Artificial Metal-Based Muscle for Long Strike Actuators

BioMetal Helix
BMX series

The BioMetal Helix (BMX Series) is a biometal micro coil. It is a linear actuator (linear-motion drive unit) featuring wide-range expansion and contraction. At room temperature, it is soft and can be elongated with ease. The BMX, elongated at room temperature, becomes stiff and sharply contracts to its original length when a current is fed through it. It is again softened by stopping the flow of current. It also contracts if heated by hot air. The BMX produces a by far greater force when it contracts than does it when it extends at room temperature. The change in length is nearly 200% of the length of the contracted BMX. It can be repeatedly used any number of times. It is ideally suited for millimeter and micrometer size actuators for use in narrow spaces where it is impossible to use motors and pneumatic cylinders.

Features of the BMX Series

Long stroke and production of strong force
A remarkably long stroke, 100%-200% of the length of the contracted BMX. Although being a very thin actuator, this product produces a very strong force. Since a wide-range movement can be brought by its simple mechanism, it can be easily incorporated into the design of systems for a wide variety of applications.

Smooth, pliable operation
The BMX moves without generating any vibration or sound. Unlike the solenoid (electromagnet), it produces the greatest force at the start point and the force produced changes only slightly over the long displacement interval. Its capability can be fully utilized when it is used for the resetting mechanism of latches and locks and for micro servo actuators.

Operation at low voltage and low power
The BMX can be moved merely by connecting it to a cell after stretching it lightly. No special drive circuit is necessary. It can be safely used because it can be driven by a low voltage. The drive current required is very small. Fine adjustment of motion can be made by using a PWM power control circuit. The BMX, which moves responding to temperature changes, can also be utilized as a thermostat-like actuator. Needless to say, it can also be moved by heating it by a hot air blower.

Ideal for milli and micro size mechanisms
The forced produced by the BMX is directly proportional to its cross-sectional area. Although small in size, the BMX is capable of producing a strong force and less susceptible to friction and viscosity than motors and solenoids. The BMX’s material itself is an actuator. It can be used even when cut short. Since being small, thin, and simple in construction, it is ideally suited for use in milli and micro size mechanisms. It is the only powerful actuator available that can be incorporated in thin IC cards and chips.

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BioMetal Helix BMX series

Applications of the BMX Series
- Ultra-small actuators
- Flexible actuators
- Ultra-thin actuators
- Actuators for toys and models
- Ultra-small temperature switches

Basic uses of the BMX

NOTE: The BMX series is not suited for the following applications.
- Applications where high-speed repetitive operations are required (The BMX can move at high speed only in the contracting direction.)
- Movement of a heavy load
- Mechanism of a size allowing the use of a motor
- Applications where the temperature can rise to above 55°C
- Prolonged use in water
- Where high reliability in produced force and service life is required, consider using the BioMetal Helix BMX series.

Major Characteristics and Specifications of the BMX Series

<table>
<thead>
<tr>
<th>BMX50</th>
<th>BMX75</th>
<th>BMX100</th>
<th>BMX150</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard coil diameter (D/mm)</td>
<td>0.2</td>
<td>0.32</td>
<td>0.4</td>
</tr>
<tr>
<td>Wire diameter (d/mm)</td>
<td>0.05</td>
<td>0.075</td>
<td>0.1</td>
</tr>
<tr>
<td>Coil diameter-to-wire diameter ratio D/d</td>
<td>4.0</td>
<td>4.3</td>
<td>4.0</td>
</tr>
<tr>
<td>Practical maximum force produced (gf)</td>
<td>3–5</td>
<td>5–10</td>
<td>10–20</td>
</tr>
<tr>
<td>Kinetic displacement (change in length) (%)</td>
<td>200</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>Standardceive current (mA)</td>
<td>50–100</td>
<td>70–120</td>
<td>100–150</td>
</tr>
<tr>
<td>Standard electric resistance (Ω/m)</td>
<td>3000</td>
<td>1600</td>
<td>900</td>
</tr>
<tr>
<td>Allowable upper temperature limit (°C)</td>
<td>—</td>
<td>—</td>
<td>50–60</td>
</tr>
<tr>
<td>Service life (times)</td>
<td>—</td>
<td>—</td>
<td>—</td>
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</tbody>
</table>

The service life of the BMX is closely associated with the magnitude of the load and the kinetic distortion. It has a track record of having made more than five million reciprocating motions under appropriate load and movement conditions. (Example: BMX50. Eight million motions completed at the load of 30 gf and at the kinetic distortion of 50%.)

- The BMX makes non-linear, asymmetric motions (contractions and expansions). It can be quickly contracted if it is heated in an adiabatic manner by feeding a large current through it. However, it cannot be quickly elongated without forced cooling because the rate of elongation depends on cooling speed. In the case of self-cooling the BMX is affected by the ambient temperature and the wind. The data shown in the table belonw those obtained at the room temperature of 20°C under the windless condition.

Line-up of BioMetal Helix BMX Series Sample Set

<table>
<thead>
<tr>
<th>Product No.</th>
<th>Coil diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMX5020</td>
<td>0.20mm</td>
</tr>
<tr>
<td>BMX7520</td>
<td>0.32mm</td>
</tr>
<tr>
<td>BMX10020</td>
<td>0.40mm</td>
</tr>
<tr>
<td>BMX15020</td>
<td>0.62mm</td>
</tr>
</tbody>
</table>

CONTENTS
- BioMetal Helix each 20 mm, 1 pc.
- Instruction manual, 1 pc.
- Spring, 4 pcs.
- Small-size spectacle terminal, 16 pcs.
- Ultra-small-size eyelet terminal, 16 pcs.

For technical inquiries, please use our inquiry form on our website.
We may not be able to answer questions over the telephone.
More detailed information on the BMX series will be available on our company's homepage.
Specifications are subject to change without prior notice.