

DELTA 7¹⁰

TRANSMISSIVE WAVEFRONT MODULATOR

DPP TECHNOLOGY

The Delta 7 is based on the Deformable Phase Plate (DPP) technology, exclusively developed by Phaseform GmbH. DPP is composed of a fluidic chamber, enclosed by a thin membrane, which is deformed by electrostatic force. The force is generated by a 2D array of transparent electrodes embedded within the optical aperture of the DPP. The sophisticated optofluidic design of the 10 mm aperture DPP enables gravity-neutral performance for orientation-independent, high-quality wavefront modulation.

KEY FEATURES

Complex wavefront modulation

63 electrodes enabling replication of up to the 7th radial order of Zernike polynomials (>35 modes) with high fidelity

Straightforward system integration

Compact housing compatible with standard 30 mm cage systems by rods, lens tubes, and post assemblies

Linear & hysteresis-free response

Electrostatic actuation suited for open-loop wavefront control

Remarkable optical quality

Active best flat with an induced RMS wavefront error of less than $\lambda/40$ independent of the DPP orientation

Polarization-independent

Wavefront modulation independent of the light polarization for maximized efficiency



SPECIFICATIONS

GENERAL

Modulator type

Clear aperture diameter

Number of actuators

Number of actuators across aperture diameter

Connectivity

Included in the Delta 7 package

OPTICAL

Wavefront RMS error of best flat

Maximum peak-to-valley of the generated wavefronts

Maximum spatial frequency of the correction

Wavefront RMS drift

Laser Induced Damage Threshold (LIDT)

Optical transmission

Optofluidic DPP (Deformable Phase Plate),
electrostatically actuated, factory calibrated

10 mm

63

7

USB 2.0

Driving electronics, control software, cables, manual

< 15 nm (orientation independent)

> 7 μm

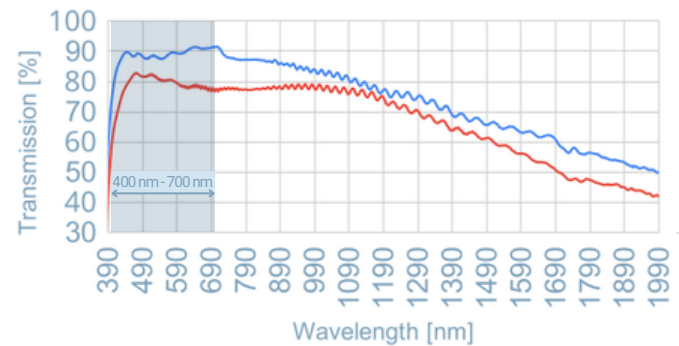
7th radial order of Zernike modes

< 5% after 60 min

10 W/cm² for 10s @ 1070 nm CW

Without AR coating

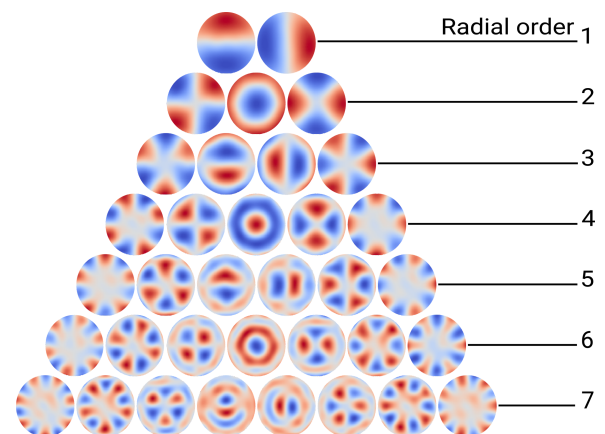
With AR coated membrane



GENERATED ZERNIKE MODES IN OPEN LOOP

Max amplitude RMS, peak-to-valley, and purity of generated Zernike modes

Z (n,m)	RMS [μm]	PV [μm]	Purity [%]	Z (n,m)	RMS [μm]	PV [μm]	Purity [%]
Z (1,-1)	2	7	98	Z (5,3)	0.15	0.7	82
Z (1,1)	2	7	97	Z (5,5)	0.15	0.9	90
Z (2,-2)	1	3.8	96	Z (6,-6)	0.1	0.8	83
Z (2,0)	1	3.8	96	Z (6,-4)	0.07	0.5	70
Z (2,2)	1	3.8	96	Z (6,-2)	0.07	0.5	77
Z (3,-3)	0.5	2.5	94	Z (6,0)	0.1	0.6	77
Z (3,-1)	0.5	1.7	94	Z (6,2)	0.07	0.5	73
Z (3,1)	0.5	1.7	93	Z (6,4)	0.07	0.5	70
Z (3,3)	0.5	2.5	95	Z (6,6)	0.1	0.8	77
Z (4,-4)	0.25	1.3	93	Z (7,-7)	0.07	0.6	74
Z (4,-2)	0.25	1.1	88	Z (7,-5)	0.07	0.5	70
Z (4,0)	0.25	1.2	91	Z (7,-3)	0.07	0.5	70
Z (4,2)	0.25	1.1	86	Z (7,-1)	0.07	0.5	70
Z (4,4)	0.25	1.3	94	Z (7,1)	0.07	0.5	70
Z (5,-5)	0.15	0.9	90	Z (7,3)	0.07	0.5	70
Z (5,-3)	0.15	0.7	84	Z (7,5)	0.07	0.5	70
Z (5,-1)	0.15	0.8	80	Z (7,7)	0.07	0.6	78
Z (5,1)	0.15	0.8	80				



*Purity is defined as the fraction of the target Zernike mode relative to the root-square-sum of all modes.

**The Zernike-tree shows experimentally measured replicated Zernike modes up to the 7th order, in open-loop, using an interferometric setup.

SPECIFICATIONS, CONT.

MECHANICAL

Thickness (within clear aperture)

Response time (best flat to maximum deformation)

Hysteresis

Linearity

Mounting orientation

Mounting capability

Connector cable length

ELECTRICAL

Actuator voltage

Maximum power consumption

Power supply

THERMAL

Storage temperature

Operating temperature

0.87 mm

< 40 ms

< 1%

> 92%

Arbitrary (horizontal and vertical standard, other orientations upon request)

30 mm cage system rods, SM1 tubing, and $\varnothing=1/2"$ post
1.5 m

up to 295 V DC

< 9 W

120/230 VAC

10 °C to 35 °C

20 °C to 25 °C

SOFTWARE

Graphical User Interface (GUI)

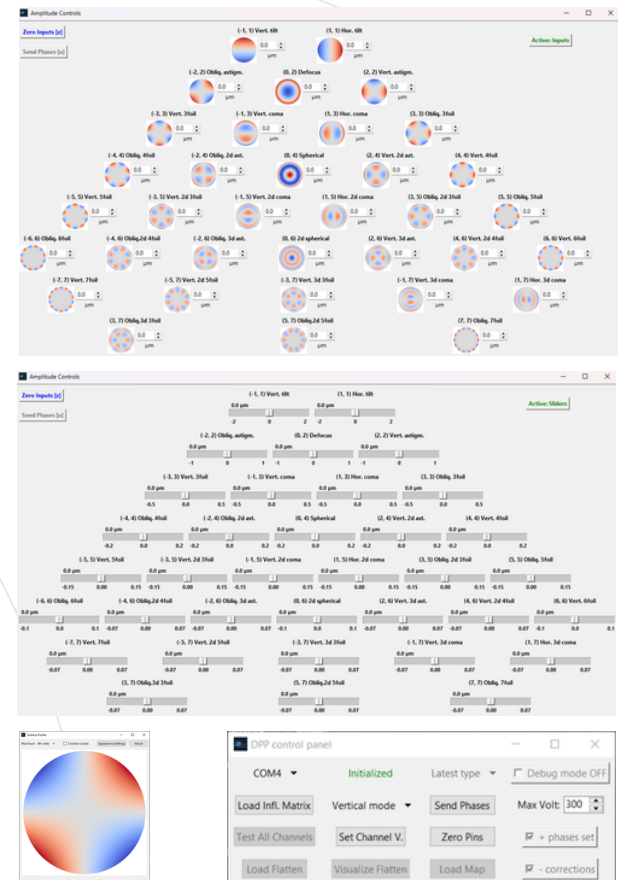
- Python-based interface using serial communication
- Direct application of phase profiles using Zernike polynomial descriptions

Software Development Kit (SDK)

- Python scripting control interface
- MATLAB wrappers to execute Python functions
- Easy integration into custom control software
- Reference implementation of the serial communication protocol included

Phinden (optional add-on for Delta 7)

- Turnkey software for real-time, image-based adaptive optics in microscopy
- Automated aberration correction improving resolution, SNR, and contrast
- Runs seamlessly alongside native microscope control software



System Requirements

Operating system: Windows, Linux, macOS

Python: Minimum version 3.8, recommended - 3.11

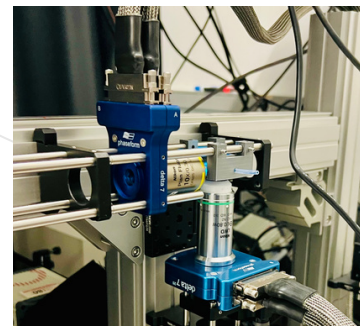
MATLAB: Minimum version R2020b



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Using a Delta 7¹⁰ in the excitation path of a light-sheet microscope to expand the effective field of view via modulating the Gaussian beam profile, and a Delta 7²⁰ in the detection path for wavefront coding to extend depth of field.

Courtesy of Prof. Pablo Loza-Alvarez and Dr. Gustavo Castro, SLN Lab, ICFO, Spain



All specifications are preliminary and subject to change without notice. No representation or warranty, either expressed or implied, is made as to the reliability, completeness, or accuracy of this specification sheet.

Get in touch with us today for a live demo!

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