High Performance Electric Actuator

for Stock Valve

PRP Series

Ideal for Basis Weight Control

Rotary Motion Electric Actuator

Model: PRP

Maximum torque
100N·m  Model: PRP-0
200N·m  Model: PRP-1

Stock Valve

M-SYSTEM CO., LTD.
www.m-system.com
Actuator Mechanism Ensuring High Precision Control of Stock Valves

- Backup battery (option)
- Micro-processor based control circuit board
- Indicator
- Terminal cover
- Worm Gear Mechanism
- Manual control shaft (hexagon socket)
- All shafts are supported with ball bearings.

Rotary Motion Electric Actuator
PRP Series

<table>
<thead>
<tr>
<th>Model</th>
<th>Maximum torque</th>
<th>Mass</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRP-0</td>
<td>100 N·m</td>
<td></td>
</tr>
<tr>
<td>PRP-1</td>
<td>200 N·m</td>
<td></td>
</tr>
</tbody>
</table>

Four reasons why the PRP is ideal for basis weight control

- Valve opening control in 1/1000 high resolution.
- Excellent repeatability and linearity of positioning.
- Opening/closing speed programmable in conjunction with the B/M control system (16 to 999 seconds per full span) to adapt with design speed changes of the paper machine.
- The actuator mass significantly reduced from conventional ones thanks to the high-torque design is convenient as replacement.

Model: PRP-0
Model: PRP-1

High Performance Electric Actuator for Stock Valve
High Precision Control of Stock Valves

Four reasons why the PRP is ideal for basis weight control:

1. **High resolution & precision**
   - Micro-processor based Electronic Motor Driver Circuit
   - Precisely tracking target position by feedback control in combination with predictive control
   - High Precision Position Sensor

2. **High torque**
   - 1/1000 high resolution

3. **Stepping Motor**
   - Motor rotation control resolution of 1.8 degrees per pulse

4. **Worm Gear Mechanism**
   - High precision gear system with minimum backlash
   - Compactly designed

5. **Worm Gear Mechanism**
   - High reduction ratio despite the compact size

6. **Stock Valve**
   - V-port ball valves are typically used.

7. **Vibration resistance**

8. **Position output**

9. **Position detection**

10. **Wiring conduit**

11. **Protection level**

12. **Failsafe function**

13. **Backup battery**

See Page 7
The following positive effects have been observed by introducing the PRP for a stock valve.

1  **Overall cost** ≈ 1/3

Calculation of the overall cost is based on an actual project in Japan, including the net cost of a replacement of the existing actuator, a control panel and installation fee. Consult with M-System for detailed information.

2  **Delivery leadtime** ≈ 1/9

Delivering a replacement of the existing actuator typically takes 9 months. 1 month will suffice for delivery of the PRP.

3  **Weight (mass)** ≈ 1/10

Mass of the old actuator and the PRP is compared in the images below. (In this project, the valve was also replaced.)

The PRP is easily adaptable with future design speed changes of the paper machine thanks to the opening/closing speed which is programmable in conjunction with the B/M control system.
In this project, the valve was also replaced. Mass of the old actuator and the PRP is compared in the images below. 1 month will suffice for delivery of the PRP. Delivering a replacement of the existing actuator typically takes 9 months. Consult with M-System for detailed information.

Calculation of the overall cost is based on an actual project in Japan, including the installation fee. The following positive effects have been observed by introducing the PRP for a stock valve.

**INSTALLATION EFFECTS**

**BEFORE**

- 1/3
- 1/10
- 4

**AFTER**

- 5
- PRP

Electric Actuator PRP Series connected to the bottom-layer pulpstock valve in the multilayer paperboard machine, with an electromagnetic flowmeter measuring pulp flow.

PRP connected to the top-layer pulpstock valve

Closeup of Picture 1: PRP
The above diagram shows the control scheme of a stock valve operating system. In the automatic operating mode, the B/M control system provides open and close contact command signals to the MXCB which increases/decreases the analog output signal proportionally to the ON time duration of the respective contact signals. They are provided from the manual loader STL in case of manual operating mode.

The analog output accuracy is approximately 0.1%. The PRP actuator is able to control the valve with 1/1000 resolution. The combination of these devices ensures the precise basis weight control.

The valve position signal is fed back to the B/M control system to quickly eliminate errors.

The travel time of an entire span (open from/to close) is programmable between 16 to 999 seconds depending upon the parameter combinations of the PRP and the MXCB.
The stepping-motor-driven actuator, PRP Series, is most suitable for operating stock valves that require high resolution, good linearity and high torque control ability.

The PRP is significantly smaller compared to conventional actuators using induction motors.

### HOW STEPPING MOTOR WORKS

**1/1000 Resolution**

The N pole and S pole toothed gears are engaged with an offset of half tooth. The bottom of a N pole tooth is aligned with the top of a S pole tooth.

Each pulse moves the shaft by a quarter (1/4) tooth pitch while the N pole teeth and the S pole teeth are attracted and repulsed in turn. Each of those rotations is called a “step.”

The motor has 50 teeth around the wheel, turning 1.8 degrees per step, requiring 200 pulses to make a complete rotation with an integer number of steps. In this way the motor can be turned by a precise mechanical angle in high resolution.

The motor shaft rotates more than 100 times while the actuator travels the entire stroke/span. The calculated resolution is greater than 1/20000°.

*The nominal resolution described in the actuator data sheet is 1/1000, considering additional influencing factors such as the accuracy of the position detecting sensor, backlash of the reducing gear mechanism.

The actuator rotor has 50 teeth. The above is a simplified example with 15 teeth.
**PRP SERIES SPECIFICATIONS**

### COMMON SPECIFICATIONS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>PRP-0</th>
<th>PRP-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input signal</td>
<td>4-20 mA DC or 1-5 V DC</td>
<td></td>
</tr>
<tr>
<td>Power input</td>
<td>100-120 V AC or 200-240 V AC</td>
<td></td>
</tr>
<tr>
<td>Protection level</td>
<td>IP 66</td>
<td></td>
</tr>
<tr>
<td>Wiring conduit</td>
<td>G 1/2 (two)</td>
<td></td>
</tr>
<tr>
<td>Motor</td>
<td>Stepping motor</td>
<td></td>
</tr>
<tr>
<td>Position detection</td>
<td>Potentiometer</td>
<td></td>
</tr>
<tr>
<td>Manual control</td>
<td>Provided</td>
<td></td>
</tr>
<tr>
<td>Position output</td>
<td>4-20 mA DC</td>
<td>100 N·m</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-20 to +55 °C</td>
<td></td>
</tr>
<tr>
<td>Vibration resistance</td>
<td>19.6 m/s² (2G) (max)</td>
<td></td>
</tr>
</tbody>
</table>

### EXTERNAL DIMENSIONS  unit: mm (inch)

<table>
<thead>
<tr>
<th>MODEL</th>
<th>PRP-0</th>
<th>PRP-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPAN</td>
<td>90 degrees</td>
<td></td>
</tr>
<tr>
<td>MAXIMUM TORQUE</td>
<td>100 N·m</td>
<td>200 N·m</td>
</tr>
<tr>
<td>OPENING/CLOSING SPEED (90 degrees)</td>
<td>12 seconds (PRP-01)</td>
<td>16 seconds (PRP-11)</td>
</tr>
<tr>
<td></td>
<td>24 seconds (PRP-03)</td>
<td>24 seconds (PRP-13)</td>
</tr>
<tr>
<td></td>
<td>8.5 to 125 seconds (PRP-00)</td>
<td>16 to 125 seconds (PRP-10)</td>
</tr>
<tr>
<td>MASS</td>
<td>Approx. 10.8 kg (approx. 12.1 kg with failsafe function option)</td>
<td></td>
</tr>
<tr>
<td>RESOLUTION</td>
<td>1/200 (deadband set to 0.5%), 1/1000 (deadband set to 0.1%)</td>
<td></td>
</tr>
</tbody>
</table>

### STANDARD TYPE

- **Model:** PRP-0
- **Maximum torque:** 100 N·m
- **Opening/closing speed:** 12 seconds (PRP-01), 24 seconds (PRP-03), 8.5 to 125 seconds (PRP-00)
- **Mass:** Approx. 10.8 kg
- **Resolution:** 1/200 (deadband set to 0.5%), 1/1000 (deadband set to 0.1%)

### FAILSAFE FUNCTION TYPE

- **Model:** PRP-1
- **Maximum torque:** 200 N·m
- **Opening/closing speed:** 16 seconds (PRP-11), 24 seconds (PRP-13), 16 to 125 seconds (PRP-10)
- **Mass:** Approx. 12.1 kg
- **Resolution:** 1/1000 (deadband set to 0.1%)

**Specifications are subject to change without notice. When ordering, use the latest data sheets available at M-System web site: www.m-system.com**