

Electro-Hydraulic Cylinder: Mini-Motion Package (MMP)



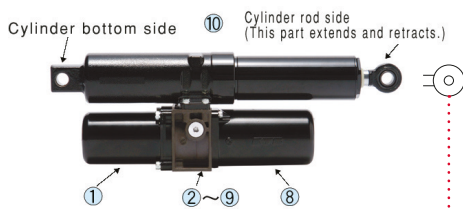
Mini-Motion Package (MMP) is a hydraulic linear actuator integrated with a DC motor, a hydraulic pump, valves, and a cylinder. By making the best use of unique features of hydraulic systems that are not gained by mechanical types such as electric screws, this is the best choice of labour-saving and automated work environments including machines, facilities of office and residential environments.

A new design concept different from the conventional hydraulic systems enables the broadening of new applications.



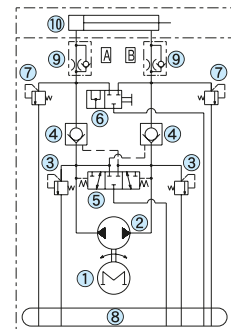
► **All the following components are integrated in this hydraulic linear actuator:**

External



Internal Hydraulic Circuit

- ① DC motor
- ② Gear pump
- ③ Relief valve
- ④ Pilot-operated check valve
- ⑤ Control valve
- ⑥ Manual release valve (for emergency)
- ⑦ Overload relief valve
- ⑧ Oil reservoir
- ⑨ Slow return valve
- ⑩ Cylinder



*Refer also to the following mechanism descriptions for the components ① - ⑩

Explanation of the operating mechanism

► Cylinder "retraction"

When the DC motor [①] rotates in the reverse direction, the gear pump [②] begins to rotate and the control valve moves to the position. High pressure oil pumped out from the gear pumps passes through the pilot-operated check valve [④] and flows into the cylinder from the B port side. The hydraulic fluid returning from the A port side of the cylinder [⑩] flows back into the gear pumps and the surplus oil drains back to the oil reservoir. The relief valve [③] activates if the system overloads or the cylinder stretches out to the limit of its stroke.

* Connecting the black lead to the terminal (+) and the white lead to the terminal (-) retracts the cylinder.

► "Stop" and load retention

When the power to the DC motor [①] is interrupted, the cylinder [⑩] stops and the load is retained by the pilot-operated check valve. (Assuming internal oil leakage of 0.3cm³/min or less).

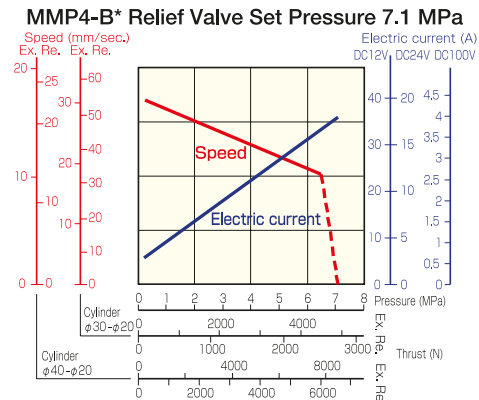
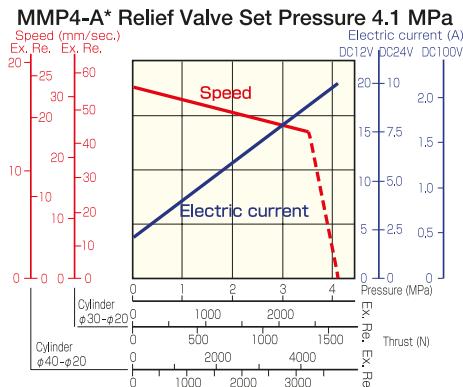
Max pressure corresponding to the retained load is 13.7MPa. When pressure increases to 13.7MPa due to an increase in the temperature, for example, the overload relief valve [⑦] activates for protection. (The cylinder starts working when the overload relief valve activates).

► Cylinder "extension"

When the DC motor [①] rotates in the normal direction, the gear pump [②] begins to rotate, the control valve [⑤] moves to the position, and hydraulic oil is drawn from the oil reservoir [⑧]. High pressure oil from the gear pump passes through the pilot-operated check valve [④] and flows into the cylinder from the A port side. Hydraulic oil returning from the B port side of the cylinder [⑩] flows back into the gear pumps. The relief valve [③] activates if the system overloads or the cylinder stretches out to the limit of its stroke.

* Connecting the black lead to the terminal (-) and the white lead to the terminal (+) extends the cylinder.

Characteristics: Typical values at the ambient temperature 25°C and rated voltage



Conversion: 1 MPa = 10.2 kgf/cm², 1000N = 102 kgf

The above charts show the characteristics of MMP without the slow return valve orifice [9]. Cylinder extension and retraction speeds differ due to the receiving area difference.

Example

Model: MMP4-A2B250AA

With a cylinder of ø 40- ø 20-250 and a motor of DC 24 V

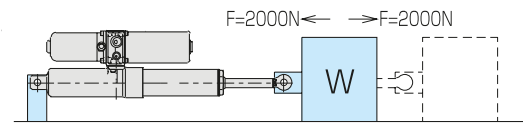
When the extension thrust is 2000N

Extension speed: Approx. 16 mm/s (15.6 sec/250 mm)

Electric current: Approx. 6 A

Retraction speed: Approx. 20 mm/s (12.5 sec/250 mm)

Electric current: Approx. 7 A



Features

- ◆ No new hydraulic facilities are required.
- ◆ The cylinder can be easily mounted with additional pins on both ends and completed electrical wiring.
- ◆ Low energy consumption and cost saving as the hydraulic pump is operated on request.
- ◆ The DC motor and hydraulic circuit are completely sealed and thus there is no oil leakage, allowing preservation of the environment.
- ◆ Smooth and strong operation are unique to the hydraulic system. Max. thrust: 8000N (816 kgf)
- ◆ The pilot-operated check valve secures load retention. No backlash is generated, which is different from mechanical types.
- ◆ The relief valve prevents overload. The motor is protected from overload operation by the circuit breaker.

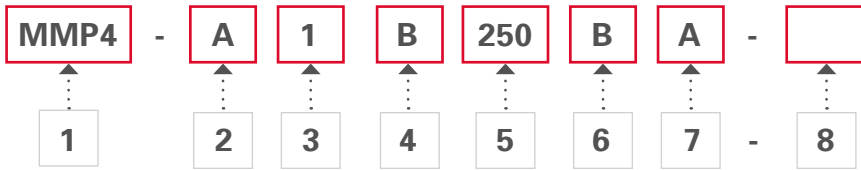
Main applications

- ◆ For the automation and energy saving of general purpose / industrial equipment.
- ◆ For compact transport equipment, hoists, food processing equipment and clamps.
- ◆ For small vehicles, agricultural vehicles and attachments.
- ◆ For office, medical, beauty, nursing and fitness equipment.
- ◆ For sports, recreation and amusement equipment.
- ◆ For automation and energy saving systems such as residences, buildings and green houses, including automatic sunroofs.
- ◆ Others.

Model



[Model Code] Example:



1	Model	MMP4 (Type 4) Mini-Motion Package
2	DC motor output and relief valve set pressure	A: 250W , 4.1MPa B: 250W , 7.1MPa
3	Power supply	1: 12VDC, 2: 24VDC, and 3: 100VDC (100VAC full-wave rectified)
4	Cylinder Size	A: ϕ 34 - ϕ 20 B: ϕ 40 - ϕ 20 (Cylinder bore-rod diameter)
5	Cylinder Stroke	150: 150mm 200: 200mm 250: 250mm (ϕ 40only) 300: 300mm (ϕ 40only) 350: 350mm (ϕ 40only)
6	A port orifice	A: Void B: ϕ 0.8 C: ϕ 0.6
7	B port orifice	A: Void B: ϕ 0.8 C: ϕ 0.6
8	Optional spec.	Void: Standard Spec. Contact us for optional and special specifications.

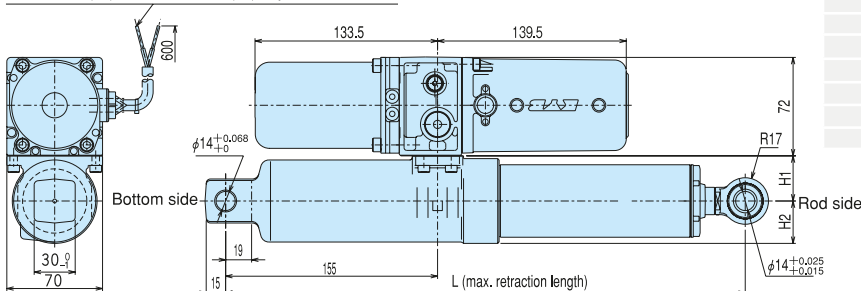
Specifications

Series	Hydraulic System spec.						Power supply spec.			Entire Unit	
	Relief valve set pressure (MPa)	Cylinder max. retention pressure (Overload relief valve setting) (MPa)	Cylinder Size (mm)	Rated extension thrust (N)	Stroke (mm)	Operating temperature range (°C)	Rated voltage (V)	Relief valve operation current (A)	Rated time (sec.)	Dimensions	Weight (kg)
MMP4-A	4.1	13.7	ϕ 34 - ϕ 20	3100	150	-20 ~ 50	DC12 DC24 DC100	23 (DC12V) 11 (DC24V) 2.4 (DC100V)	30	ϕ 34 - ϕ 20 x 150	4.2
					200					ϕ 34 - ϕ 20 x 200	4.5
			ϕ 40 - ϕ 20	4300	150					ϕ 40 - ϕ 20 x 150	4.3
					200					ϕ 40 - ϕ 20 x 200	4.7
					250					ϕ 40 - ϕ 20 x 250	5.1
					300					ϕ 40 - ϕ 20 x 300	5.4
350	ϕ 40 - ϕ 20 x 350	5.8									
MMP4-B	7.1	13.7	ϕ 34 - ϕ 20	5800	150	-20 ~ 50	DC12 DC24 DC100	40.8 (DC12V) 18.5 (DC24V) 4.4 (DC100V)	30	ϕ 34 - ϕ 20 x 150	4.2
					200					ϕ 34 - ϕ 20 x 200	4.5
			ϕ 40 - ϕ 20	8000	150					ϕ 40 - ϕ 20 x 150	4.3
					200					ϕ 40 - ϕ 20 x 200	4.7
					250					ϕ 40 - ϕ 20 x 250	5.1
					300					ϕ 40 - ϕ 20 x 300	5.4
350	ϕ 40 - ϕ 20 x 350	5.8									

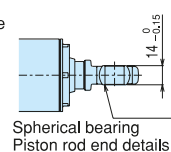
- Waterproof : JISD0203 D2 compliant
- Vibration durability: JISD1601 Class 3 B compliant

Dimensions (unit:mm)

White lead (+) and black lead(-): Cylinder extension
White lead (-) and black lead (+): Cylinder retraction



Cylinder size Cylinder bore i.d. - rod diameter x stroke	Max. retraction length L	H1	H2
ϕ 34 - ϕ 20 x 150	280	31	28.5
ϕ 34 - ϕ 20 x 200	330		
ϕ 40 - ϕ 20 x 150	280	33	31
ϕ 40 - ϕ 20 x 200	330		
ϕ 40 - ϕ 20 x 250	380		
ϕ 40 - ϕ 20 x 300	430		
ϕ 40 - ϕ 20 x 350	480		



Recommended
pin diameter
 ϕ 14 $\begin{matrix} -0.025 \\ -0.068 \end{matrix}$

Caution on Selecting/Using Models



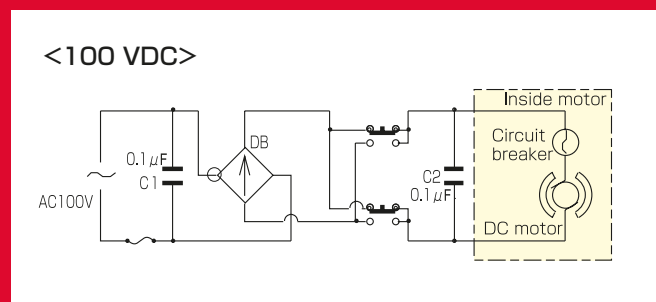
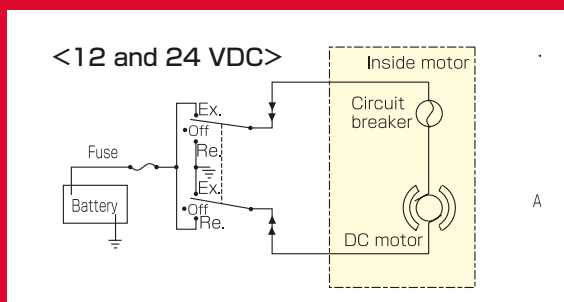
Select proper models according to the following selection procedure and check sheet:

- ◆ MMP specifications and characteristic values are typical ones and may vary depending on operational conditions like the temperature. Try to select the model with thrust and speed large enough to meet requested specifications.
- ◆ Maximum internal leakage may amount to 0.3 cm³/min. Apply a mechanical lock for secure load retention.

▶ Selection Procedure

- 1** Determine maximum thrust, maximum speed, power supply, and stroke required of an MMP cylinder from the application and specifications of the equipment.
- 2** Select the relief valve set pressure, power supply, cylinder size, and cylinder stroke from the specifications and characteristics of the selected MMP model.
- 3** Select orifices for port A and B from the load to be applied to the cylinder at page 44.
A: Port A orifice (retraction load), B: Port B orifice (extension load), D: Port A and B orifices (retraction and extension load)
- 4** Electric wiring and Switching
* The customer should prepare the power supply and switching system. Please contact us for any details.

Wiring Example



- ◆ Use a bipolar, double throw, instantaneous-contact type switch with the switching off position at the neutral point at the center for 12/24 VDC switching.

- ◆ Use a 100-VDC MMP with the 100-VAC power supply via a full-wave rectifier.

5 Selecting wire

Select a wire diameter suitable for a DC motor operation voltage applied in the range $\pm 10\%$ of the rated voltage.

► Caution on cylinders in operation



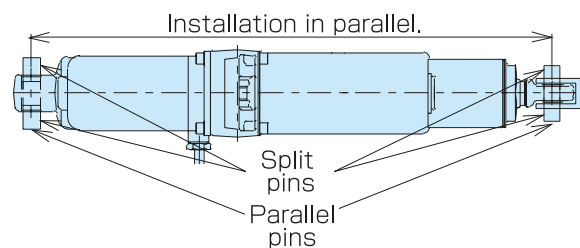
Relief Valve: Do not activate the relief valve over 2 seconds. Otherwise, a rise in oil temperature or a malfunction may occur. The relief valve set pressure is fixed (at 4.1 or 7.1 MPa) and cannot be changed.

Duty cycle / Circuit breaker:

- ◆ All models are designed for an intermittent operation and will automatically shut down when operated continuously. Use the MMP under the rated pressure (thrust) in intervals of 30 seconds within ED25% (pause over 90 seconds).
- ◆ When the allowable duty cycle is exceeded, the circuit breaker built in the DC motor will automatically turn off the MMP.
- ◆ When the DC motor cools down, the circuit breaker will automatically reset enabling the restart of the MMP. Continuing to use the MMP in conditions, in which the circuit breaker is often triggered, is not recommended.
- ◆ In case of power failure, electric wire break, and other emergencies, the cylinder may be extended or retracted using the manual release valve [⑥]. After loosening the manual release valve by turning it two or three times with a hex wrench, the cylinder can be extended or retracted by hand or by its own weight. (Be careful of a free fall).

Mounting

- ◆ Mount the MMP with two parallel pins (recommended diameter: $\varnothing 14 \begin{smallmatrix} -0.025 \\ -0.068 \end{smallmatrix}$) and secure in place with split pins.
- ◆ The MMP can be easily mounted by securing the rod side to the load side and the bottom side to the frame of the equipment.



► Storage

When the MMP is not going to be used for a long period, keep the cylinder in the fully retracted position. If the cylinder is kept in the extended position for a long time, dust deposits or rust may damage the oil seal, causing eventual malfunction.

► Disposal

When disposing the MMP, unplug the oil tank, remove operating oil from the oil reservoir and cylinder. When removing the plug, do it slowly after extending the cylinder. Otherwise, the oil may gush out because the tank is pressurized.

► **Selecting an orifice (slow return valve)**



If a hunting phenomenon occurs with the weight of the cylinder, an orifice will be required on the return side. (Hunting phenomenon: Uncontrollable intermittent motion of a cylinder)

- * Select orifices for Port A and B according to the load applied to the cylinder.
- * When the cylinder is diagonally positioned, select kind of load by its own weight from A ~ D.
- * An orifice is installed to prevent a hunting phenomenon. It is not useful for speed control.
- * Please contact us if you do not know the criteria for selection.

A. Compression load	B. Tension load	C. Horizontal load	D. Compression and tension load
An orifice is required at Port A.	An orifice is required at Port B.	An orifice is not required.	An orifice is required at Port A and B.

Orifice diameter (calculated value)

Load condition	Cylinder size	Load (kN)									
		0	1	2	3	4	5	6	7	8	9
A. Compression load	φ 34	φ 0.8		φ 0.6			φ 0.6				
	φ 40	φ 0.8		φ 0.6			φ 0.6				
B. Tension load	φ 34	φ 0.8	φ 0.6	※							
	φ 40	φ 0.8	φ 0.6	※							

Note:

1. In the case of D (compression and tension load, select both A (compression load) and B (tension load).
2. Please contact us for parts marked with an asterisk (※)
3. Make sure to test the selected MMP on the intended equipment.

Selection example:

For a compression load of 6 kN on the cylinder of φ 40, select an orifice of φ 0.6.

► Check Sheet



Basic specifications	Relief valve pressure		<input type="checkbox"/> 4.1MPa <input type="checkbox"/> 7.1MPa		Motor	Wiring		<input type="checkbox"/> Standard (600mm)				
	Cylinder	Cylinder bore - rod diameter		<input type="checkbox"/> $\phi 34 - \phi 20$ <input type="checkbox"/> $\phi 40 - \phi 20$		End treatment		<input type="checkbox"/> Standard (lead wire only)				
		Stroke		<input type="checkbox"/> 150mm <input type="checkbox"/> 200mm <input type="checkbox"/> 250mm <input type="checkbox"/> 300mm <input type="checkbox"/> 350mm		Stop method						
		Required speed		<input type="checkbox"/> Standard <input type="checkbox"/> Non-standard (mm/sec)		<input type="checkbox"/> Position detection <input type="checkbox"/> Visual observation <input type="checkbox"/> Stroke end						
	DC motor	Voltage (V)				Selecting orifice		Port A orifice: <input type="checkbox"/> None <input type="checkbox"/> $\phi 0.8$ <input type="checkbox"/> $\phi 0.6$				
		Voltage fluctuation						Port B orifice: <input type="checkbox"/> None <input type="checkbox"/> $\phi 0.8$ <input type="checkbox"/> $\phi 0.6$				
Required thrust	Max.	Ordinary	Required speed	Max.	at thrust							
Installation Environment	Place	<input type="checkbox"/> Indoor <input type="checkbox"/> Outdoor	Duty cycle	Stop duration	(min./time)							
	Ambient temperature	~ °C		Intermittent operation	(times/day)							
	Others	<input type="checkbox"/> On vehicle <input type="checkbox"/> Stationary		Annual operation frequency	(times/year)							
	Vibration	<input type="checkbox"/> No <input type="checkbox"/> Yes (G)										
Mounting position				Load on cylinder	A: Compression		B: Tension		C: Horizontal		D: Tension and Compression	
					<input type="checkbox"/> A		<input type="checkbox"/> B		<input type="checkbox"/> C		<input type="checkbox"/> D	
					Loads				~		(N)	
Selected model	MMP4 - <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>											
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