

NUMATICS®

AR Series

Rotary Actuator



www.numatics.com

AR Series

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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:

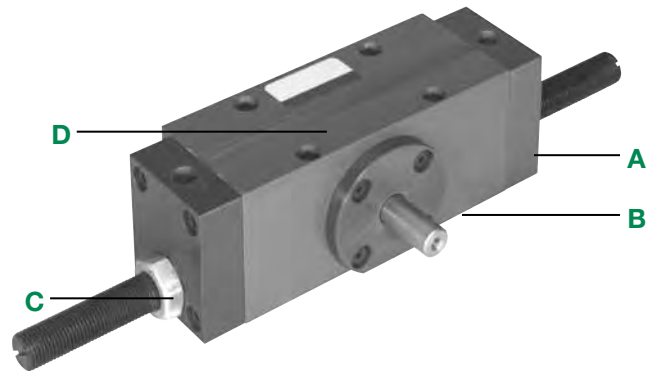
Clockwise and Counter Clockwise Adjustment over 185° total stroke

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

AR 020 A 1 A Z C 1 X

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.

Disk Size**

- A = NuMate Disk 020
- B = NuMate Disk 025
- C = NuMate Disk 032
- X = No Disk

Shock Options

- 1 = Shocks Yes
- 2 = Shocks No

Sensing Position

- A = Single Position CW
- B = Single Position CCW
- C = Two Position
- D = No Sensing

Sensing Type

- Standard Cord Set
 - 1 = Hall Effect - PNP (sourcing)
 - 2 = Hall Effect - NPN (sinking)
 - 3 = Reed Switch
 - 6 = No Sensing
 - Quick Disconnect Cord Set
 - Z = Hall Effect - PNP (sourcing)
 - Y = Hall Effect - NPN (sinking)
 - X = Reed Switch
- See page 7.

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

| Series | Buna | FKM |
|--------|-----------|-----------|
| AR020 | ARSKB-020 | ARSKV-020 |
| AR025 | ARSKB-025 | ARSKV-025 |
| AR032 | ARSKB-032 | ARSKV-032 |

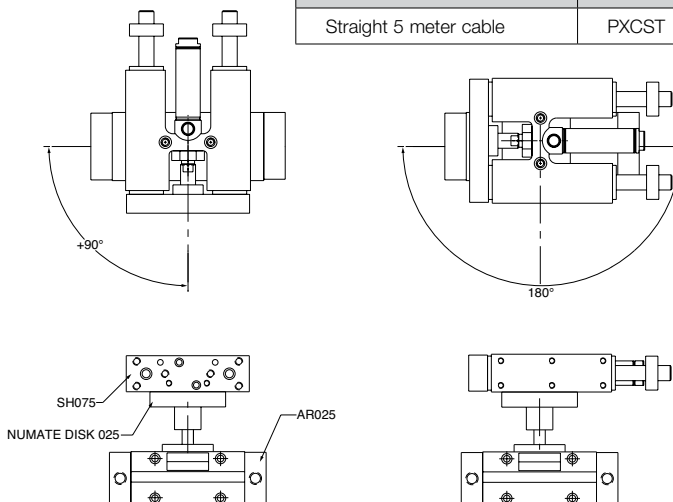
| Replacement | Shocks |
|-------------|--------|
| AR020 | SK030 |
| AR025 | SK106 |
| AR032 | SK106 |

NuMate Disk

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

****Compatibility Table**

| AR Series | SH Series | ND |
|-----------|-----------|-------|
| AR020 | SH056 | ND020 |
| AR025 | SH075 | ND025 |
| AR032 | SH106 | ND032 |

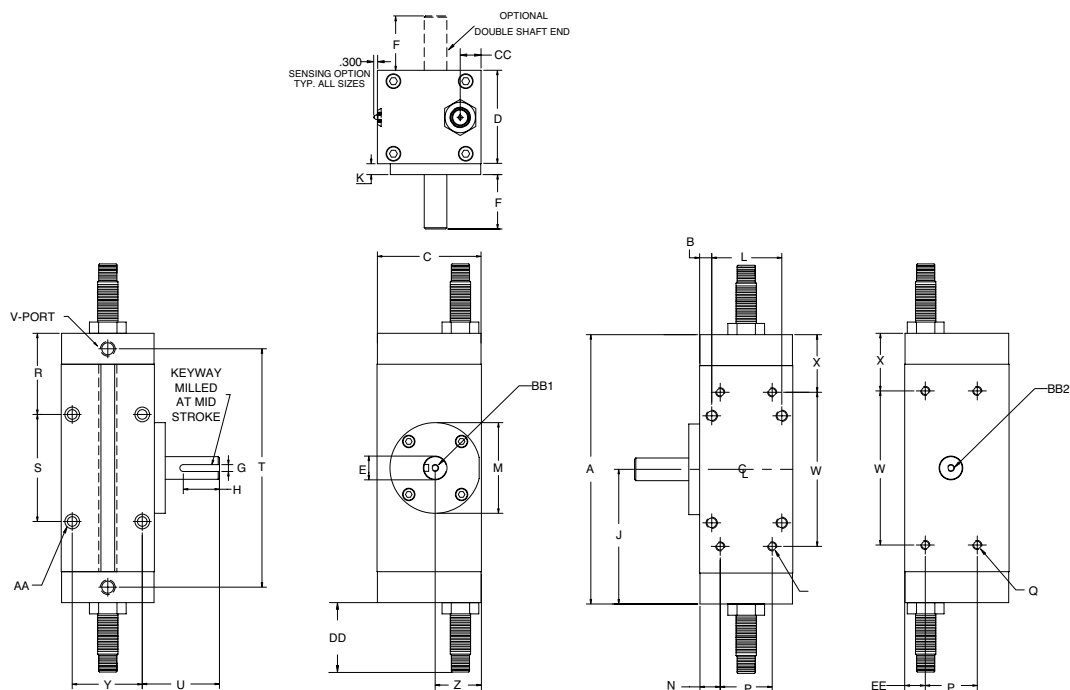


Sensing Kits

| Standard Cord Set | |
|----------------------------|--------------|
| Switch | Part No. |
| Hall Effect PNP (Sourcing) | PNP-FL2-00-U |
| Hall Effect NPN (Sinking) | NPN-FL2-00-U |
| Reed Switch | REED-FL2-00 |
| Quick Disconnect Cord Set | |
| Part No. | |
| Hall Effect PNP (Sourcing) | PNP-QDS-M8-U |
| Hall Effect NPN (Sinking) | NPN-QDS-M8-U |
| Reed Switch | REED-QDS-M8U |
| 90° 5 meter cable | PXC90 |
| Straight 5 meter cable | PXCST |

Dimensions: Inches

AR Series



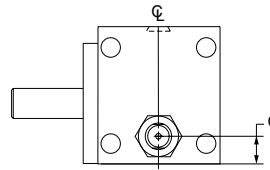
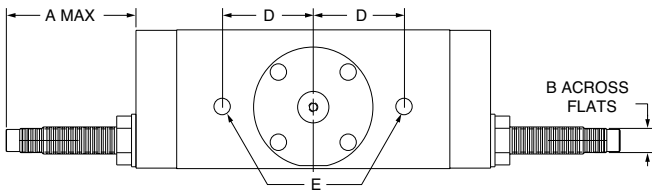
| | AR020 | AR025 | AR032 |
|-----|--|---|---|
| A | 5.18 | 6.43 | 7.43 |
| B | 0.22 | 0.22 | 0.33 |
| C | 1.83 | 2.25 | 2.89 |
| D | 1.76 | 2.12 | 2.56 |
| E | 0.37 | 0.47 | 0.63 |
| F | 1.00 | 1.00 | 1.50 |
| G | 0.093 X 0.054/0.058 DP | 0.125 X 0.070/0.074 DP | 0.187 X 0.105/0.110 DP |
| H | 0.65 | 0.75 | 1.00 |
| J | 2.58 | 3.21 | 3.71 |
| K | 0.24 | 0.25 | 0.30 |
| L | 1.31 | 1.57 | 1.94 |
| M | 1.87 | 2.125 | 2.50 |
| N | 0.47 | 0.49 | 0.56 |
| P | 0.81 | 1.13 | 1.44 |
| Q | 10-32 | 1/4-20 | 1/4-20 |
| R | 1.50 | 2.02 | 2.23 |
| S | 2.16 | 2.37 | 2.96 |
| T | 4.46 | 5.71 | 6.57 |
| U | 1.46 | 1.75 | 2.13 |
| V | 1/8 NPT | 1/8 NPT | 1/8 NPT |
| W | 3.38 | 3.81 | 4.26 |
| X | 0.90 | 1.30 | 1.58 |
| Y | 1.31 | 1.57 | 1.94 |
| ZZ | 0.80 | 0.98 | 1.27 |
| AA | C' Bored for M4 SHCS, Tapped M5 X 0.8 from opposite side | C' Bored for M5 SHCS, Tapped M8 X 1.25 from opposite side | C' Bored for M6 SHCS, Tapped M8 X 1.25 from opposite side |
| BB1 | M3 X 0.5 | M5 X 0.8 | M5 X 0.8 |
| BB2 | M3 X 0.5 | M5 X 0.8 | M5 X 0.8 |
| CC | 0.40 | 0.51 | 0.58 |
| DD | 1.31 | 1.50 | 1.81 |
| EE | 0.40 | 0.42 | 0.56 |

AR Series

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

Shock Option

Face Mounting



| | AR020 | AR025 | AR032 |
|---|-------|-------|-------|
| A | 2.70 | 2.70 | 2.75 |
| B | 0.49 | 0.49 | 0.49 |
| C | 0.40 | 0.51 | 0.58 |
| D | 1.69 | 1.90 | 2.12 |
| E | M5 | M6 | M8 |

Kinetic Energy Basic Formula

$$KE = 1/2 J \omega^2$$

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

KE = Kinetic Energy

J = Rotational mass moment of inertia (in-lb-sec²)
(dependent on physical size of object and weight)

W = 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)

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

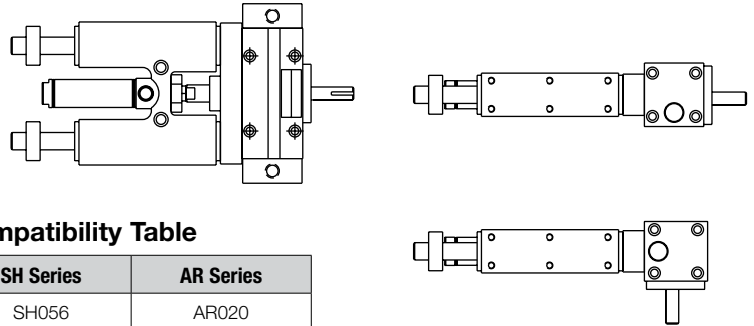
$$J = \frac{W}{g} \times \frac{a^2 + b^2}{12}$$

Rectangular Plate Mounted off Center

$$J = \frac{W1}{g} \times \frac{4a^2 + C^2}{12} + \frac{W2}{g} \times \frac{4b^2 + C^2}{12}$$

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

| SH Series | AR Series |
|-----------|-----------|
| SH056 | AR020 |
| SH075 | AR025 |
| SH106 | AR032 |

AR Series Rotary

| Bore | Bracket P/N |
|-------|-------------|
| AR020 | N99-1185 |
| AR025 | N99-1185 |
| AR032 | N99-1185 |

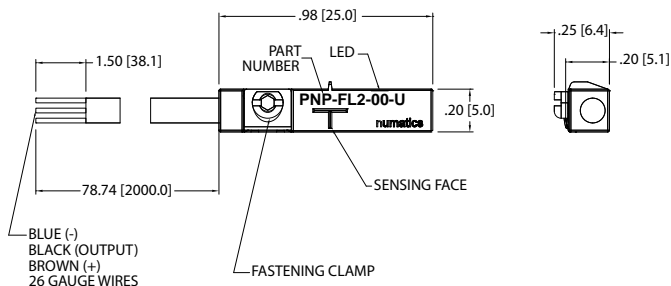


| Sensor Description | Standard Cord Set | Quick Disconnect |
|--------------------|-------------------|------------------|
| Reed Switch | REED-FL2-00 | REED-QDS-M8U |
| Hall PNP | PNP-FL2-00-U | PNP-QDS-M8-U |
| Hall NPN | NPN-FL2-00-U | NPN-QDS-M8-U |

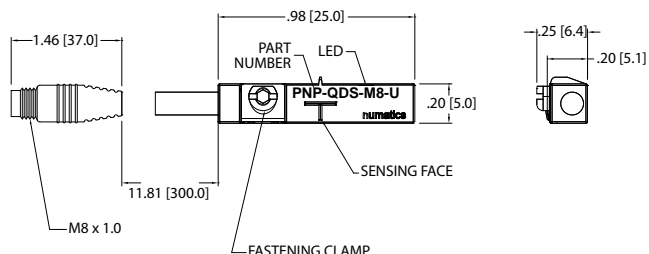
See page 8, 9, & 10 for sensor specifications

Sensing Part Numbers

PNP-FL2-00-U



PNP-QDS-M8-U

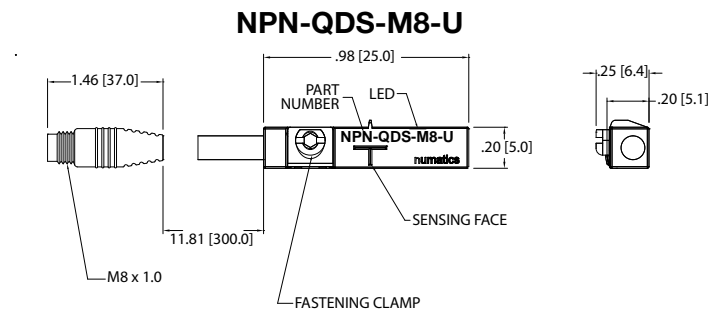
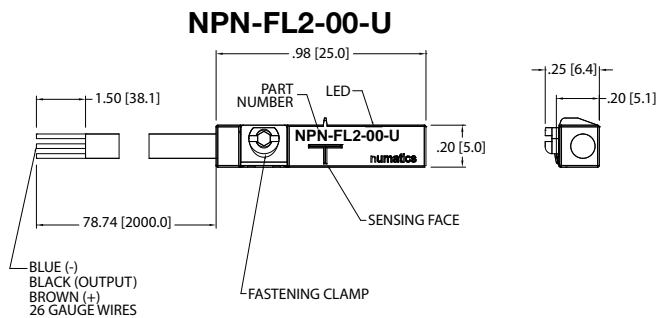





| | |
|-----------------------------------|---|
| ELECTRICAL DESIGN | DC PNP |
| OUTPUT | Normally Open |
| OPERATING VOLTAGE | 10-30 VDC |
| CURRENT RATING | 100 mA |
| SHORT-CIRCUIT PROTECTION | Yes |
| OVERLOAD PROTECTION | Yes |
| REVERSE POLARITY PROTECTION | Yes |
| VOLTAGE DROP | < 2.5 V |
| CURRENT CONSUMPTION | < 12 mA |
| REPEATABILITY | < .2mm |
| POWER-ON DELAY TIME | < 30 ms |
| SWITCH FREQUENCY | > 3000 Hz |
| AMBIENT TEMPERATURE | -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 SWITCHING STATUS | 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 Placeholder, Cable Clip, and Cut Sheet To Be Provided with Every Switch |
| AGENCY APPROVALS | CE cULus RoHS |




| | |
|-----------------------------------|---|
| 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 | -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 SWITCHING STATUS | 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 Placeholder, 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



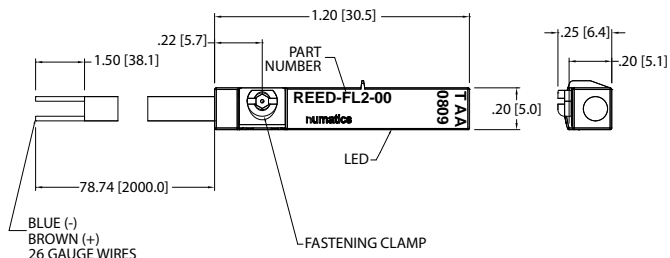
| ELECTRICAL DESIGN | DC NPN |
|-----------------------------------|---|
| OUTPUT | Normally Open |
| OPERATING VOLTAGE | 10-30 VDC |
| CURRENT RATING | 100 mA |
| SHORT-CIRCUIT PROTECTION | Yes |
| OVERLOAD PROTECTION | Yes |
| REVERSE POLARITY PROTECTION | Yes |
| VOLTAGE DROP | < 2.5 V |
| CURRENT 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 SWITCHING STATUS | 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 Placeholder, Cable Clip, and Cut Sheet To Be Provided with Every Switch |
| AGENCY APPROVALS |    |

| 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 SWITCHING STATUS | 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 Placeholder, Cable Clip, and Cut Sheet To Be Provided with Every Switch |
| AGENCY APPROVALS |    |

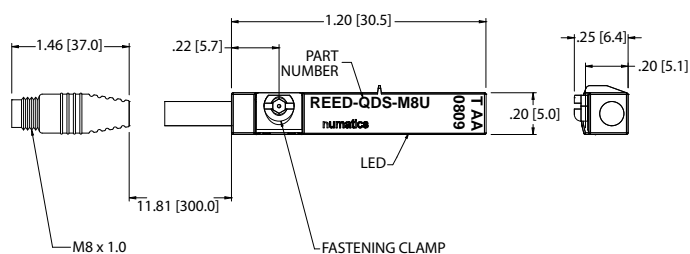
*Switches are not designed for wet environments. Please see your distributor for additional information.

Sensing Part Numbers

REED-FL2-00



REED-QDS-M8U

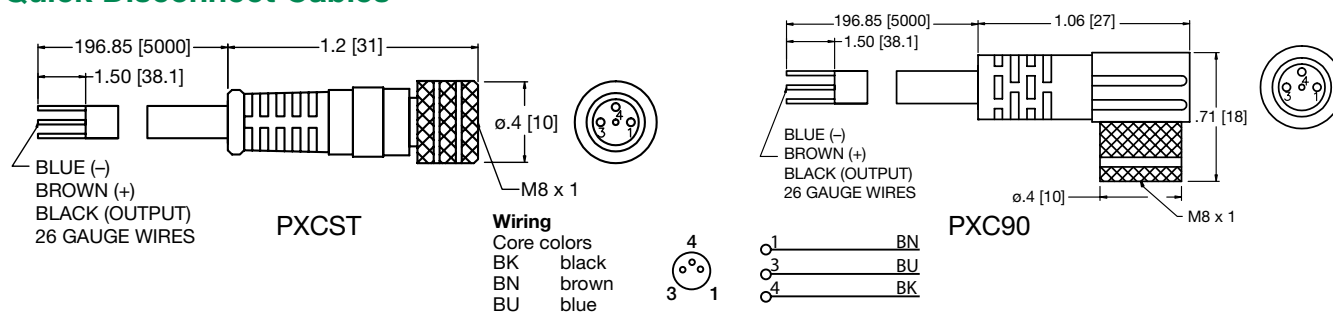


| | |
|-----------------------------------|---|
| ELECTRICAL DESIGN | AC/DC REED |
| OUTPUT | Normally Open |
| OPERATING VOLTAGE | 5-120 VAC/DC |
| CURRENT RATING | 100 mA* |
| SHORT-CIRCUIT PROTECTION | No |
| OVERLOAD PROTECTION | No |
| REVERSE POLARITY PROTECTION | Yes |
| VOLTAGE DROP | < 5 V |
| 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 SWITCHING STATUS | 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 Placeholder, Cable Clip, and Cut Sheet To Be Provided with Every Switch |
| AGENCY APPROVALS | CE RoHS |

| | |
|-----------------------------------|---|
| 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 SWITCHING STATUS | 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 Placeholder, Cable Clip, and Cut Sheet To Be Provided with Every Switch |
| AGENCY APPROVALS | CE RoHS |

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

Quick Disconnect Cables



| Order Code | Type | Operating Voltage | Current Rating | Cable Material | Protection | Connector |
|------------|--|-------------------|----------------|----------------|------------|-----------|
| PXCST | Straight 5 m Cable (3 x 26 Gauge wire) | 60 AC/75 DC | 3 A | PUR | IP 68, III | M8 |
| PXC90 | 90° 5 m Cable (3 x 26 Gauge wire) | 60 AC/75 DC | 3 A | PUR | IP 68, III | M8 |



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