{b^2}{3} \)
Size and Selection Example

Point load application
W=5 lb. load
r=12 inch arm length
Want to use 1 1/2 bore rotary actuator
Need to rotate 180 degrees in 2 seconds
Should I use bumpers, cushions, shocks, or none of these?

From Catalog:

\[
\omega = 0.035 \times \frac{\text{Angle traveled (DEG)}}{\text{Rotation time (SEC)}}
\]

\[
\omega = 0.035 \times \frac{180 \text{ DEG}}{2 \text{ SEC}}
\]

\[
\omega = \frac{3.15}{\text{SEC}}
\]

\[
J = \frac{W}{g} \times r^2
\]

\[
J = 5 \text{ LB} \times \frac{\text{SEC}^2}{386.4 \text{ IN}} \times \text{IN}^2
\]

\[
J = 1.86 \text{ IN-LB-SEC}^2
\]

\[
KE = \frac{1}{2} J \omega^2
\]

\[
KE = \frac{1}{2} \times 1.86 \text{ IN-LB-SEC}^2 \times \left(\frac{3.15}{\text{SEC}}\right)^2
\]

\[
KE = 9.23 \text{ IN-LB}
\]

Looking at Kinetic Energy Rating Chart:

Maximum KE=20 IN-LBS for a 1 1/2" bore rotary with cushions

Therefore, application requires cushions.
## Specifications

### Unit Weights (lbs)

<table>
<thead>
<tr>
<th>Model</th>
<th>90</th>
<th>180</th>
<th>270</th>
<th>360</th>
</tr>
</thead>
<tbody>
<tr>
<td>SARL</td>
<td>14</td>
<td>15</td>
<td>16</td>
<td>17</td>
</tr>
<tr>
<td>SBRM</td>
<td>31</td>
<td>34</td>
<td>38</td>
<td>41</td>
</tr>
<tr>
<td>SARP</td>
<td>45</td>
<td>47</td>
<td>49</td>
<td>52</td>
</tr>
<tr>
<td>SBRP</td>
<td>62</td>
<td>67</td>
<td>72</td>
<td>77</td>
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### Bearing Load Capacities

<table>
<thead>
<tr>
<th>Bore</th>
<th>Radial Load (lb)</th>
<th>Thrust Load (lb)</th>
<th>Distance Between Bearings (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&quot;</td>
<td>100</td>
<td>75</td>
<td>1.40</td>
</tr>
<tr>
<td>1 1/2&quot;</td>
<td>300</td>
<td>200</td>
<td>2.15</td>
</tr>
<tr>
<td>2&quot;</td>
<td>500</td>
<td>350</td>
<td>2.15</td>
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<tr>
<td>2 1/2&quot;</td>
<td>900</td>
<td>600</td>
<td>2.50</td>
</tr>
<tr>
<td>3 1/4&quot;</td>
<td>1300</td>
<td>900</td>
<td>3.75</td>
</tr>
</tbody>
</table>

### Port and Cushion Locations

#### Single Rack

PORTS SHOWN IN POSITION 2.

#### Double Rack

PORTS SHOWN IN POSITION 2.

Standard port location is position 1. Standard cushion location is position 2. Ports and/or cushions in position 4 are only available on single rack rotary actuators.
Multi-position Rotary Actuator

3 Position

Our rotary actuators are available in various multi-position configurations. The following shows 3, 4 and 5 position types. Consult factory for additional configurations.

A three position rotary actuator provides one intermediate stopping position between the full counterclockwise and full clockwise position. The full counterclockwise position is achieved by pressurizing port 1. The intermediate position is achieved by pressurizing both ports 2 and 3. The final clockwise position is achieved by pressurizing port 4. Rotation adjustment for the full counterclockwise and full clockwise positions only are standard.
A four position rotary actuator provides two intermediate stopping positions between the full counterclockwise and full clockwise positions. The full counterclockwise position is achieved by pressurizing port 1. The first intermediate position is achieved by pressurizing both ports 2 and 3. The second intermediate position is achieved by pressurizing both ports 4 and 5. The final position is achieved by pressurizing port 6. Rotation adjustment for the full counterclockwise and full clockwise positions only are standard.
A five position rotary actuator provides three intermediate stopping positions between the full counterclockwise and full clockwise positions. The full counterclockwise position is achieved by pressurizing port 1. The first intermediate position is achieved by pressurizing both ports 2 and 3. The second intermediate position is achieved by pressurizing both ports 4 and 5. The third intermediate position is achieved by pressurizing both ports 6 and 7. The final clockwise position is achieved by pressurizing port 8. Rotation adjustment for the full counterclockwise and full clockwise positions only are standard.
**R Series Rotary Actuator**

### R Series Rotary (Profile)

<table>
<thead>
<tr>
<th>Bore</th>
<th>Bracket P/N</th>
</tr>
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<tbody>
<tr>
<td>1&quot;</td>
<td>N99-1185</td>
</tr>
<tr>
<td>1 1/2&quot;</td>
<td>N99-1185</td>
</tr>
<tr>
<td>2&quot;</td>
<td>N99-1185</td>
</tr>
<tr>
<td>2 1/2&quot;</td>
<td>N99-1185</td>
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</table>

<table>
<thead>
<tr>
<th>Sensor Description</th>
<th>Standard Cord Set</th>
<th>Quick Disconnect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reed Switch</td>
<td>REED-FL2-00</td>
<td>REED-QDS-M8U</td>
</tr>
<tr>
<td>Hall PNP</td>
<td>PNP-FL2-00-U</td>
<td>PNP-QDS-M8-U</td>
</tr>
<tr>
<td>Hall NPN</td>
<td>NPN-FL2-00-U</td>
<td>NPN-QDS-M8-U</td>
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See page 15, 16, & 17 for sensor specifications.

### R Series (Tie Rod)

<table>
<thead>
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<tr>
<td>3 1/4&quot;</td>
<td>N99-1182</td>
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</tbody>
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## Sensing Part Numbers

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>M8 x 1.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>PNP-FL2-00-U</td>
<td></td>
</tr>
<tr>
<td>PNP-QDS-M8-U</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ELECTRICAL DESIGN</th>
<th>DC PNP</th>
</tr>
</thead>
<tbody>
<tr>
<td>OUTPUT</td>
<td>Normal Open</td>
</tr>
<tr>
<td>OPERATING VOLTAGE</td>
<td>10-30 VDC</td>
</tr>
<tr>
<td>CURRENT RATING</td>
<td>100 mA</td>
</tr>
<tr>
<td>SHORT-CIRCUIT PROTECTION</td>
<td>Yes</td>
</tr>
<tr>
<td>OVERLOAD PROTECTION</td>
<td>Yes</td>
</tr>
<tr>
<td>REVERSE POLARITY PROTECTION</td>
<td>Yes</td>
</tr>
<tr>
<td>VOLTAGE DROP</td>
<td>&lt; 2.5 V</td>
</tr>
<tr>
<td>CURRENT CONSUMPTION</td>
<td>&lt; 12 mA</td>
</tr>
<tr>
<td>REPEATABILITY</td>
<td>&lt; .2mm</td>
</tr>
<tr>
<td>POWER-ON DELAY TIME</td>
<td>&gt; 30 ms</td>
</tr>
<tr>
<td>SWITCH FREQUENCY</td>
<td>&gt; 3000 Hz</td>
</tr>
<tr>
<td>AMBIENT TEMPERATURE</td>
<td>-25°C to 85°C</td>
</tr>
<tr>
<td>PROTECTION</td>
<td>IP 67, III</td>
</tr>
<tr>
<td>HYSTERESIS</td>
<td>1.0mm</td>
</tr>
<tr>
<td>MAGNETIC SENSITIVITY</td>
<td>2.0 mT</td>
</tr>
<tr>
<td>TRAVEL SPEED</td>
<td>&gt; 10 m/s</td>
</tr>
<tr>
<td>HOUSING MATERIAL</td>
<td>PA (Polyamide) Black; Fastening Clamp: Stainless Steel</td>
</tr>
<tr>
<td>FUNCTION DISPLAY</td>
<td>Yellow LED</td>
</tr>
<tr>
<td>SWITCHING STATUS</td>
<td></td>
</tr>
<tr>
<td>CONNECTION</td>
<td>Flying Leads, Pur Cable (2m Long, 3 x 26 Gauge Wire)</td>
</tr>
<tr>
<td>REMARKS</td>
<td>Clamping Screw with Combined Slot/Hexagon Socket Head AF 1.5 cULus - Class 2 Source Required</td>
</tr>
<tr>
<td>ACCESSORIES</td>
<td>Rubber Placehold, Cable Clip, and Cut Sheet To Be Provided with Every Switch</td>
</tr>
<tr>
<td>AGENCY APPROVALS</td>
<td>CE cULus RoHS</td>
</tr>
</tbody>
</table>

*Switches are not designed for wet environments. Please see your distributor for additional information.
## Sensing Part Numbers

### NPN-FL2-00-U

- **Part Number**: NPN-FL2-00-U
- **Electrical Design**: DC NPN
- **Output**: Normally Open
- **Operating Voltage**: 10-30 VDC
- **Current Rating**: 100 mA
- **Short-Circuit Protection**: Yes
- **Overload Protection**: Yes
- **Reverse Polarization Protection**: Yes
- **Voltage Drop**: < 2.5 V
- **Current Consumption**: < 12 mA
- **Repeatability**: < .2 mm
- **Power-On Delay Time**: < 30 ms
- **Switch Frequency**: > 3000 Hz
- **Ambient Temperature**: -25°C to 85°C
- **Protection**: IP 67, III
- **Hysteresis**: 1.0 mm
- **Magnetic Sensitivity**: 2.0 mT
- **Travel Speed**: > 10 m/s
- **Material**: PA (Polyamide) Black; Fastening Clamp: Stainless Steel
- **Function Display**: Yellow LED
- **Connection**: Flying Leads, Pur Cable (2m Long, 3 x 26 Gauge Wire)
- **Remarks**: Clamping Screw with Combined Slot/Hexagon Socket Head AF 1.5 cULus - Class 2 Source Required
- **Accessories**: Rubber Placehold, Cable Clip, and Cut Sheet To Be Provided with Every Switch

### NPN-QDS-M8-U

- **Part Number**: NPN-QDS-M8-U
- **Electrical Design**: DC NPN
- **Output**: Normally Open
- **Operating Voltage**: 10-30 VDC
- **Current Rating**: 100 mA
- **Short-Circuit Protection**: Yes
- **Overload Protection**: Yes
- **Reverse Polarization Protection**: Yes
- **Voltage Drop**: < 2.5 V
- **Current Consumption**: < 12 mA
- **Repeatability**: < .2 mm
- **Power-On Delay Time**: < 30 ms
- **Switch Frequency**: > 3000 Hz
- **Ambient Temperature**: -25°C to 85°C
- **Protection**: IP 67, III
- **Hysteresis**: 1.0 mm
- **Magnetic Sensitivity**: 2.0 mT
- **Travel Speed**: > 10 m/s
- **Material**: PA (Polyamide) Black; Fastening Clamp: Stainless Steel
- **Function Display**: Yellow LED
- **Connection**: M8 Connector (Snap Fit), Pur Cable (.3 m)
- **Remarks**: Clamping Screw with Combined Slot/Hexagon Socket Head AF 1.5 cULus - Class 2 Source Required
- **Accessories**: Rubber Placehold, Cable Clip, and Cut Sheet To Be Provided with Every Switch

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**Information subject to change without notice. For ordering information or regarding your local sales office visit [www.numatics.com](http://www.numatics.com).**
### Rotary Actuator

**Sensing Part Numbers**

#### REED-FL2-00

- **ELECTRICAL DESIGN**: AC/DC REED
- **OUTPUT**: Normally Open
- **OPERATING VOLTAGE**: 5-120 VAC/DC
- **CURRENT RATING**: 100 mA* 
- **SHORT-CIRCUIT PROTECTION**: No
- **OVERLOAD PROTECTION**: No
- **REVERSE POLARITY PROTECTION**: Yes
- **VOLTAGE DROP**: < 5 V
- **REPEATABILITY**: ± .2mm
- **MAKETIME INCLUDING BOUNCE**: <.6 ms
- **BREAKTIME**: <.1 ms
- **SWITCHING POWER (MAX)**: 5 W
- **SWITCH FREQUENCY**: 1000 Hz
- **AMBIENT TEMPERATURE**: -25°C to 70°C
- **PROTECTION**: IP 67, II
- **HYSTERESIS**: .9mm
- **HOUSING MATERIAL**: PA (Polyamide) Black; Fastening Clamp: Stainless Steel
- **FUNCTION DISPLAY**: YELLOW LED
- **CONNECTION**: Flying Leads, Pur Cable (2m Long, 2 x 26 Gauge Wire)
- **REMARKS**: *External Protective Circuit for Inductive Load (Valve, Contactor, Etc..) Necessary. Conforms to 2008 NEC Section 725 III, Class 2 Circuits Clamping Screw with Combined Slot/Hexagon Socket Head AF 1.5. No LED Function in case of Polarity in DC Operation
- **ACCESSORIES**: Rubber Placehold, Cable Clip, and Cut Sheet To Be Provided with Every Switch
- **AGENCY APPROVALS**: RoHS

#### REED-QDS-M8U

- **ELECTRICAL DESIGN**: AC/DC REED
- **OUTPUT**: Normally Open
- **OPERATING VOLTAGE**: *5-60 VDC / 5-50 VAC
- **CURRENT RATING**: 100 mA
- **SHORT-CIRCUIT PROTECTION**: No
- **OVERLOAD PROTECTION**: No
- **REVERSE POLARITY PROTECTION**: Yes
- **VOLTAGE DROP**: < 5 V
- **REPEATABILITY**: ± .2mm
- **MAKETIME INCLUDING BOUNCE**: <.6 ms
- **BREAKTIME**: <.1 ms
- **SWITCHING POWER (MAX)**: 5 W
- **SWITCH FREQUENCY**: 1000 Hz
- **AMBIENT TEMPERATURE**: -25°C to 70°C
- **PROTECTION**: IP 67, II
- **HYSTERESIS**: .9mm
- **HOUSING MATERIAL**: PA (Polyamide) Black; Fastening Clamp: Stainless Steel
- **FUNCTION DISPLAY**: YELLOW LED
- **CONNECTION**: M8 Connector (Snap Fit), Pur Cable (.3m)
- **REMARKS**: *External Protective Circuit for Inductive Load (Valve, Contactor, Etc..) Necessary. Conforms to 2008 NEC Section 725 III, Class 2 Circuits M8 Connector voltage limited to 5-60 vdc / 5-50 vac to conform with 2008 IEC 61076-2-104 Clamping Screw with Combined Slot/Hexagon Socket Head AF 1.5. No LED Function in case of Polarity in DC Operation
- **ACCESSORIES**: Rubber Placehold, Cable Clip, and Cut Sheet To Be Provided with Every Switch
- **AGENCY APPROVALS**: RoHS

*Switches are not designed for wet environments. Please see your distributor for additional information.*
Quick Disconnect Cables

<table>
<thead>
<tr>
<th>Order Code</th>
<th>Type</th>
<th>Operating Voltage</th>
<th>Current Rating</th>
<th>Cable Material</th>
<th>Protection</th>
<th>Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>PX CST</td>
<td>Straight 5 m Cable (3 x 26 Gauge wire)</td>
<td>60 AC/75 DC</td>
<td>3 A</td>
<td>PUR</td>
<td>IP 68, III</td>
<td>M8</td>
</tr>
<tr>
<td>PX C90</td>
<td>90° 5 m Cable (3 x 26 Gauge wire)</td>
<td>60 AC/75 DC</td>
<td>3 A</td>
<td>PUR</td>
<td>IP 68, III</td>
<td>M8</td>
</tr>
</tbody>
</table>

R Series World Switch Hall Effect Part Numbers

<table>
<thead>
<tr>
<th>P/N</th>
<th>Switch Style</th>
<th>Electrical Design</th>
<th>Output</th>
<th>Operating Voltage</th>
<th>Current Rating</th>
<th>Switching Power</th>
<th>Voltage Drop</th>
<th>NEMA IP Rating</th>
<th>Temperature Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>SH6-031</td>
<td>Flying Lead</td>
<td>DC PNP</td>
<td>Normally Open</td>
<td>6-24 VDC</td>
<td>0.3 Amps Max.</td>
<td>7.2 Watts Max.</td>
<td>.5 Volts</td>
<td>NEMA 6</td>
<td>-25° to +75° C</td>
</tr>
<tr>
<td>SH6-032</td>
<td>Flying Lead</td>
<td>DC PNP</td>
<td>Normally Open</td>
<td>6-24 VDC</td>
<td>0.3 Amps Max.</td>
<td>7.2 Watts Max.</td>
<td>.5 Volts</td>
<td>NEMA 6</td>
<td>-25° to +75° C</td>
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<tr>
<td>SH6-021</td>
<td>M8 Connector</td>
<td>DC NPN</td>
<td>Normally Open</td>
<td>6-24 VDC</td>
<td>0.3 Amps Max.</td>
<td>7.2 Watts Max.</td>
<td>.5 Volts</td>
<td>NEMA 6</td>
<td>-25° to +75° C</td>
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<td>SH6-022</td>
<td>M8 Connector</td>
<td>DC NPN</td>
<td>Normally Open</td>
<td>6-24 VDC</td>
<td>0.3 Amps Max.</td>
<td>7.2 Watts Max.</td>
<td>.5 Volts</td>
<td>NEMA 6</td>
<td>-25° to +75° C</td>
</tr>
</tbody>
</table>

PNP Sourcing

NPN Sinking