# AR Series

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Features and Benefits</td>
<td>3</td>
</tr>
<tr>
<td>How to Order</td>
<td>4</td>
</tr>
<tr>
<td>Dimensions</td>
<td>5</td>
</tr>
<tr>
<td>Technical Specifications</td>
<td>6</td>
</tr>
<tr>
<td>NuMate Compatibility</td>
<td>7</td>
</tr>
<tr>
<td>Sensing Part Numbers</td>
<td>8-10</td>
</tr>
<tr>
<td>Quick Disconnect Cables</td>
<td>11</td>
</tr>
</tbody>
</table>
Rotary Actuator Utilizes a Dual Rack-n-Pinion System

The Torque Rack produces the rotary output torque while the control rack determines rotary stroke.

The output shaft is supported by two angular contact bearings. The NuMate mounting feature provides a convenient method of mounting the AR-Rotaries to the SH-Series linear slide.

**A. Body:**
Hardcoat Anodized Aluminum
Lightweight, durable, high strength to weight ratio, PTFE impregnated inside and out.

**Multiple mounting surfaces**
Flexible, easy access mounting.

**B. Output Shaft:**
Hardened electroless nickel
Corrosion and wear resistance.

**Angular Contact Bearings**
Two angular contact bearings better supporting both thrust and radial loads.

**C. Stroke Adjustment:**
Clockwise and Counter Clockwise Adjustment over 185° total stroke
Infinite adjustment in both directions of rotation, secured by jam nut.

**D. Sensor Mounting Channel:**
Machined into body
Accepts Numatics Motion Control dovetail switches, easy access, easy adjustment

Magnetic piston is standard on all models.

Permanently lubricated seals are standard on all models, no lube required. FKM compound for high temperature applications, optional.

Additional options:
- Shock absorbers
- Double output shaft
How to Order

Bore Sizes
020 = 20 mm
025 = 25 mm
032 = 32 mm

Rotation
A = 90°-180°

Seal Option
1 = Buna
2 = FKM

Shaft Option
A = Standard Single Shaft End
Z = Additional Double Shaft End*
*Tapped both ends.

Example order:
Part Number: AR020A1AZC1X*
Part Description: AR rotary with 20mm bore, 90° rotation, standard seals, standard single output shaft, Hall PNP quick disconnect sensing, two positions, with shocks without NuMate disk.

*When entering an order, DO NOT use spaces or dashes. Follow example above.

Replacement Components and Kits

AR Rotary Seal Kit

<table>
<thead>
<tr>
<th>Series</th>
<th>Buna</th>
<th>FKM</th>
</tr>
</thead>
<tbody>
<tr>
<td>AR020</td>
<td>ARSKB-020</td>
<td>ARSKV-020</td>
</tr>
<tr>
<td>AR025</td>
<td>ARSKB-025</td>
<td>ARSKV-025</td>
</tr>
<tr>
<td>AR032</td>
<td>ARSKB-032</td>
<td>ARSKV-032</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Replacement</th>
<th>Shocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>AR020</td>
<td>SK030</td>
</tr>
<tr>
<td>AR025</td>
<td>SK106</td>
</tr>
<tr>
<td>AR032</td>
<td>SK106</td>
</tr>
</tbody>
</table>

NuMate Disk

The NuMate Disk provides a simple solution for combining rotary and linear motion

**Compatibility Table

<table>
<thead>
<tr>
<th>AR Series</th>
<th>SH Series</th>
<th>ND</th>
</tr>
</thead>
<tbody>
<tr>
<td>AR020</td>
<td>SH056</td>
<td>ND020</td>
</tr>
<tr>
<td>AR025</td>
<td>SH075</td>
<td>ND025</td>
</tr>
<tr>
<td>AR032</td>
<td>SH106</td>
<td>ND025</td>
</tr>
</tbody>
</table>
### AR Series

Dimensions: Inches

<table>
<thead>
<tr>
<th></th>
<th>AR020</th>
<th>AR025</th>
<th>AR032</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>5.18</td>
<td>6.43</td>
<td>7.43</td>
</tr>
<tr>
<td>B</td>
<td>0.22</td>
<td>0.22</td>
<td>0.33</td>
</tr>
<tr>
<td>C</td>
<td>1.83</td>
<td>2.25</td>
<td>2.89</td>
</tr>
<tr>
<td>D</td>
<td>1.76</td>
<td>2.12</td>
<td>2.56</td>
</tr>
<tr>
<td>E</td>
<td>0.37</td>
<td>0.47</td>
<td>0.63</td>
</tr>
<tr>
<td>F</td>
<td>1.00</td>
<td>1.00</td>
<td>1.50</td>
</tr>
<tr>
<td>G</td>
<td>0.093 X 0.054/0.058 DP</td>
<td>0.125 X 0.070/0.074 DP</td>
<td>0.187 X 0.105/0.110 DP</td>
</tr>
<tr>
<td>H</td>
<td>0.65</td>
<td>0.75</td>
<td>1.00</td>
</tr>
<tr>
<td>J</td>
<td>2.58</td>
<td>3.21</td>
<td>3.71</td>
</tr>
<tr>
<td>K</td>
<td>0.24</td>
<td>0.25</td>
<td>0.30</td>
</tr>
<tr>
<td>L</td>
<td>1.31</td>
<td>1.57</td>
<td>1.94</td>
</tr>
<tr>
<td>M</td>
<td>1.87</td>
<td>2.125</td>
<td>2.50</td>
</tr>
<tr>
<td>N</td>
<td>0.47</td>
<td>0.49</td>
<td>0.56</td>
</tr>
<tr>
<td>P</td>
<td>0.81</td>
<td>1.13</td>
<td>1.44</td>
</tr>
<tr>
<td>Q</td>
<td>10-32</td>
<td>1/4-20</td>
<td>1/4-20</td>
</tr>
<tr>
<td>R</td>
<td>1.50</td>
<td>2.02</td>
<td>2.23</td>
</tr>
<tr>
<td>S</td>
<td>2.16</td>
<td>2.37</td>
<td>2.96</td>
</tr>
<tr>
<td>T</td>
<td>4.46</td>
<td>5.71</td>
<td>6.57</td>
</tr>
<tr>
<td>U</td>
<td>1.46</td>
<td>1.75</td>
<td>2.13</td>
</tr>
<tr>
<td>V</td>
<td>1/8 NPT</td>
<td>1/8 NPT</td>
<td>1/8 NPT</td>
</tr>
<tr>
<td>W</td>
<td>3.38</td>
<td>3.81</td>
<td>4.26</td>
</tr>
<tr>
<td>X</td>
<td>0.90</td>
<td>1.30</td>
<td>1.58</td>
</tr>
<tr>
<td>Y</td>
<td>1.31</td>
<td>1.57</td>
<td>1.94</td>
</tr>
<tr>
<td>ZZ</td>
<td>0.80</td>
<td>0.98</td>
<td>1.27</td>
</tr>
</tbody>
</table>

**AA**

<table>
<thead>
<tr>
<th></th>
<th>C’ Bored for M4 SHCS, Tapped M5 X 0.8 from opposite side</th>
<th>C’ Bored for M5 SHCS, Tapped M6 X 1.25 from opposite side</th>
<th>C’ Bored for M6 SHCS, Tapped M8 X 1.25 from opposite side</th>
</tr>
</thead>
<tbody>
<tr>
<td>BB1</td>
<td>M3 X 0.5</td>
<td>M5 X 0.8</td>
<td>M5 X 0.8</td>
</tr>
<tr>
<td>BB2</td>
<td>M3 X 0.5</td>
<td>M5 X 0.8</td>
<td>M5 X 0.8</td>
</tr>
<tr>
<td>CC</td>
<td>0.40</td>
<td>0.51</td>
<td>0.58</td>
</tr>
<tr>
<td>DD</td>
<td>1.31</td>
<td>1.50</td>
<td>1.81</td>
</tr>
<tr>
<td>EE</td>
<td>0.40</td>
<td>0.42</td>
<td>0.56</td>
</tr>
</tbody>
</table>
AR Series

<table>
<thead>
<tr>
<th>Model</th>
<th>Torque @ 100PSI</th>
<th>Dynamic Thrust Load</th>
<th>Dynamic Radial Load</th>
<th>Displacement per Degree</th>
<th>Unit Weight</th>
<th>Maximum Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>AR020</td>
<td>14.6 inlb (1.6 N-m)</td>
<td>106 lbf (471 N)</td>
<td>421 lbf (1872 N)</td>
<td>0.0026 cuin. (0.043 cc)</td>
<td>2.3 lbs</td>
<td>250 psi</td>
</tr>
<tr>
<td>AR025</td>
<td>29.4 inlb (3.3 N-m)</td>
<td>127 lbf (564 N)</td>
<td>501 lbf (2228 N)</td>
<td>0.0052 cuin. (0.085 cc)</td>
<td>3.1 lbs</td>
<td>250 psi</td>
</tr>
<tr>
<td>AR032</td>
<td>61.3 inlb (6.9 N-m)</td>
<td>191 lbf (849 N)</td>
<td>677 lbf (3011 N)</td>
<td>0.0108 cuin. (0.177 cc)</td>
<td>5.7 lbs</td>
<td>250 psi</td>
</tr>
</tbody>
</table>

Kinetic Energy Basic Formula

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

\[
\omega = 0.035 \times \frac{\text{Angle traveled (deg.)}}{\text{Rotation time (sec)}}
\]

Point Load

Thin Disk Mounted on Center

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

Thin Disk End Mounted on Center

\[
J = \frac{W}{g} \times \frac{1}{4} \times \left( \frac{L^2}{3} + r^2 \right)
\]

Point Load

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

Thin Rectangular Plate Mounted on Center

\[
J = \frac{W}{g} \times \frac{a^2 + b^2}{12}
\]

Rectangular Plate Mounted off Center

\[
J = \frac{W_1}{g} \times \frac{4a^2 + C^2}{12} + \frac{W_2}{g} \times \frac{4b^2 + C^2}{12}
\]

Shock Option

Face Mounting

KE = Kinetic Energy

\( J = \) Rotational mass moment of inertia \((\text{in-lb-sec}^2)\)

(dependent on physical size of object and weight)

\( W = \) Peak Velocity \((\text{rad/sec})\) \(\) (Assuming twice average velocity)

\( W = \) Weight of load \((\text{lb})\)

\( g = \) Gravitational constant \(= 386.4 \text{ in/sec}^2\)

\( r = \) Radius of gyration \((\text{in})\)
NuMate Direct Mount, Mounting System

The NuMate mounting system provides a standard series of drilled, tapped and counterbored holes allowing each slide series to mount with each other and other slide series in various combinations without the use of adapter, transition plates or other costly methods. The NuMate mounting system is the most versatile mounting method of its kind, providing customers with a cost effective method of building modular component automation. The NuMate mounting system is consistent across the Numatics Motion Control spectrum of products for automation.

### Compatibility Table

<table>
<thead>
<tr>
<th>SH Series</th>
<th>AR Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>SH056</td>
<td>AR020</td>
</tr>
<tr>
<td>SH075</td>
<td>AR025</td>
</tr>
<tr>
<td>SH106</td>
<td>AR032</td>
</tr>
</tbody>
</table>

### AR Series Rotary

<table>
<thead>
<tr>
<th>Bore</th>
<th>Bracket P/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>AR020</td>
<td>N99-1185</td>
</tr>
<tr>
<td>AR025</td>
<td>N99-1185</td>
</tr>
<tr>
<td>AR032</td>
<td>N99-1185</td>
</tr>
</tbody>
</table>

### Sensor Specifications

<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>
</tr>
</tbody>
</table>

See page 8, 9, & 10 for sensor specifications.
## Sensing Part Numbers

### PNP-FL2-00-U
- **Electrical Design**: DC PNP
- **Output**: Normally Open
- **Operating Voltage**: 10-30 VDC
- **Current Rating**: 100 mA
- **Short-Circuit Protection**: Yes
- **Overload Protection**: Yes
- **Reverse Polarity Protection**: Yes
- **Voltage Drop**: < 2.5 V
- **Current Consumption**: < 12 mA
- **Repeatability**: < .2mm
- **Power-On Delay Time**: < 30 ms
- **Switch Frequency**: > 3000 Hz
- **Ambient Temperature**: -25ºC to 85ºC
- **Protection**: IP 67, III
- **Hysteresis**: 1.0 mm
- **Magnetic Sensitivity**: 2.0 mT
- **Travel Speed**: > 10 m/s
- **Housing Material**: PA (Polyamide) Black; Fastening Clamp: Stainless Steel
- **Function Display**: Yellow LED
- **Switching Status**: Flying Leads, Pur Cable (2m Long, 3 x26 Gauge Wire)
- **Connection**: Clamping Screw with Combined Slot/Hexagon Socket Head AF 1.5 cULus - Class 2 Source Required
- **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
- **Agency Approvals**: CE, cULus, RoHS

### PNP-QDS-M8-U
- **Electrical Design**: DC PNP
- **Output**: Normally Open
- **Operating Voltage**: 10-30 VDC
- **Current Rating**: 100 mA
- **Short-Circuit Protection**: Yes
- **Overload Protection**: Yes
- **Reverse Polarity Protection**: Yes
- **Voltage Drop**: < 2.5 V
- **Current Consumption**: < 12 mA
- **Repeatability**: < .2mm
- **Power-On Delay Time**: < 30 ms
- **Switch Frequency**: > 3000 Hz
- **Ambient Temperature**: -25ºC to 85ºC
- **Protection**: IP 67, III
- **Hysteresis**: 1.0 mm
- **Magnetic Sensitivity**: 2.0 mT
- **Travel Speed**: > 10 m/s
- **Housing Material**: PA (Polyamide) Black; Fastening Clamp: Stainless Steel
- **Function Display**: Yellow LED
- **Switching Status**: M8 Connector (Snap Fit) , Pur Cable (.3 m)
- **Connection**: Clamping Screw with Combined Slot/Hexagon Socket Head AF 1.5 cULus - Class 2 Source Required
- **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
- **Agency Approvals**: CE, cULus, RoHS

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

**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 POLARITY PROTECTION**: Yes
- **VOLTAGE DROP**: < 2.5 V
- **CURRENT CONSUMPTION**: < 12 mA
- **REPEATABILITY**: < .2mm
- **POWER-ON DELAY TIME**: < 30 ms
- **SWITCH FREQUENCY**: > 3000 Hz
- **AMBIENT TEMPERATURE**: -25°C to 85°C
- **PROTECTION**: IP 67, III
- **HYSTERESIS**: 1.0mm
- **MAGNETIC SENSITIVITY**: 2.0 mT
- **TRAVEL SPEED**: > 10 m/s
- **HOUSING MATERIAL**: PA (Polyamide) Black; Fastening Clamp: Stainless Steel
- **FUNCTION DISPLAY**: Yellow LED
- **CONNECTION**: Flying Leads, Pur Cable (2m Long, 3 x26 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**

- **ELECTRICAL DESIGN**: DC NPN
- **OUTPUT**: Normally Open
- **OPERATING VOLTAGE**: 10-30 VDC
- **CURRENT RATING**: 100 mA
- **SHORT-CIRCUIT PROTECTION**: Yes
- **OVERLOAD PROTECTION**: Yes
- **REVERSE POLARITY PROTECTION**: Yes
- **VOLTAGE DROP**: < 2.5 V
- **CURRENT CONSUMPTION**: < 12 mA
- **REPEATABILITY**: < .2mm
- **POWER-ON DELAY TIME**: < 30 ms
- **SWITCH FREQUENCY**: > 3000 Hz
- **AMBIENT TEMPERATURE**: -25°C to 85°C
- **PROTECTION**: IP 67, III
- **HYSTERESIS**: 1.0mm
- **MAGNETIC SENSITIVITY**: 2.0 mT
- **TRAVEL SPEED**: > 10 m/s
- **HOUSING 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

---

*Switches are not designed for wet environments. Please see your distributor for additional information.*
### 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 x26 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
- **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:**
  - 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
- **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>PXCST</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>PXC90</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>

Wiring:
- Core colors: BK black, BN brown, BU blue

Diagram:
- Blue (–)
- Brown (+)
- Black (OUTPUT)
- 26 GAUGE WIRES
- M8 x 1

Dimensions:
- BLUE: 196.85 [5000]
- BROWN: 1.50 [38.1]
- BLACK: ø.4 [10]
- Current: 1.50 [38.1]
- Diameter: 1.2 [31]
- Lead: 1.50 [38.1]