MSYSTEM
2016-10
EC-4800 500486
6-0002
Rev. 0.5
01

ELECTRIC ACTUATORS

No Need for Pneumatic System Components

PUSH **PULL** **ROTATE**

DIGITAL POSITIONER
- Easy zero/span adjustment
- Programmable opening/closing speed

STEPPING MOTOR
Precise control with 1/1000 resolution

RESOLUTION 1/1000
See Page 8

DC POWER DRIVE
Failsafe function by backup battery operation is optional.

Shafts are supported with ball bearings at both ends for excellent vibration resistance and durability.

Transparent image of model PRP

Lloyd's Register approved

APPROVED LR TYPE APPROVAL SCHEME

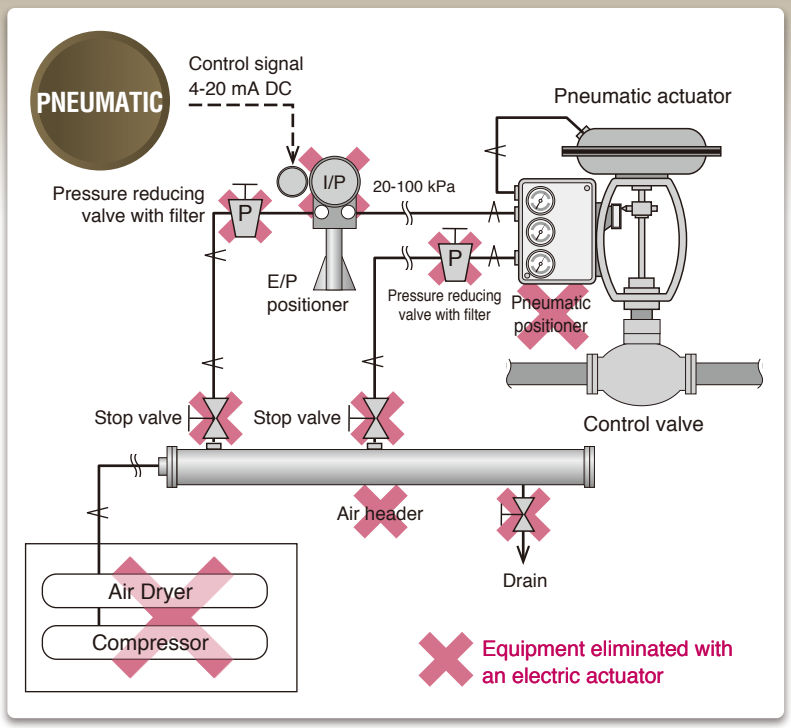
TYPE	LINEAR MOTION				ROTARY MOTION			
SERIES	MSP Series *1			PSN Series	MRP Series *1			PRP Series
	 CE	 CE	 CE	 CE	 CE	 CE	 CE	
MODEL	MSP4	MSP5	MSP6	PSN	MRP4	MRP5	MRP6	PRP
THRUST TORQUE	150 to 700 N	150 to 700 N	600 to 2500 N	1500 to 5000 N	5 N·m	10 N·m	10 to 33 N·m	100 to 200 N·m
OPEN NETWORK	CC-Link DeviceNet			Consult M-System	CC-Link DeviceNet			Consult M-System

*1. CE marking is available with selected models. Please consult M-System for detailed information.

M-SYSTEM CO., LTD.
www.m-system.com

A Simple, Life-cycle Cost Saving

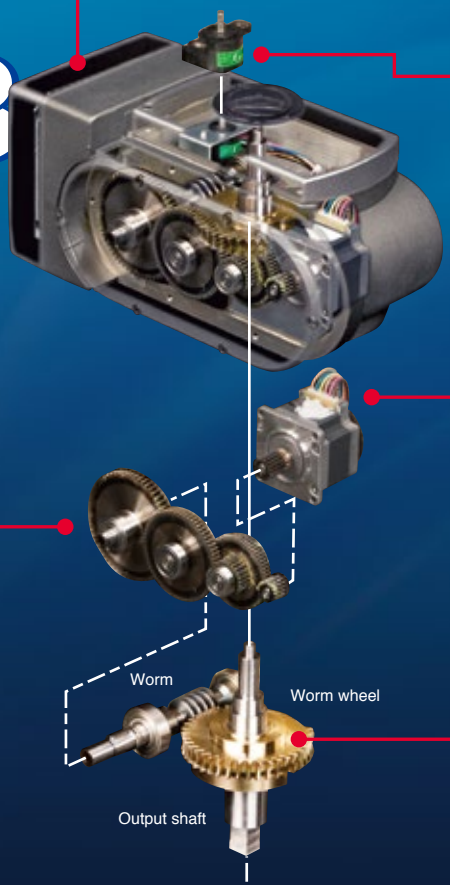
Pneumatic actuator requires a complex system and high electricity cost.



Before

In addition to the high equipment costs, the electricity bill is a headache. Compressor air leaks waste energy and cause system pressures.

Here is the mechanism that achieves high precision and high resolution control.



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

High torque
1/1000 high resolution

Stepping Motor

Motor rotation control resolution of 1.8 degrees per pulse

See Page 8

High precision torque control

3-step Reduction Gear Mechanism

High precision gear system with minimum backlash

Compactly designed

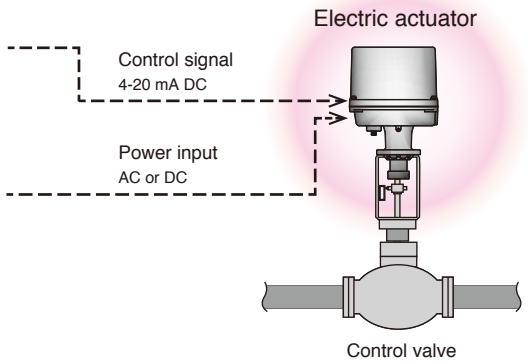
Worm Gear Mechanism

High reduction ratio despite the compact size

Solution.

Electric actuators consume less energy, without needing auxiliary equipment

ELECTRIC



Open network type is available for selected models.

Open networks including DeviceNet and CC-Link, are available.
Consult with M-System for other network protocols.

Emergency failsafe operation at power loss can be chosen with selected models using a backup battery (full-open, full-close, hold or specific position).

After

Equipment cost
↓1/5
Energy consumption
↓1/10

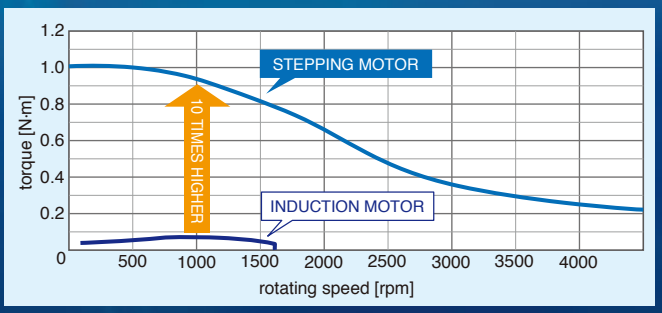
Features of Stepping Motor

See Page 8

Comparing to an induction motor

A stepping motor has the following advantages compared to an induction motor. It is most suitable as an actuating drive for small mechanisms including control valves.

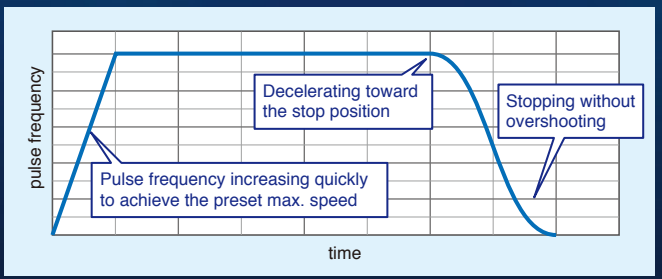
- High torque for small size (approx. 10 times greater than an induction motor of the same mass)
- High torque at startup; with little torque variation during acceleration
- Variable rotating speed
- Rotating speed unaffected by load changes
- High precision positioning by acceleration/deceleration control
- Unaffected by voltage or frequency variations by the power source



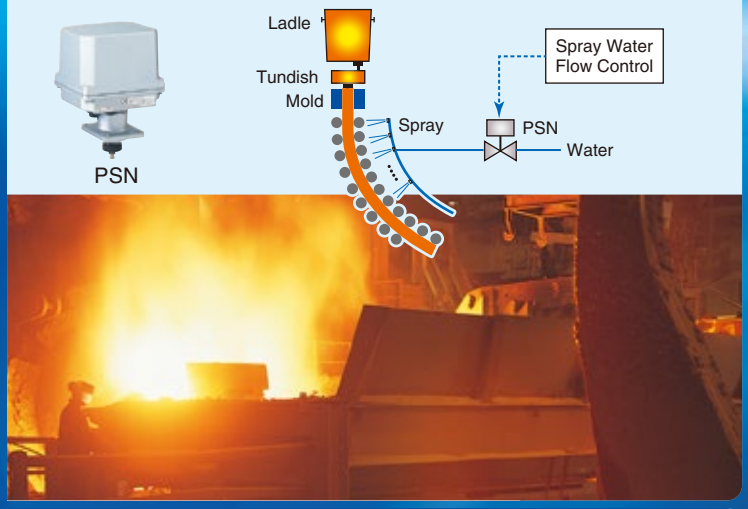
Predictive control enabling the motor to stop without overshooting

Basic rotating step per pulse of the two-phase stepping motor employed by the electric actuators is 1.8 degrees, thus requiring 200 pulses to complete a full 360-degree rotation.
The exact number of pulses is controlled by a micro-processor.

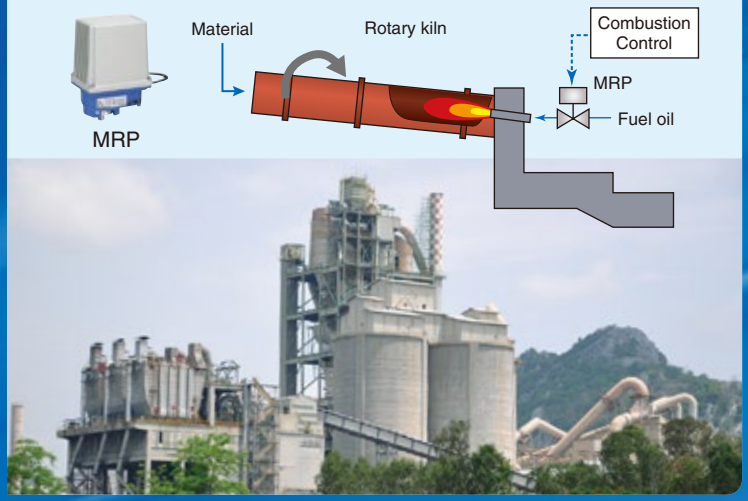
The “Predictive Control” employed as a part of its control algorithm enables the actuator to smoothly stop at an exact position (angle) without overshooting.



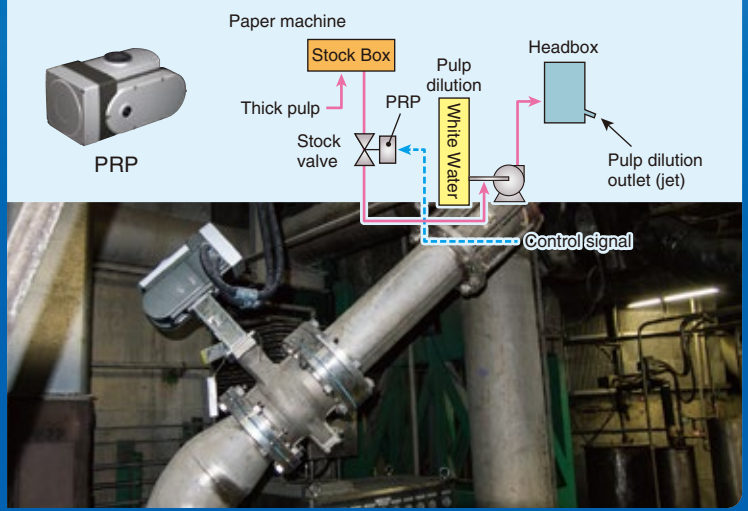
STEEL
Water Flow Control in Continuous Casting Line



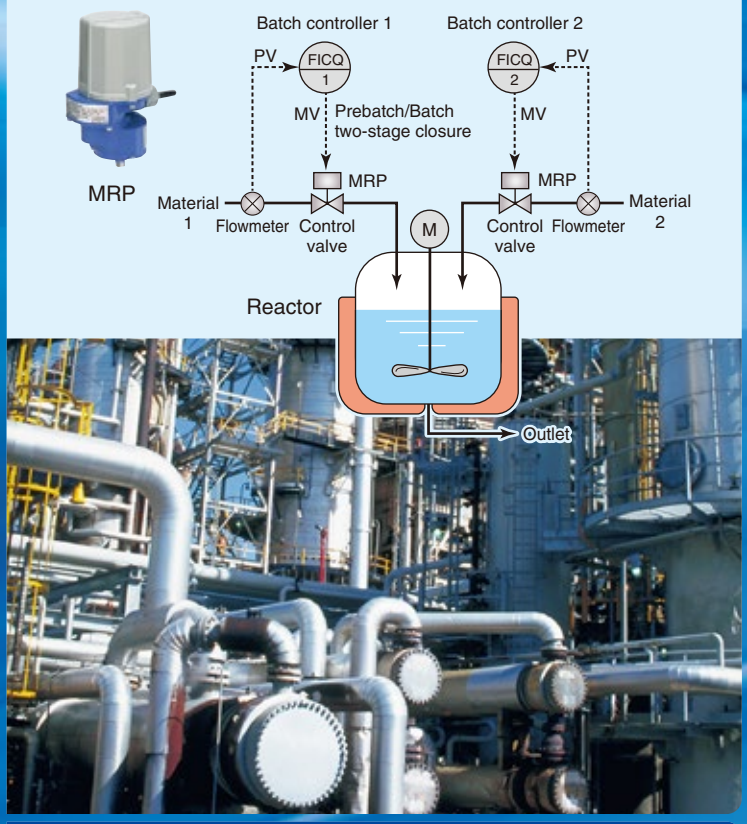
CEMENT
Fuel Flow Control in Rotary Kiln



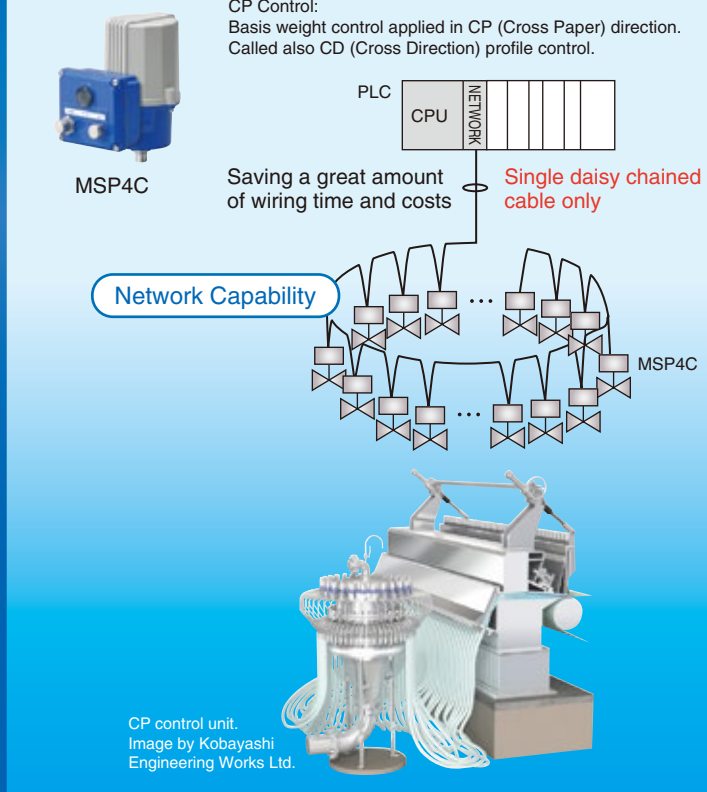
PAPER
Basis Weight Control



CHEMICAL
Batch Control



PAPER
Paper Profile Control



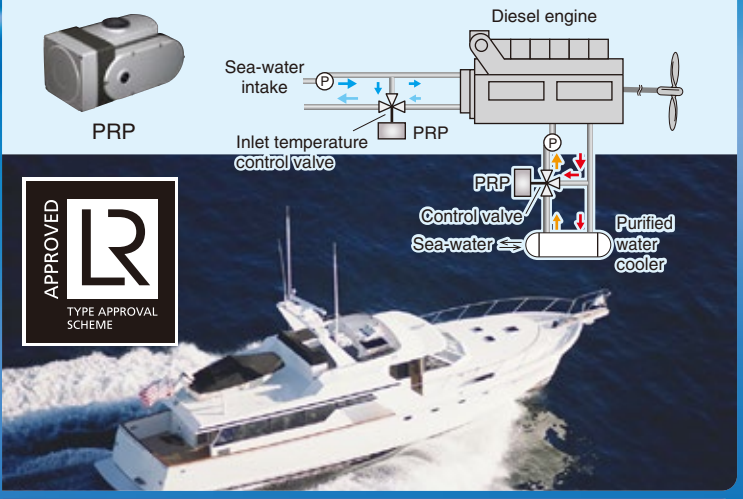
TURBO COMPRESSOR

Inlet Guide Vane Control

Turbo compressor
Image by IHI corporation

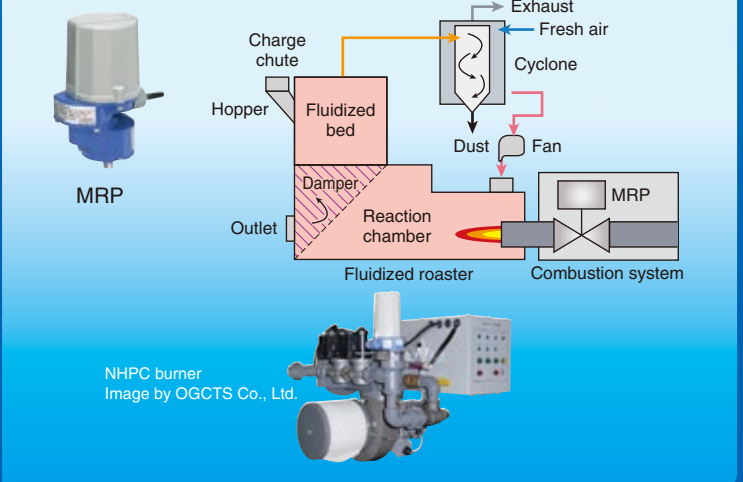
SHIP

Diesel Engine Cooling System



FOOD

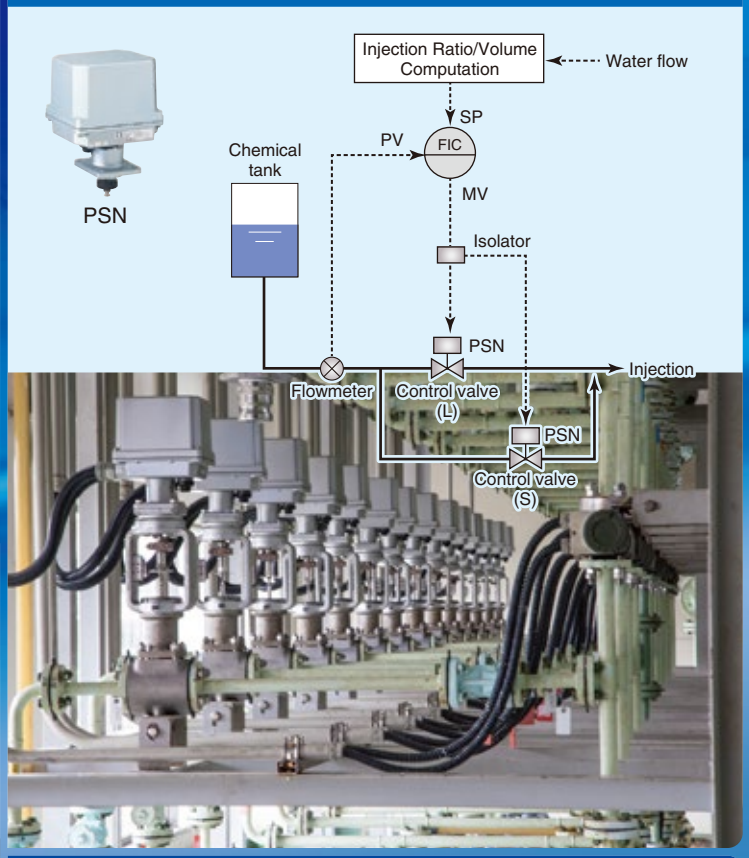
Gas Flow Control in Combustion System for Roasting Machine



NHPC burner
Image by OGCTS Co., Ltd.

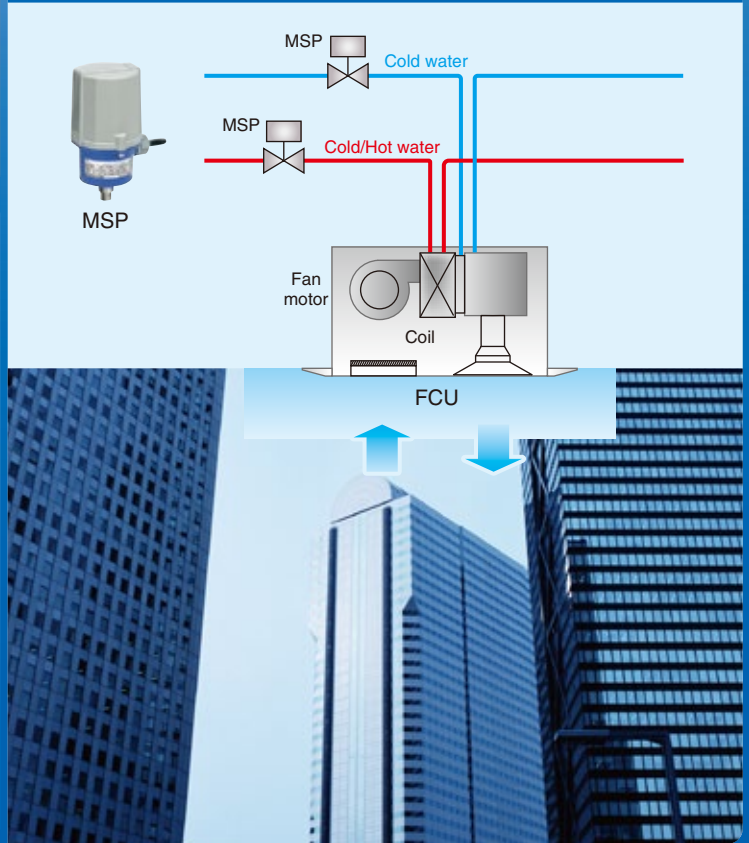
WATER TREATMENT

Chemical Injection Ratio Control



BUILDING HVAC

Cold/Hot Water Control for Fan Coil Unit



Proven Reliability. For over 30 years

Electric actuators are used in va

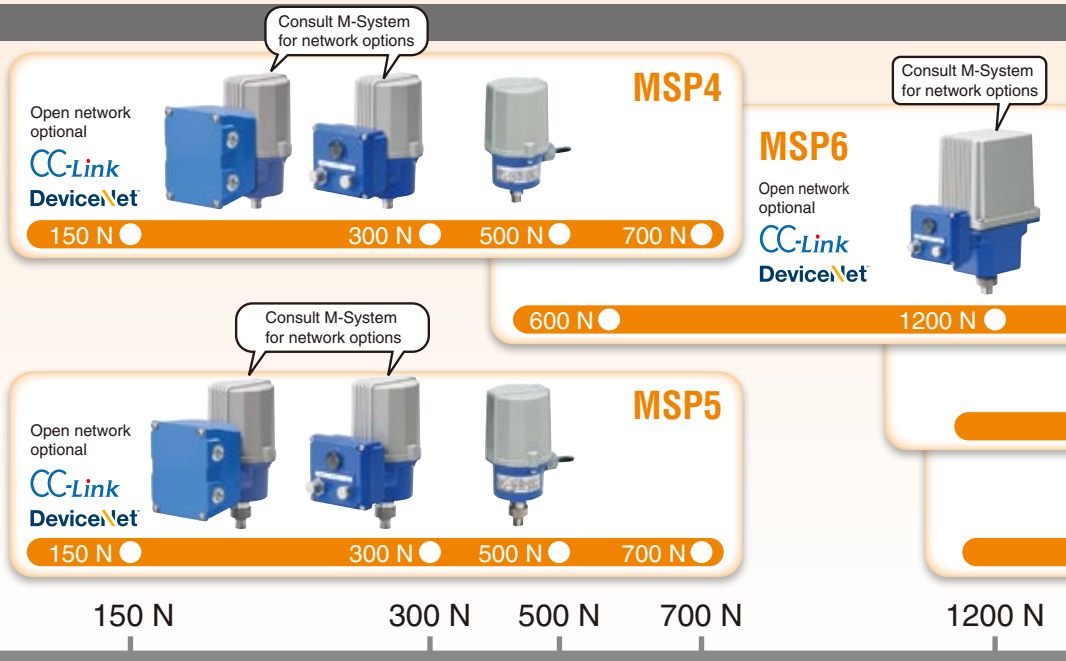
PUSH

PULL

THRUST

MSP Series

Open network capable electric actuators using stepping motors.
Compact size, long life and high resolution 1/1000.

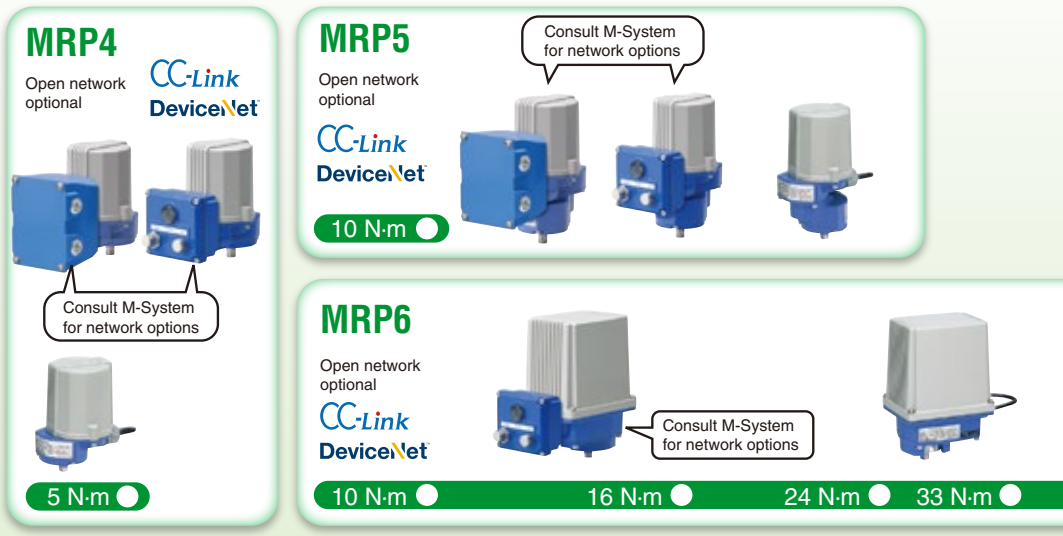


150 N 300 N 500 N 700 N 1200 N

TORQUE

5 N·m 10 N·m 16 N·m 24 N·m 33 N·m

ROTATE



MRP Series

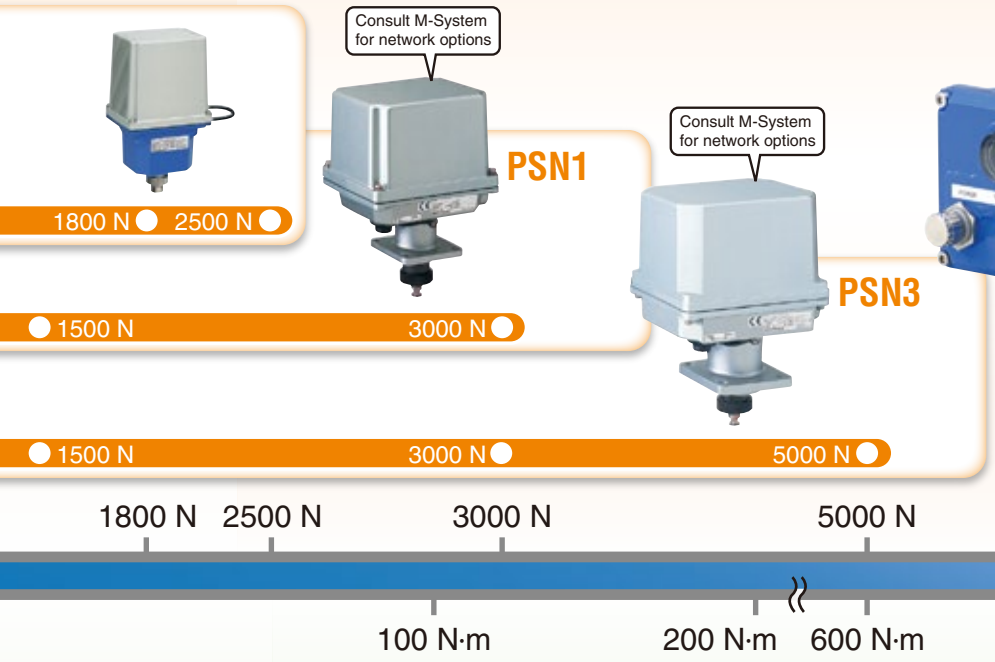
Open network capable electric actuators using stepping motors.
Compact size, long life and high resolution 1/1000.

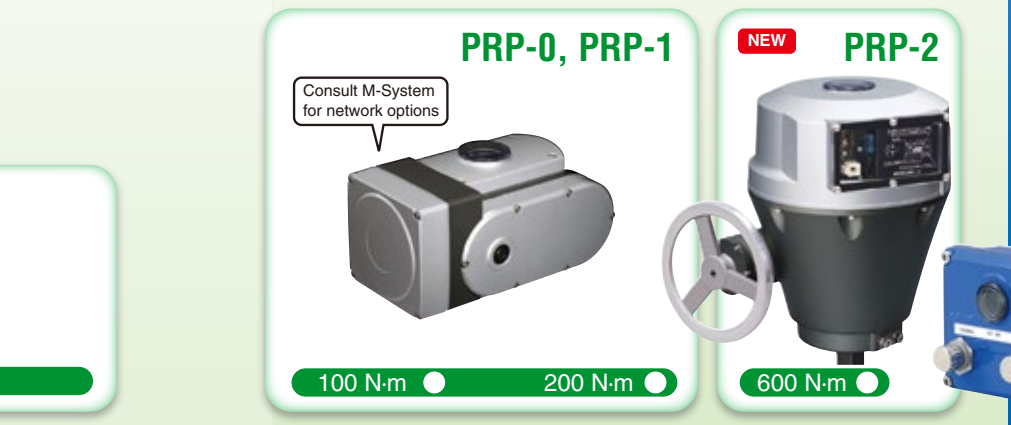
and more than 56,000 units installed.

rious demanding process fields.

PSN Series

Stepping motor realizing high resolution of 1/1000.
Opening/closing speed programmable. Brushless angle sensor.





Linear motion type

PSN1

Linear motion type

MSP5

Rotary motion type

PRP

Rotary motion type

MRP6

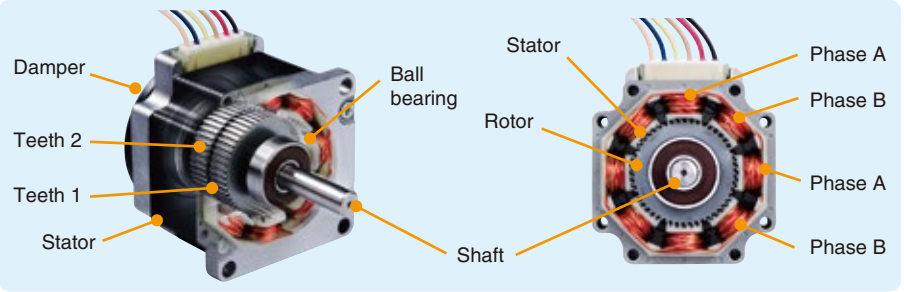
PRP Series

The PRP-2 is under development as of October 2016.
Specifications are subject to change without notice.

Stepping motor realizing high resolution of 1/1000.
Opening/closing speed programmable (8.5 to 125 sec/90°).

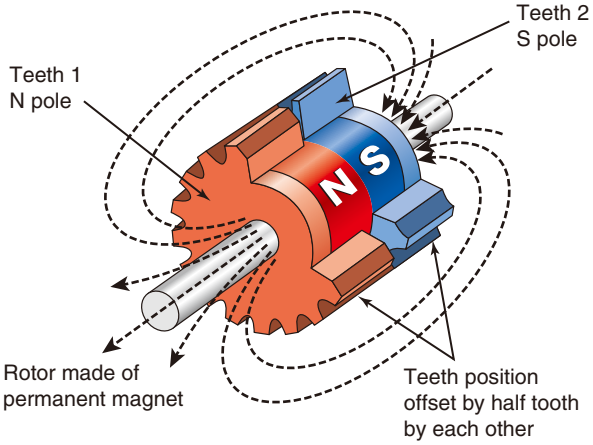
MECHANISM OF STEPPING MOTOR

The below illustrations show cross section images of a stepping motor, called also “stepper motor” or “step motor.”
The stepping motor consists of two major components: a stator (stationary part) and a rotor (rotating part).
The rotor is a permanent magnetic rotating shaft, surrounded by eight electromagnets or coils of two phases (A and B).
Each electromagnet is energized in turn, attracting and repulsing the rotor to rotate its shaft.
The motor shaft is connected to a damper that enhances the torque characteristics of the motor at high speed.



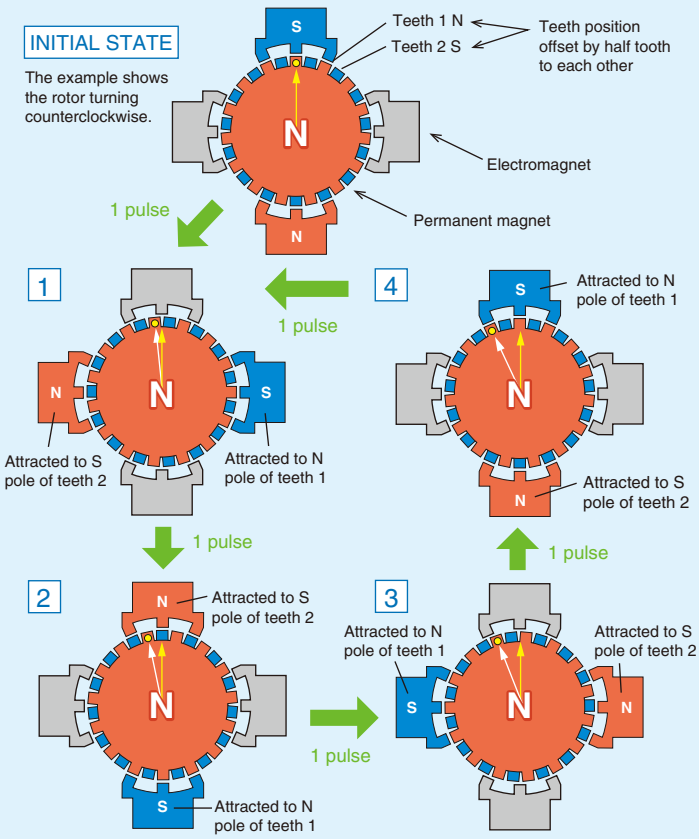
HOW STEPPING MOTOR WORKS 1/1000 Resolution

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.

Simplified Stepping Motor Operation



The actuator rotor has 50 teeth. The above is a simplified example with 15 teeth.

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