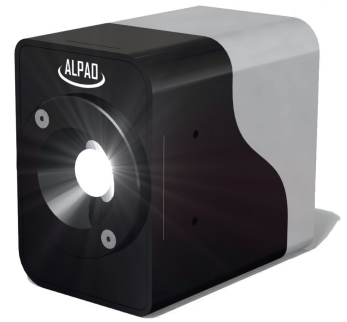
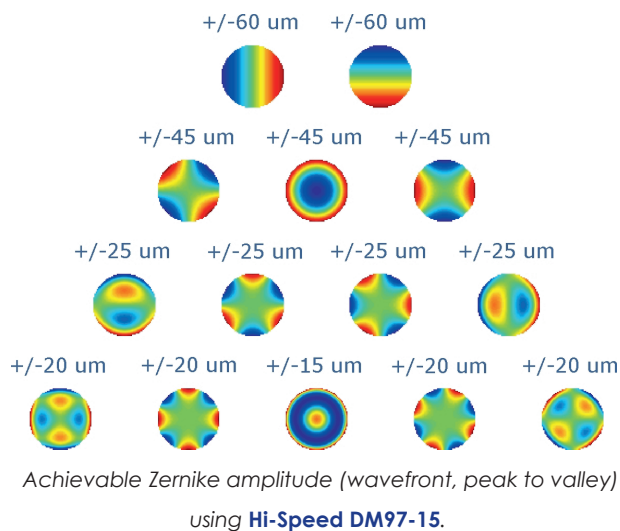


Hi-Speed Deformable Mirrors (DM)

ALPAO Hi-Speed DM deformable mirrors feature large strokes, excellent linearity and small settling times. ALPAO deformable mirrors meet and exceed requirements for fast and accurate wavefront correction.



Correcting low order aberrations

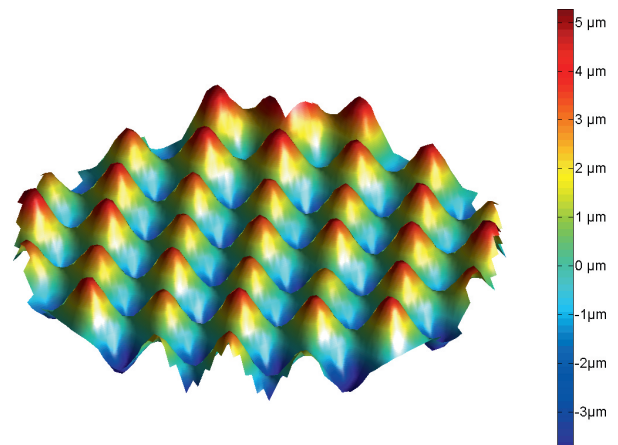


Using **ALPAO Hi-Speed DM** you can correct large aberrations and shape wavefronts with high precision, including high-order Zernike.

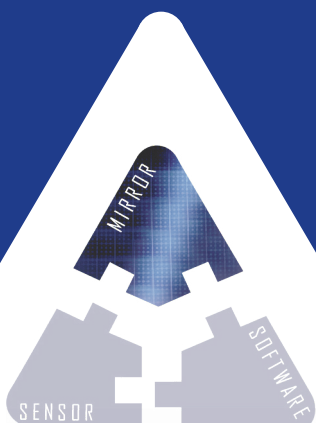
Hi-Speed DM have such a large amplitude of deformation that it allow you to use adaptive optics as never before. You can for example correct directly the tip-tilt, use the large defocus capability, or correct some optical misalignment.

Correcting high order aberrations

Hi-Speed DM mirrors offer better than 3 μm wavefront inter-actuator strokes, allowing the combination of high spatial-frequency and large amplitude corrections. Large high-order optical aberrations are efficiently corrected.



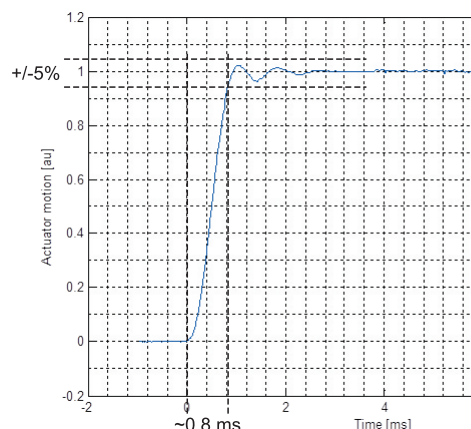
Wavefront pattern obtained by applying a waffle mode using **Hi-Speed DM97-15**.



Fast deformable mirrors

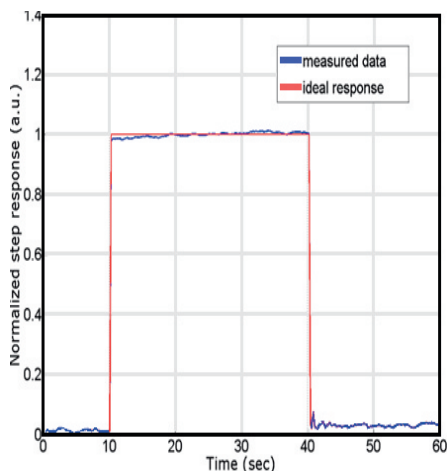
The settling times of ALPAO **Hi-Speed DM** of 1.5mm pitch are <1.0 ms (at $\pm 5\%$) with very low overshoot (<10%).

Consequently, the deformable mirror provides excellent correction because adaptive optics temporal errors are dramatically reduced.



Step response of **Hi-Speed DM97-15**

Linearity and stability



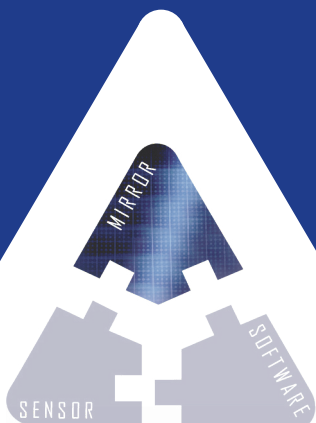
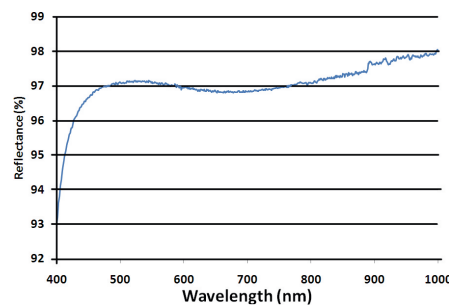
ALPAO deformable mirrors have almost no hysteresis, as well as high linearity (nonlinearity errors <3%) and great stability ($\pm 1\%$ over 30s).

Control of an ALPAO deformable mirror is straightforward and results in very low residual wavefront errors.

High quality coating

Broadband coating (protected silver) gives ALPAO mirrors an excellent reflection coefficient.

Our silver coating features a reflectivity larger than 96.5% (from 500 nm up to 2.0 μm). On request, ALPAO is happy to provide other coatings, such as gold or aluminium.



Low voltage drive electronics: stability and accuracy

The **Hi-Speed DM** includes:

- robust low voltage 14-bit control electronics.
- a high performances PCIe I/O board (latency <25 μ s, up to 78 K frames/s).
- software drivers for Labview®, Matlab® and C/C++, for easy integration into your software system.

All our hardware and software are compliant with Microsoft Windows® XP (32/64-bit), Seven (32/64-bit) and many Linux® (32bits) operating systems (Red Hat - Fedora Core).

Optional trigger-IN and trigger-OUT are available.

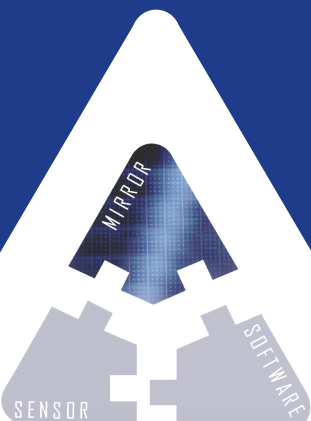
Maximum Power consumption	400W
Power supply	from 110 to 250V AC, 50 to 60Hz
Weight	6kg (12 pounds)
Dimensions	43.6 x 17.7 x 35.5 cm (17.2 x 7.0 x 14.0 inches)
Operating temperature	10 to 35 °C
Power supply cable length	2 m (6.5 foot)
PC Card to the drive electronics cable length	2 m (6.5 foot)
Drive electronics to the deformable mirror cable length	2 m (6.5 foot)

Easy installation

ALPAO provides helpful optionnal accessories to make it easy to integrate a deformable mirror into your system.

Our accessories include:

- **Dummy static mirrors** which use the same housing and mirror positioning. A dummy static mirror can replace your ALPAO deformable mirror when you must move the DM to a different optical bench.
- The **LEDBOX**: LEDs on the LEDBOX represent your DM (one LED per actuator). This device helps advanced users develop and the test their control software prior to any optical installation.



Hi-Speed DM performances

	DM69	DM88	DM97-08	DM97-15	DM241	DM277	DM468*	DM820*
Number of actuators	69	88	97	97	241	277	468	820
Pupil diameter	10.5 mm	20.0 mm	7.2 mm	13.5 mm	37.5 mm	24.5 mm	33.0 mm	45.0 mm
Pitch	1.5 mm	2.5 mm	0.8 mm	1.5 mm	2.5 mm	1.5 mm		
Mirror best flat (1)	7.0 nm RMS							
Wavefront tip/tilt stroke (PtV)	60 μm	35 μm	80 μm	60 μm	25 μm	15 μm		
Wavefront inter-actuator stroke	> 3.0 μm PtV							
Wavefront 3x3 stroke (PtV)	> 25 μm	> 15 μm	> 25 μm			> 10 μm		
Settling time (at +/-5%)	1.0 ms	2.0 ms		1.0 ms	2.0 ms	0.7 ms		
Bandwidth (2)	> 750 Hz	> 400 Hz		> 750 Hz	> 400 Hz	> 2 000 Hz		
Typical AO loop frame rate	< 7.5 kHz	< 4.0 kHz		< 7.5 kHz	< 4.0 kHz	< 10.0 kHz		
Hysteresis error	< 1%							
Non-linearity error	< 3%							
Coating (3)	Protected Silver							
Operating temperature (4)	10 to 35 °C							

* Preliminary specifications

(3) other coatings available

(1) in closed loop

(4) for CE marking ; compatible with cryogenics environment

(2) first resonance of the membrane (higher bandwidth available upon request)

Custom deformable mirrors

ALPAO is pleased to create custom products to fit your needs.

Contact the ALPAO team for custom deformable mirrors (higher bandwidth, larger stroke, specific pitch, much larger number of actuators, OEM versions, and so forth).

Product datasheet
Deformable Mirrors
rev. D

