ALPAO Deformable Mirrors (DMs) feature large strokes, high dynamic motion and an excellent optical quality. ALPAO DMs are providing state-of-the-art performances which will meet and exceed your requirements for fast and accurate wavefront corrections.

Key features

- **LARGE DEFORMATION**
  - Up to 90μm PV for tip-tilt

- **HIGH DYNAMIC MOTION**
  - Settling time as low as 400μs at +/-10%

- **EXCELLENT OPTICAL QUALITY**
  - Active best flat <7nm RMS (<3nm RMS optional)
Using **ALPAO DMs**, you can correct large aberrations and shape wavefronts with high precision, including high-order Zernike modes.

Such large amplitudes of deformation allow to use adaptive optics as never before. You can, for example, skip the separate tip-tilt mirror (astronomy), use the large defocus capability for fast z-scan (microscopy) or correct large eye-aberrations (ophthalmology).

**The settling times of ALPAO DMs are as low as 400µs (at ±10%) with very low overshoot.**

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

Additional DMs typical features and benefits:
- Operating temperature: -50/35°C
- Protected Silver coating (other coatings available)
- Vacuum compatibility
- Sub-nm resolution
- No protective glass
- Surface roughness <15Å RMS
- LIDT for protected silver coating: 880mJ/cm² (@12ns,10Hz,1064nm) / 50W (CW @ 1064nm)
- MTBF: 10¹¹ cycles
- <10nm RMS open loop stability over hours
- Square grid-pattern except for large size DM (hexagonal pattern)

Additional drive electronics typical features and benefits:
- Few W average power dissipation
- Thin and flexible cables

**ALPAO DMs have almost no hysteresis (<2%), as well as high linearity (>97%) and great stability.**

Straightforward control of an ALPAO DM results in very low residual wavefront errors.

**ALPAO DM includes software drivers (SDK) for Labview®, Matlab®, C/C++ and Python.**

Our hardware and software are compliant with Microsoft Windows® XP (32bit), 7, 8.1, 10 (32/64bit) and many Linux® (32/64bits) operating systems.
**ALPAO PERFORMANCE**

**SIZING**

<table>
<thead>
<tr>
<th>Number of actuators</th>
<th>Diaphragm (mm)</th>
<th>Number of actuators across a diameter</th>
<th>Tip/tilt stroke (µm)</th>
<th>Defocus/def. stroke (µm)</th>
<th>3x3 stroke (µm)</th>
<th>Spillage from 3x3 (1%/10%/5%/stroke)</th>
<th>Frequency of the membrane (Hz)</th>
<th>Mechanical dimensions (WxHxD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM49-08</td>
<td>69</td>
<td>0.8 10.5 9</td>
<td>80 40 25</td>
<td>1.5 400 300</td>
<td>52 x 74 x 35</td>
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<td>244 x 290 x 78</td>
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<td>1.5 400 300</td>
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<td>1.5 400 300</td>
<td>52 x 74 x 35</td>
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<td>7</td>
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<td>1.5 400 300</td>
<td>52 x 74 x 35</td>
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<td>2.5 13.5 11</td>
<td>40 30 25</td>
<td>1.5 600 500</td>
<td>72 x 84 x 23</td>
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<tr>
<td>DM69-15</td>
<td>1.5 13.5 11</td>
<td>40 30 25</td>
<td>1.5 600 500</td>
<td>72 x 84 x 23</td>
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<td>244 x 290 x 78</td>
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<tr>
<td>DM69-25</td>
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<td>40 30 25</td>
<td>1.5 600 500</td>
<td>72 x 84 x 23</td>
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<td>7</td>
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<td>244 x 290 x 78</td>
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<tr>
<td>DM69-50</td>
<td>5.0 45.11</td>
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<td>72 x 84 x 23</td>
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<td>244 x 290 x 78</td>
</tr>
</tbody>
</table>

Non-linearity below 3%, hysteresis as low as 2% for all DMs and 6% for DMXs. Performances at room temperature

**LOW-VOLTAGE ELECTRONICS**

<table>
<thead>
<tr>
<th>Protocol / Resolution</th>
<th>Power consumption</th>
<th>Power supply</th>
<th>Weight</th>
<th>Dimensions (L x W x H)</th>
<th>Operating temperature</th>
<th>Cable length</th>
<th>Analog response time</th>
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</thead>
<tbody>
<tr>
<td>USB / Ethernet</td>
<td>&lt;150W</td>
<td>4kg (9 pounds)</td>
<td>31.5 x 23.5 x 13.5 cm</td>
<td>0 to 30°C</td>
<td>2m - 6.5 foot</td>
<td>&lt;10 µs</td>
<td></td>
</tr>
<tr>
<td>PCIe card (included)</td>
<td>&lt;500W</td>
<td>10kg (22 pounds)</td>
<td>37.1 x 45 x 17.5 cm</td>
<td>0 to 30°C</td>
<td>2m - 6.5 foot</td>
<td>&lt;10 µs</td>
<td></td>
</tr>
</tbody>
</table>

**Note:**
- Preliminary specifications
- Longer cable available upon request

**ALPAO PERFORMANCE**

**DEFORMABLE MIRROR**

**Note:**
- Preliminary specifications
- Longer cable available upon request
ALPAO custom DMs are available upon request. No matter what your needs are: OEM versions, custom pitch or diameters, custom number of actuators (up to several thousand), contact us to build the DM that will suit your needs.

**OPTIONAL ITEMS**

- Large stroke, High speed or High optical quality options provide additional specific features:

<table>
<thead>
<tr>
<th>Large stroke</th>
<th>High speed</th>
<th>High optical quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>/2</td>
<td>3</td>
</tr>
<tr>
<td>x1.5</td>
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<td>x2</td>
<td>x2</td>
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<td>/2</td>
<td></td>
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<tr>
<td></td>
<td>/2</td>
<td></td>
</tr>
</tbody>
</table>

- High stability option provides increased open-loop performances.
- Other coatings: gold, aluminium or dielectric for higher LIDT.

**ACCESSORIES**

- **Rotation stage** for precise tip-tilt and alignment adjustment.
- **Motorized rotation stage**
- **Trigger-IN and trigger-OUT** to synchronise sharply the hardware of your system.
- **Alignment static mirrors** which use the same housing and mirror positioning. It replaces your ALPAO DM for alignment or when you must move the DM to a different optical bench.
- **LEDBOX**: 64 LEDs on the LEDBOX represent your DM (one LED per actuator). This device helps advanced users to develop and test their control software prior to any optical installation.

**ORDER TODAY**

Need more information?

Fitting simulation, open loop control, LIDT, MTBF, software compatibility, cryogenic environment, external size drawings, 3D files or any other requests, we have more information to share.

Contact us for one-to-one guidance and technical support.

- [www.alpao.com](http://www.alpao.com)
- [contact@alpao.fr](mailto:contact@alpao.fr)
- [+33 476 890 965](tel:+33476890965)
ALPAO Deformable Modal Mirrors (DMM) provide an excellent correction of the most common optical aberrations. Each control channel corresponding to one optical mode (e.g., focus or astigmatism), the control is straightforward.

Key features

- **SIMPLE USE**
  - One control channel per mode
  - Embedded electronics

- **OPTIMIZE ZERNIKE CORRECTION**
  - Large deformation (up to 100µm)
  - Low fitting error (down to 2%)

- **COST EFFICIENT**
  - Designed for OEM applications
IN TERFACES

Using ALPAO DMM, you can correct the first optical aberrations at large amplitude and with high precision.

DMM allows to use adaptive optics as never before. You can, for example, correct alignment errors, use the defocus capability for z-scan or correct large optical aberrations.

ALPAO DMM presents a low-voltage and low power consumption embedded electronics, with a standard Ethernet interface (or USB using a dongle). The control and monitoring are easily performed from any web browser. A simple API based on web-services is provided, it is compatible with any language and operating system. No drivers are required.

Thanks to their standard tube packaging, ALPAO DMM is easily integrated into systems.

SIMPLE CONTROL

Each control channel corresponds to Zernike. As simply as you would do an auto-focus, you can now do an auto-astigmatism or an auto-spherical.

Straightforward control of an ALPAO DMM results in very low residual wavefront errors.

FEATURES AND BENEFITS

Typical ALPAO DMM characteristics:

- Protected Silver coating
- No protective glass
- Surface roughness <15Å RMS
- LIDT for protected silver coating2: 880mJ/cm² (@12ns, 10Hz, 1064nm) / 50W (CW @1064nm)

ALPAO DMM can be customized according to your needs (larger stroke, pupil diameter, different coating, etc).

Note 1: Ratio of RMS after and before correction
Note 2: Technical note available upon request