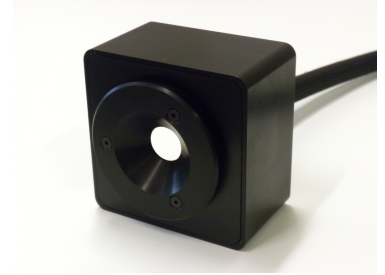




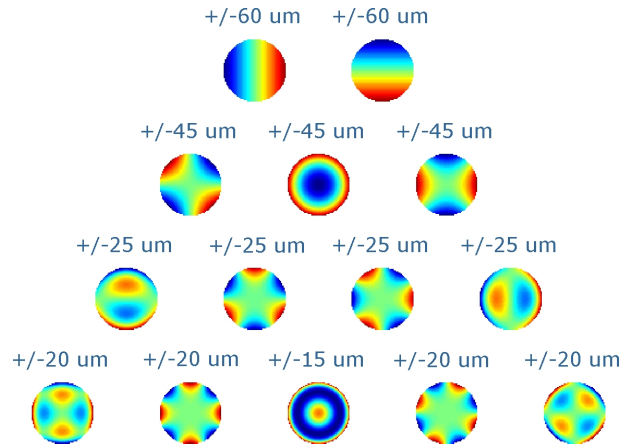
Hi-Speed DM deformable mirrors

The **ALPAO Hi-Speed DM** deformable mirrors feature large strokes, linearity and a small settling time. Therefore, these ALPAO deformable mirrors meet and exceed the requirements for fast and accurate wavefront correction.



Correcting large low order aberrations

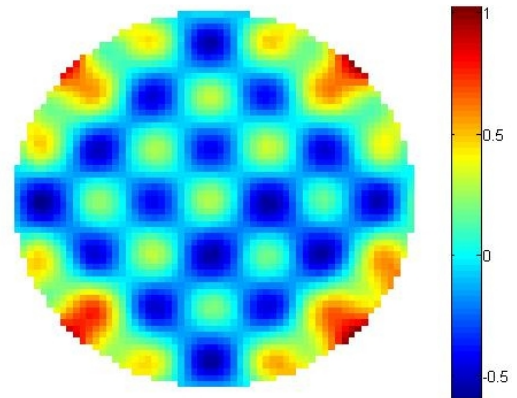
Large aberrations can be corrected or generated with high precision, including high order Zernikes. The **Hi-Speed DM** mirrors such as the **Hi-Speed DM97-15** can be used to simultaneously correct misalignment (tilt, defocus) and high spatial frequency wavefront errors.



Typical Zernike amplitude achievable (wavefront, peak to valley) with the Hi-Speed DM97-15. More actuators lead to increased accuracy.

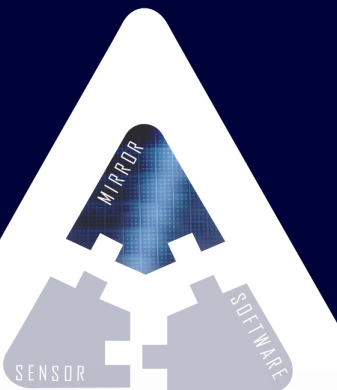
Correcting high order aberrations

The **Hi-Speed DM** mirrors offer more than 3 μm wavefront inter-actuator stroke, allowing the combination of high spatial frequency and large amplitudes corrections. Large high order optical aberrations are efficiently corrected.



Typical pattern obtained by applying a waffle mode (20% of the full stroke) with the **Hi-Speed DM69-15**.

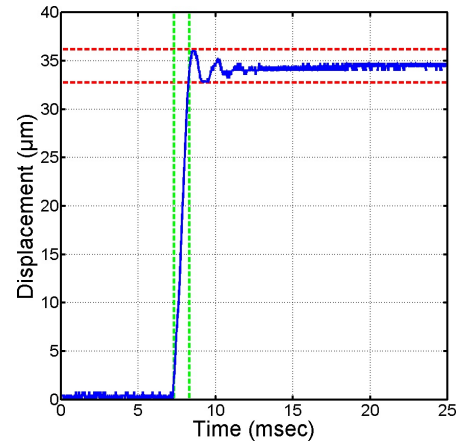
Hi-Speed DM
PRODUCT DATA SHEET



Fast deformable mirrors

The typical settling time of ALPAO **Hi-Speed DM** is about 1ms (at $\pm 5\%$) with a very weak overshoot (typically $< 10\%$).

Consequently, the corrections made by the deformable mirror will be excellent as the temporal errors of the adaptive optics are dramatically reduced.

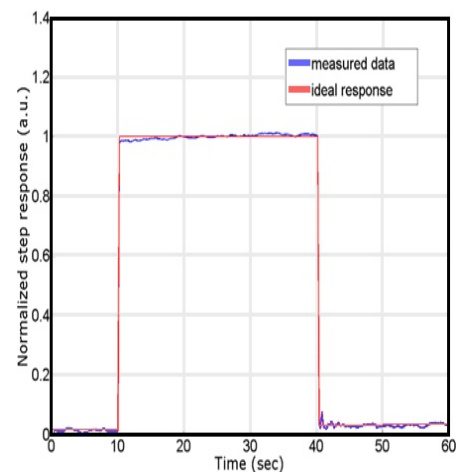


Typical step response of the **Hi-Speed DM97-15**

Linearity & Stability

Our deformable mirrors have nearly no hysteresis. Additionally, our mirrors have a high linearity (nonlinearity errors $< 3\%$) and have an exceptional stability ($\pm 1\%$ over 30s).

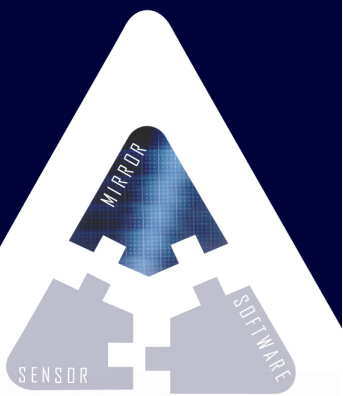
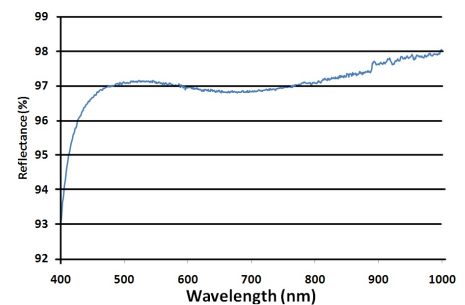
Therefore, the control of the deformable mirror is straightforward and the residual wavefront error is very low.



High quality coating

We provide a broadband coating (protected silver) giving you an excellent reflection coefficient.

Our silver coating features a reflectivity larger than 97% from 500nm up to 2.0µm. On request, **ALPAO** can provide other coatings like gold or aluminium.



Low Voltage drive electronics: stability and accuracy

The **Hi-Speed DM** are delivered with:

- A robust and low voltage 14 bit control electronics.
- A PCI I/O board, chosen for high performances (latency of 25µs, 30k frames/s).
- A set of software drivers for Labview®, Matlab® and C/C++, allowing an easy integration of the device within your own software system.

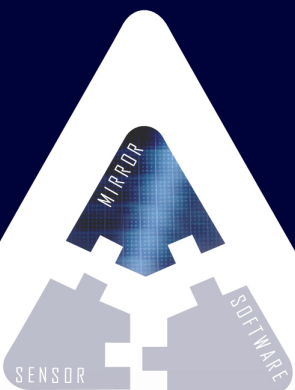
All our hardwares and softwares are compliant with Microsoft Windows® XP (32 bits), Seven (32 bits) and some Linux® (32bits) operating systems (Red Hat - Fedora Core).

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

In order to facilitate the integration of the deformable mirror in your system, **ALPAO** developed some helpful accessories such as:

- **Dummy static mirrors** with the same housing and mirror position. Those static mirrors can be used to replace **ALPAO**'s mirrors in the necessity to move the DM from one optical bench to another.
- The **LEDBOX**: a device composed of LEDs, representing a DM (one LED per actuator). This device targets advanced user. It permits the development and the test of their own control software prior to any optical set-up installation.



Hi-Speed DM with 1.5mm of pitch

	Hi-Speed DM37-15	Hi-Speed DM52-15	Hi-Speed DM69-15	Hi-Speed DM97-15
Pitch	1.5 mm			
Number of actuators	37	52	69	97
Pupil diameter	7.5 mm	9.0 mm	10.5 mm	13.5 mm
Mirror best flat (1)	7.0 nm RMS			
Wavefront tip/tilt stroke	+/- 60.0 μm PtV			
Wavefront inter-actuator stroke	> 3.0 μm PtV			
Wavefront 3x3 stroke	> 24.0 μm PtV			
Settling time	1.0ms at +/-5%			
Bandwidth (2)	> 750 Hz			
Non-linearity error	< 3%			
Hysteresis error	< 1%			
Coating (3)	Protected Silver			
Operating temperature	10 to 35 °C			

(1) in closed loop

(3) other metallic coatings available

(2) first resonance of the membrane

Hi-Speed DM with 2.5mm of pitch

	Hi-Speed DM52-25	Hi-Speed DM88-25
Pitch	2.5 mm	
Number of actuators	52	88
Pupil diameter	15.0 mm	20.0 mm
Mirror best flat (1)	7.0 nm RMS	
Wavefront tip/tilt stroke	+/- 30.0 μm PtV	+/-40.0 μm PtV
Wavefront inter-actuator stroke	> 3.0 μm PtV	
Wavefront 3x3 stroke	> 15.0 μm PtV	
Settling time	<2.0ms at +/-5%	
Bandwidth (2)	> 500 Hz	
Non-linearity error	< 3%	
Hysteresis error	< 1%	
Coating (3)	Protected Silver	
Operating temperature	10 to 35 °C	

(1) in closed loop

(3) other metallic coatings available

(2) first resonance of the membrane

Custom deformable mirrors

Do not hesitate to contact ALPAO team for custom deformable mirrors (strokes, size, number of actuators, etc.).

