

MRF damper/blocker



The MRF damper / blocker are new electromechanical components using Magneto Rheological Fluids (MRF). These smart fluids are characterized by their ability to change their rheological properties versus applied magnetic field. With sufficient field, they can switch from a liquid to almost solid body. This effect is reversible. It operates in few milliseconds.

This effect can be used for generating controllable damping, smart shock absorption or braking capabilities, which can be used for making special electro-fluidic actuators.

Objective

The purpose of the developed MRF damper/blocker is threefold:

- to provide an electrically-controllable resistive force over a stroke of 30 mm.
- to offer a blocking force at rest, which can be strongly reduced by applying a current.
- to perform the control of the force in a very short time, typically in a few milliseconds.

Description

Two architectures of the device are suggested:

- **Damper with a single piston rod:** The device allows to damp a movement versus the frame
- **Damper with a double piston rod:** The movement can be transmitted through the damper which operates in series with the motion line.

Applications

The MRF damper/blocker can be used for two main applications:

- **Damping:** An optimized damping needs a controllable energy dissipation.

The device provides dissipated energy control in real time thanks to the current control. In a few milliseconds, the energy dissipation can be increased by 500%.

A maximum damping can be maintained without power supply and so the fail safe operating can be guaranteed in several applications. Vibrations damping and shocks absorption can be optimized thanks to a closed loop.

- **Positioning lockage:** The current control allows to block the load in any positions along the stroke. Whatever the piston rod position, if the motion force is lower than the maximal force damping (@0A), the control of the current provide a lock of the movement of the rod.

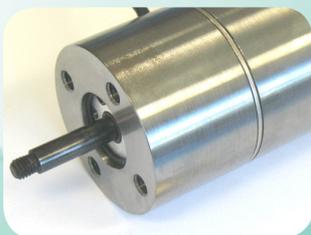


Damper with a single piston rod.



Damper with a double piston rod.

MRF damper/blocker



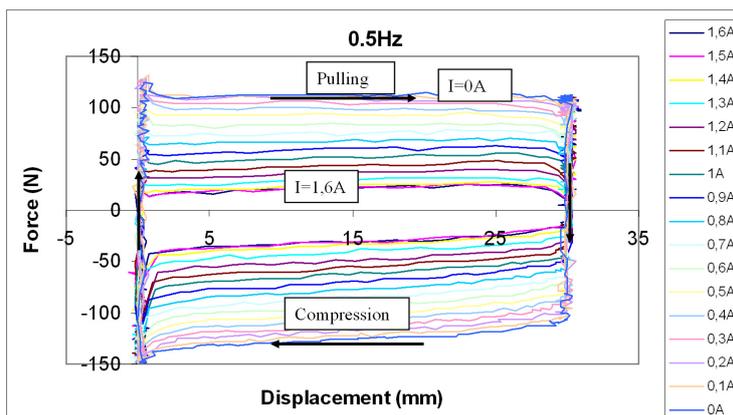
Operating

- **Damping:** A current variation from 0 A to 1.6 A in the coil allows to vary the damping force from 100N to 20N in a few milliseconds. The current control allows to control the damping force. The performances are constant over the full stroke. Thanks to a current regulation, the damping can be optimized in real time versus the mechanical excitation.
- **Positioning locking:** The supplying of the coil allows to make free movement. The decrease of the coil supply increases the resistive force against the movement. When the force produced by the actuator is lower than the resistive force produce by the MRF device, the position is locked.

Performance of the MRF damper/blocker

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	A-MRF single piston rod	A-MRF double piston rod
<i>Notes</i>			
Stroke	mm	30	28
Damping force @ 0A	N	120	90
Damping force @ 1.6A	N	25	16
Dissipated energy pers cycle @ 0A	Nm	7.2	5.04
Dissipated energy pers cycle @ 1.6A	Nm	1.5	0.72
Total weight	g	640	730
Diameter	mm	43	43
Height (without stroke)	mm	94	97
Max current	A	1.6	1.6
Electrical interface		1 coils = 2 wires	1 coils = 2 wires
Winding resistance	ohm	1.67	1.65
Winding inductance	mH	10.82	9.95
Electric time response	ms	6.5	6
Electric dissipated power @1.6A	W	4.3	4.2



Damping force versus current – The Cycle represent the dissipated energy