

INSTITUTE ON LASER AND INFORMATION TECHNOLOGIES

DEFORMABLE MIRRORS

the active elements for adaptive optics systems

Applications:

- ◆ Medical imaging
- ◆ Laser beam control and shaping
- ◆ Optical communications
- ◆ Astronomy

Features:

- ◆ Large stroke
- ◆ High surface quality
- ◆ Excellent mechanical stability
- ◆ Fast response
- ◆ High optical damage threshold
- ◆ Suitable for vacuum conditions
- ◆ Shock and vibration resistant
- ◆ Inexpensive



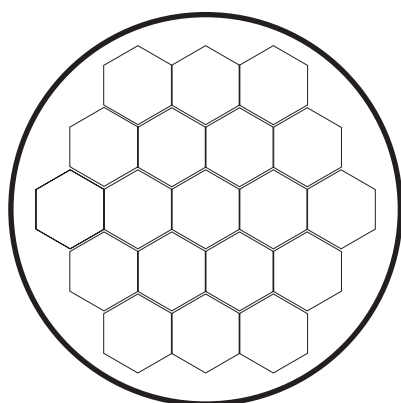
Typical Specification

Item	Value
Substrate	quartz, glass
Clear Aperture (diameter), mm	30-60
Stroke, μ	15-40
Number of control electrodes	13-24
Control voltage (max), V	± 300
Resonance frequency, Hz	> 2000
Reflecting coatings	protected Al, Ag, Cu, multilayer dielectric coating of reflectivity $P > 99\%$
Optical Damage threshold in CW operation (up to), kW/cm^2 in pulsed operation (up to), J/cm^2	0.1 4
Surface quality (scratch-dig)	60-40
Hysteresis	$< 15\%$
Operating temperature range $^{\circ}\text{C}$	$+10 \text{ } +40$
Storage temperature range $^{\circ}\text{C}$	$-30 \text{ } +70$
Weight (max), Kg	0.15
Size, mm	$\Phi 55 \times 55$

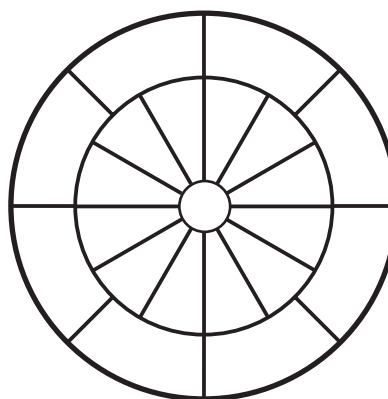
Principle of operation of bimorph and unimorph mirrors

The bimorph (unimorph) mirror itself is constructed of two (one) thin plates of piezo electric material coupled with the substrate plate. The electrode pattern is deposited on the piezo-plates, which are then glued together to form a sandwich of electrodes. The ground plane is the common middle surface of the bimorph or the back surface of the substrate in the unimorph. An optical surface is formed on the front surface of the substrate plate. The polarization of the piezo-electric plate is chosen so that to make the plate expand or contract when voltage is applied to the electrode. The differential expansion/contraction of the substrate and piezo-plates causes the bimorph (unimorph) to bend, much in the same way as a bi-metallic strip will bend when heated. The mirrors of this type have proved so far to be highly reliable.

Typical electrode arrangement diagram for standard mirrors



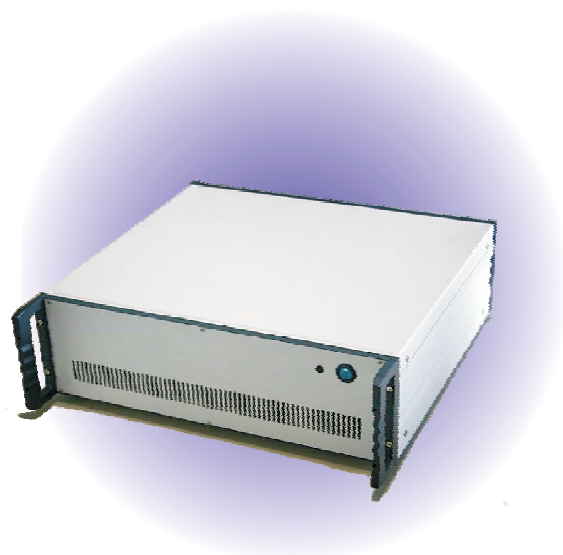
19 electrodes
HEX-arrangement



21 electrodes
MDL-arrangement

Specification of the control unit

Item	Value
Number of channels*(max)	32
Control interface	USB-2
Response delay (max), s	0.001
Output voltage range, V	± 300
Control step, V	0.15
Standard frequency bandwidth at -3dB, 100nF load, Hz	> 500
Operating temperature range, °C	-10 / +40
Storage temperature range, °C	-10 / +70
Weight (max), Kg	8
Size, mm	440x400x140 (19" rack mountable)
Power supply	110-220V ; 50-60 Hz
Mirror connection cable length (standard), m	5



* Several units can be connected to the host computer for control mirrors with more than 32 electrodes.

Control Software:

Device drivers for Windows 2000/XP, diagnostic and control utility with graphic interface, SDK for C/C++.