

INSTRUCTION MANUAL  
 BioMetal<sup>®</sup> Helix  
 (Preliminary translation of Japanese instructions)

The BioMetal Helix (BMX) is a new type of actuator designed to work like muscles. The BMX, elongated at room temperature, contracts to its original length when a current is fed through it. It also contracts if heated by hot air. When heated, it contracts with greater force than it extends at room temperature. It can be repeatedly used any number of times.

Directions for Use

- Elongate the BMX to 40-50 mm. When it is carefully and slowly elongated at room temperature it abruptly becomes difficult to extend any further. This means that it has reached its limit length. If it is elongated beyond this limit, it will no longer returned to its original length. However, even in that case, it can extend and contract.
- Each end of the BMX is provided with a crimp terminal for the passage of current through it. It can be made hard to break by heating its crimp terminal parts with a soldering iron to a temperature of about 200-300 °C. Even if it is bent during the work, it will restore to normal when heated.
- Connect one AA cell between the terminals of the BMX to feed a current through it, and it will contract to its original length. It has no polarity. It is heated on the same principle as with nichrome wires when a current is fed through it. The voltage of a dry cell is suitable for its use. At room temperature (20 °C), it begins to move when a the amount “Typ Cur” (from table at end of instructions) in mA of current is fed through it. Even if a greater amperage of current than necessary is fed through it, the contracting force will not increase.

Note: Do not overheat. A very hazardous condition might occur. Since no electrical insulation is provided for its surface, care should be taken to avoid accidental contact. If it is elongated when it is heated, it will become hard to return to its original length.

- The BMX will also contract when it is directly heated by a dryer. It may degrade in performance if it is heated to 200 °C or higher. Be careful not to overheat it.
- To move the BMX again, stop energizing or heating it, cool it for a period of 1 to 2 seconds, and then slowly elongate it. When it is sufficiently cooled it may extend on its own with no force applied to it. However, this does not indicate any abnormality.
- The BMX is made of a very strong material. To cut it, use a pair of nippers with strong edges. If a pair of scissors is used for cutting it, its edges may chip.

Wire specification

<i>Mondo-tronics</i>		<i>Helix O.D.</i>	<i>Wire Res</i>	<i>Typ Cur</i>	<i>Wire Dia</i>	<i>Recovery</i>	<i>Activation</i>	<i>Contracted</i>
<i>P/N</i>	<i>Product Name</i>	<i>mm</i>	<i>Ω / m</i>	<i>mA</i>	<i>μm</i>	<i>Force gr</i>	<i>Temp °C</i>	<i>length mm</i>
#3-912	BioMetal Micro Helix 050, 20 mm	0.20	3,750	40	050	3	90	20
#3-925	BioMetal Micro Helix 100, 20 mm	0.40	1,350	80	100	12	90	20
#3-922	BioMetal Micro Helix 150, 20 mm	0.60	375	150	150	30	90	20
#3-942	BioMetal Micro Helix 200, 20 mm	0.80	250	220	200	50	90	20

- Coil is shipped on solid wire and must be carefully removed first.
- Coil can be elongated to 40-50 mm.
- The crimp terminals can be solder connected.

## Applications

### A: Hanging a weight on the BMX

Hang a weight on the BMX and then heat it, and it will lift the weight. Although it can produce a strong lifting force, the suitable weight (up to “recovery force” in table **above**) in grams. With a heavier weight hung on it, it may not return to its original length. Applying too great force to it during heating will shorten its useful life. The lighter the load, the longer will be its useful life.

### B: Use of a spring

Connect the BMX with the spring supplied so that they pull against each other. Adjust the spring to a tension weaker than the contracting force of a heated BMX. When heated, it pulls the spring. When cooled, it is elongated by the spring. The contracting force of a heated BMX is by far stronger than the force required to elongate it at room temperature.

### C: Differential System

Connect two BMXs together so that they pull against each other. Note: Heat only one of these BMXs at a time. No movement can be obtained if both of them are heated.

## Drawings

(A) (1) Fixed part (2) Switch (3) Point of operation (4) AA cell (5) Weight (6) Elongated when cooled.

(B) (1) Moved in this direction when heated. (2) Extension spring

(C) (1) Heating Cooling (2) Only one of these BMXs is heated.

## Handling Precautions

- Exercise care not to feed an excessive amount of current through the BMX, or it may be dangerously overheated.
- Do not heat the BMX by the flame of a lighter, or it would be broken or might burn.
- The numerical values given in this instruction manual are only a guide; they are not guaranteed values. We shall not be liable for any damages resulting from the use of this product.
- Although the material of this product is excellent in corrosion resistance, prolonged use of the product in water or in damp places may make it easy to break.
- Specifications are subject to change without prior notice due to improvements in quality or performance.

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