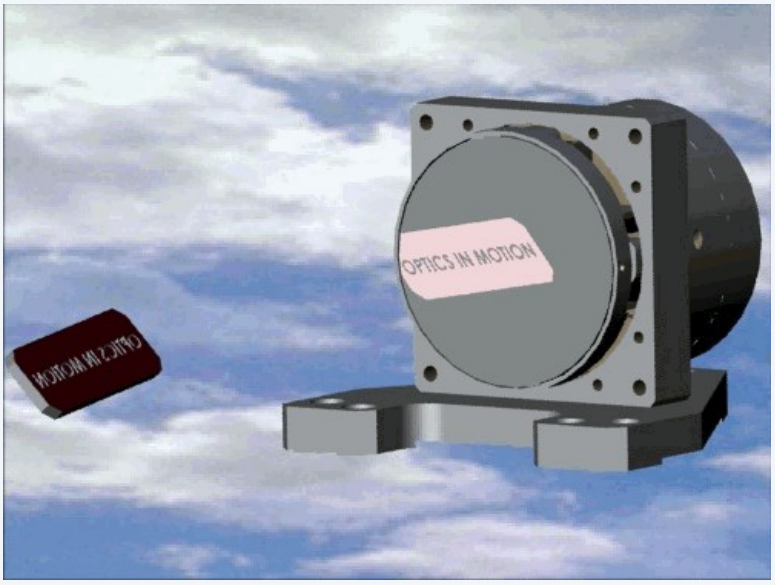
Description

Fast Steering Mirror Description



Voice coil driven Fast Steering Mirrors (FSM) have been used for several years in military and aerospace applications for target acquisition, scanning, and beam steering. These mirrors were typically low volume – high cost parts. Optics-In-Motion has engineered a line of fast steering mirrors which have many of the attributes of the military versions (low noise, high pointing accuracy, and high acceleration/step speeds) but are available at commercial prices.

Fast Steering Mirror Models:

The 100 series fast steering mirror product line consists of a one inch glass version with a user replaceable mirror/sub-mount, and a two inch glass mirror version where the mirror is hard mounted to the mirror gimbal, and a elliptical two inch by three inch metal mirror.

Model OIM101 Mirror key features:

- ✓ Uses industry standard 1" x 0.25" (or 1" x 6mm) glass mirrors
- ✓ Mirror coating to customer requirements
- ✓ Mirror mounted into sub-mount using low out-gassing RTV
- ✓ Additional sub-mount available for user installation of mirror
- ✓ Wave-front quality 1/10th wave p-v (depends on mirror substrate)
- ✓ Useable aperture 0.94"

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custom 3.5 x 5 inch, +/- 10 degree range fast steering mirror.

July 2004 - Improved standard fast steering mirror actuator design. Added performance and improved heat-sinking (allows higher peak power).

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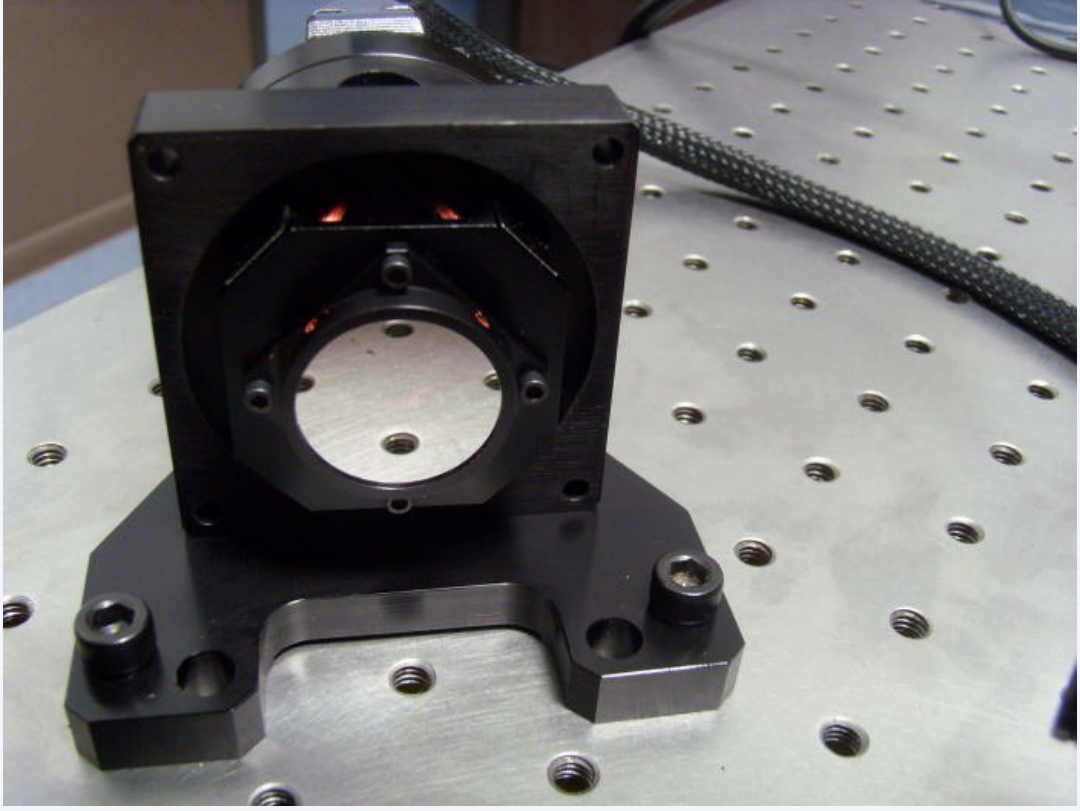


Model OIM101
(Shown with the standard 1" protected aluminum glass mirror)

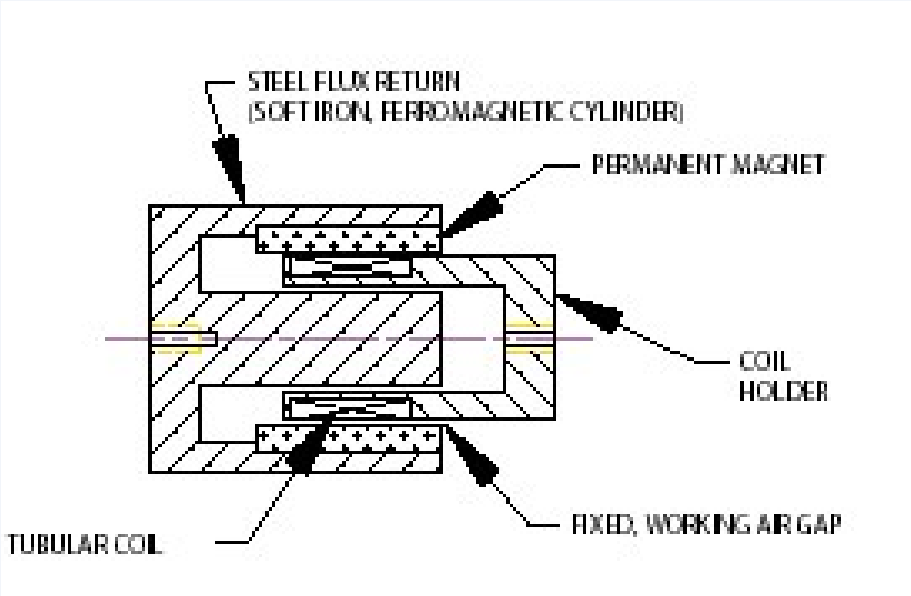
Model OIM102 Mirror key features:

- ✓ 2" glass mirror mounted to gimbal using low out-gassing RTV
- ✓ Mirror coating to customer requirements
- ✓ Wave-front quality ¼ wave p-v
- ✓ Useable aperture 1.95"

Model OIM102.3 Mirror key features:

- ✓ 2" x 3" metal mirror
- ✓ Mirror surface either diamond turned or replicated
- ✓ Mirror coating to customer requirements
- ✓ Wave-front quality 1/2 wave p-v
- ✓ Useable aperture 2" x 3" or 2" at 45 degrees

Drive Motors:



Both mirror models are driven by a push/pull configuration of voice coils (similar to speaker coil – magnet arrangement). However unlike a speaker the FSM is configured with a moving magnet instead of a moving coil. This arrangement has several advantages. The first being that since the coil is stationary the wires do not have to move which adds greater overall reliability. The second advantage is that the heat generated by the mirror coils is conducted to the mirror housing away from the optical mirror substrate. This prevents thermal distortions of the mirror wavefront quality.

Voice coil actuators are two wire non-commutated direct-drive, hysteresis-free, cog-free devices used for providing highly accurate linear and rotary motion. By virute of their high acceleration and the absence of commutation, they offer numerous advantages in high precision applications. They deliver infinite position sensitivity, limited only by the encoder used for feedback. The force-versus-stroke curve is perfectly smooth. It all adds up to increased throughput for your system.

Mirror Suspension:

The mirror is flexurally suspended in two axes. The flexure is designed for an infinite fatigue life under normal operation (the absence of high levels of external vibration). The mirror rotates in both directions around a single pivot point. The pivot point for model OIM101 (1" mirror) is located 12mm behind the mirror surface and for model OIM102 (2" mirror) the pivot point is 9.5mm behind the mirror surface.

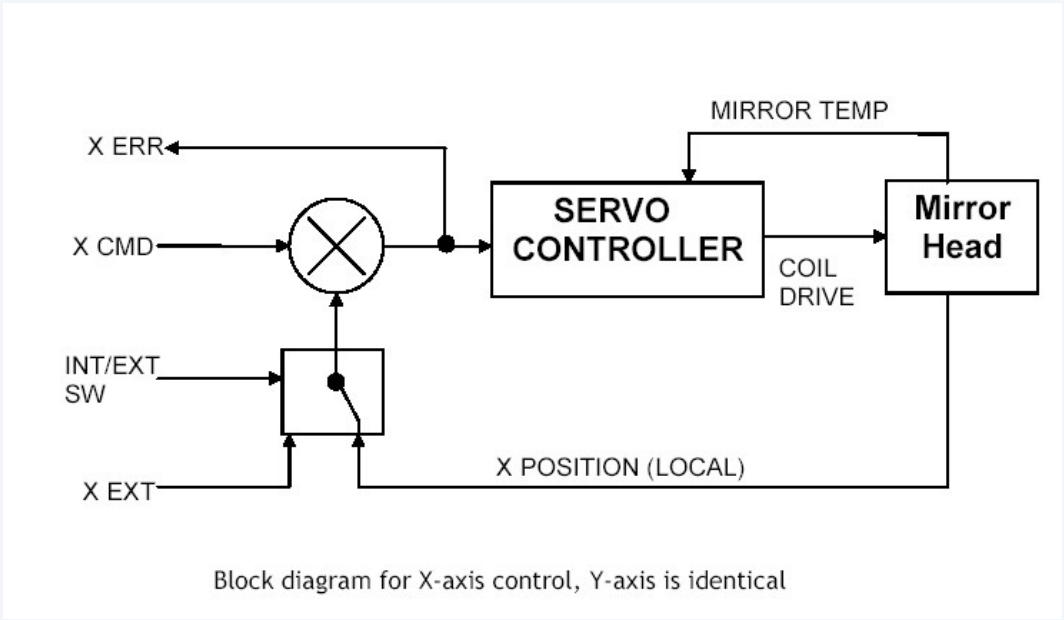
Mirror Angular Position:

Local Position – the mirror has a built in optical position sensor. The position sensor provides mirror feedback information to the controller which can also be monitored by the user. The local position sensor outputs a voltage which is proportional to the mirror angular position. The position sensor scale factor is 10volts = 1.5 degrees (26.2 mrad) and has a range from +10 volts (+1.5 degrees mechanical +3.0 degrees optical) to -10 volts (-1.5 degrees mechanical, -3.0 degrees optical).

External Position – the mirror controller has inputs for a user supplied control signals. Typically these signals are from an external quadrant cell which is used to monitor the position of a beam reflected off the surface of the fast steering mirror. These external signals (x and y position angles) are differentially input into the mirror command connector. A TTL level high input to the command connector INT/EXT switch controls the source of mirror feedback, switching it from local to external position control.

Mirror Controller:

The mirror controller electronics are housed in a remote enclosure connected to the FSM via a 6 foot cable. Mirror commands are input to the controller through a 25 socket D sub-miniature connector. The commands are differential signals representing the x and y mirror positions, scaled to the +/- 10 volt range. Monitor signals are provided for the actual mirror positions, error signals (feedback error between commanded position and actual position), and temperature overload (TTL signal with high representing a mirror thermal overload condition).



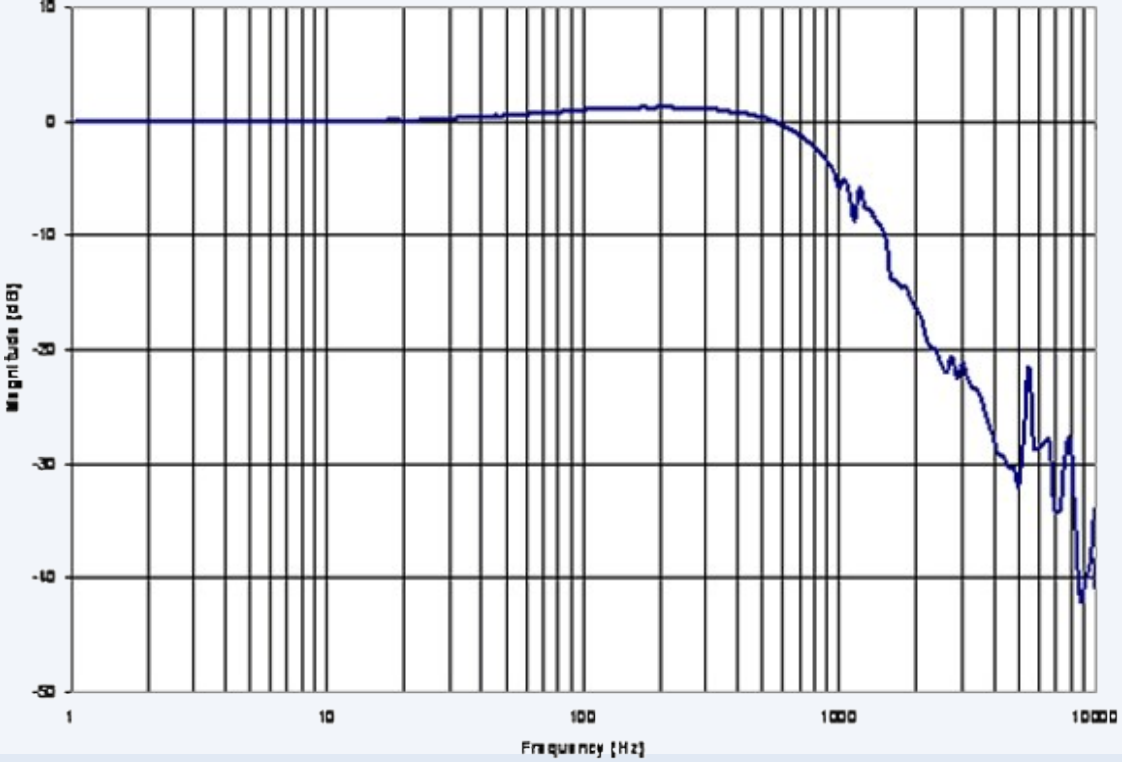
Block diagram for X-axis control, Y-axis is identical

Mirror Power Supply:

The controller is powered by an external tabletop +/-15 volt power supply (model number SRP-30A-2005) capable of 1.5 amps of current. The external power supply is an air cooled tabletop supply which plug directly into a 110 or 220 volt wall socket.

Mirror Performance:

Here is a typical Bode plot from our 1" glass fast steering mirror.



Closed Loop Bode Plot
3dB Bandwidth = 870 Hz
Gain Peaking = 1.3 dB

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