Flexible Optical B.V.
Adaptive Optics • Optical Microsystems • Wavefront Sensors

1-channel micromachined deformable mirror (Focusator)

technical passport

OKO Technologies,

1 MMDM focusators and A4MEMS

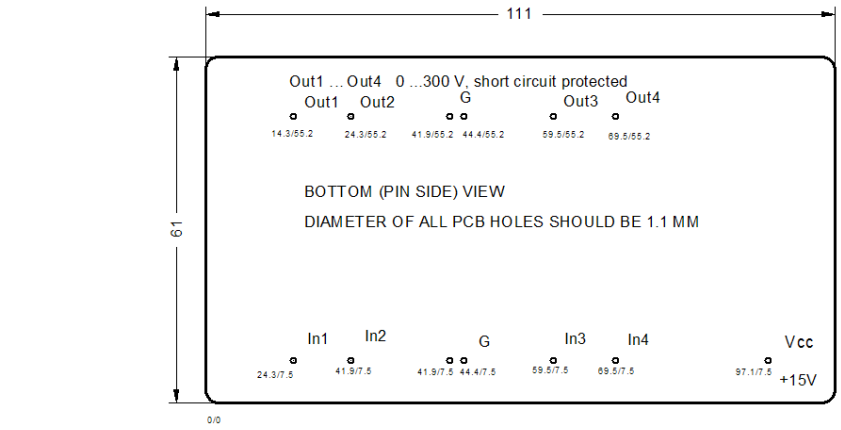
Figure 1: *Typical view of single-channel micromachined deformable mirrors (aka defocus correctors or focusators), with and without case, and 4-channel high-voltage DC amplifier A4MEMS*

Silicon micromachined mirror is fabricated by Flexible Optical B.V. using the technology of silicon bulk micromachining.

The mirror, shown in Fig. 1, consists of a silicon chip mounted over electrostatic electrode structure. The chip contains multilayer silicon nitride membrane, which is coated with a special coating to form the mirror. The PCB contains the control electrode structure, spacer and connector. To reduce the air damping effect, there are through holes in the PCB under the membrane — do not close these holes!

The scheme of the assembled mirror is illustrated in Fig. 3

Defocus corrector is a 10mm single-channel MMDM specially designed to correct the aberration of defocus. The mirror has better than 2 fringes P-V initial flatness over the whole aperture. The optical power of the mirror can be controlled continuously in the range of about 2 dioptres for Al-coated focusators and about 0.5 dioptres for gold-coated correctors. The response time is better than 1ms, mirror capacitance is less than 200pF and the current consumed is zero. These devices can be driven from a single voltage source with very high internal impedance of tens of MOhms since they consume no DC current. Driver voltage should be in a range 0 to Vmax (see Table 1). Available coatings: Al, gold. Available sizes: 5mm (special order), 10mm (stock), 15mm (special order).



Defocus corrector,
view from the membrane side

A4MEMS

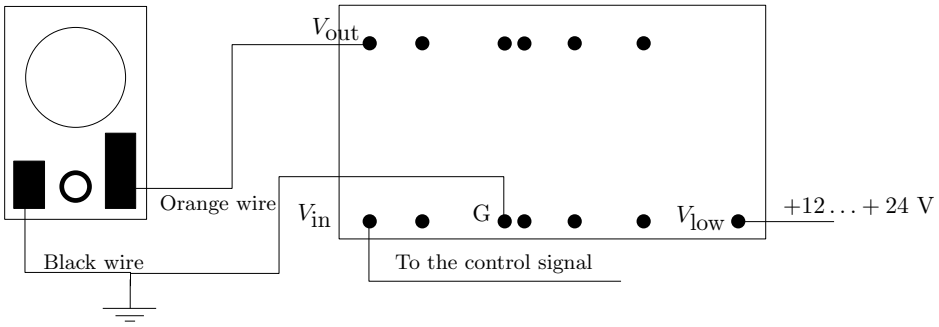


Figure 2: *Pin-out and connection scheme for the defocus corrector and A4MEMS*

One channel of A4MEMS high-voltage amplifier can be used to drive defocus correctors. The amplifier should be connected to a stabilized low-voltage DC supply (16 . . . 25 V) as shown in Fig. 2.

Table 1: *Technical parameters*

Parameter	Value
Focusator	
Aperture shape	approximately circular
Mirror coating	Al
Aperture dimensions	10 mm diameter
Control voltages V_c	0 . . . 266 V
Initial RMS deviation from plane	less than 0.1 μm
Frequency range	0 . . . 1kHz
Deflection of the mirror center at 266 V	9.4 μm

See Table 1 for technical parameters of the focusator before shipping.
Small surface defects are possible. They do not influence the quality of the mirror.

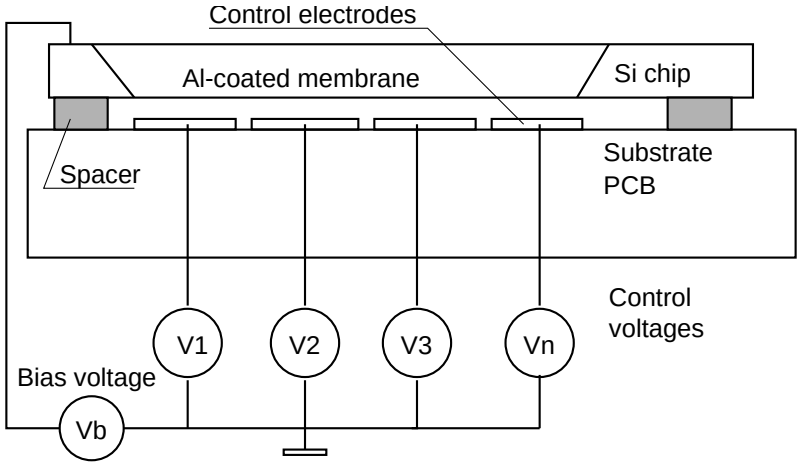


Figure 3: *Schematic section of the micromachined adaptive mirror.*

Never apply voltage greater than Vmax to focusators. This will damage the membrane. The A4MEMS shipped with the focusator has been tuned already to the maximum safe voltage.

The membrane is very fragile, and can be destroyed by a ESD or an air current. Do not walk with the unprotected device around the lab!

Do not touch or clean the membrane.

Do not ever think about touching or cleaning the membrane.

2 Optical quality

The interferograms of the mirror obtained before shipping are shown in Fig. 4.

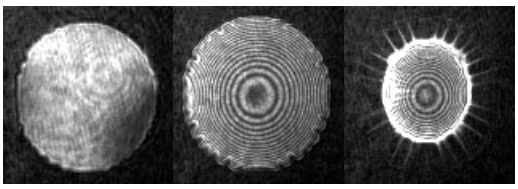


Figure 4: *Test of the defocus correctors: zero voltage applied, bias voltage applied, max voltage applied (left to right).*

3 Warranty

The equipment is covered by a one-year factory-defect warranty.

If the mirror is damaged during shipping, it will be replaced by a similar device within two months. A photo of the damaged device should be sent to Flexible Optical B.V. (OKO Technologies) within 3 days after the damaged device is received.

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4 Contact person

All questions about the technology, quality and applications of adaptive mirror should be addressed to:
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Date:

Signature:

(Dr. Oleg Soloviev,
Senior Associate)