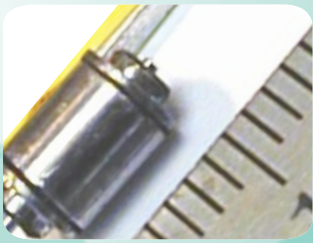


Bi-stable Linear Moving Magnet BLMM



Principle

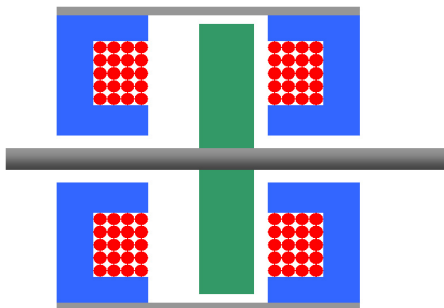
The Moving Magnet Actuators are based on a permanent magnet moving between two opposite electromagnets. They provide two stable positions at rest. Supplying one electromagnet to provide a magnetic field pulse adding to the permanent magnet field and making the opposite with the second electromagnet allows the permanent magnet to move toward the first electromagnet, and vice-versa.

For this reason, they are also called bi-stable actuators or flip-flop actuators.

Design issues

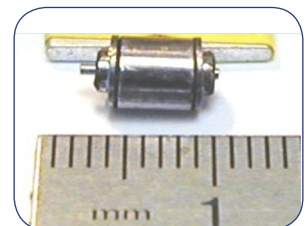
Moving Magnet Actuators are rather complex structures needing a careful design, which can benefit of Flux FEM software from CEDRAT S.A.:

- **Magnetic Forces:** The static force at rest is determined by the permanent magnet size. The actuation force depends of the stroke and varies a lot along the strokes. The actuation force is minimum when the moving magnet is leaving its initial position. Design should take care of this issue in combination with the load. In addition, transversal forces are not negligible as soon as there are some play in the guiding, which may damage bearings.
- **Thermics:** There is no power at rest, so no heating at rest. Heating is met only in operation when the switching frequency is going up.
- **Miniaturization:** For specific applications, CEDRAT TECHNOLOGIES has investigated the possibility of miniaturizing Moving Magnet Actuators leading to Micro Bistable Linear Moving Magnets BLMM.

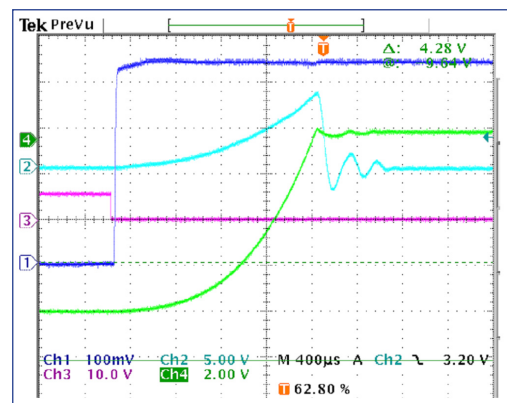


Principle of a moving magnet actuator.

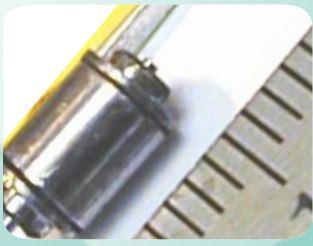
BLMM-1Micro bistable Actuator.



BLMM1-1 Micro Actuator response
[Current : 1A = 100mV]; [position : 80 μ m = 1V]; [Speed : 125mm/s = 1V];



Bi-stable Linear Moving Magnet BLMM



Performances

Typical performances are given in the following table. This table is not exhaustive as many other actuators can be rapidly designed by CEDRAT TECHNOLOGIES using its design tools, lab facilities and technological know-how.

References	Unit	BLMM-1	BLMM-2
Notes			<i>preliminary</i>
Stroke	mm	0,62	3
Holding force at rest (F_h)	N	0,093	50
Actuation force at start stroke (F_s) for I_{npc}	N	0,033	10
Actuation force at end stroke (F_e) for I_{npc}	N	0,6	> 100
Electrical interface		2 wires	2 wires
Nominal pulse voltage	V	+/- 2,6	TBD
Nominal pulse current I_{npc}	A	+/- 5,4	TBD
Pulse width	ms	0,63	TBD
Switch response time	ms	2,7	10
Maximal speed	mm.s ⁻¹	437	TBD
Impact speed	mm.s ⁻¹	265	TBD
Winding resistance	ohm	0,48	TBD
Temperature rise for 10 switch/s	°C	3,5	TBD
Moving mass	mg	76	15
Total mass	g	0,8	50
Diameter	mm	5	25
Height	mm	6,7	20
Usefull force F_s / mass / curent	mN/g/A	7,64	TBD
Usefull force F_e / mass / curent	mN/g/A	138,19	TBD

Applications

Moving Magnet Actuators find applications as bi-stable actuators, locking actuators, electro-valves vibration generators, ...

They are used in electric industry, production industry, air&space industry, and are considered for Braille application, ink jet printers...

Collaborations, Supports

CEDRAT TECHNOLOGIES is supported by Oseo French Innovation Agency.

For more information, please contact:

CEDRAT TECHNOLOGIES
15 Chemin de Malacher - Inovalée
38246 Meylan Cedex - France
actuator@cedrat.com
Phone: +33 (0)4 76 90 50 45 - Fax: +33 (0)4 56 38 08 30