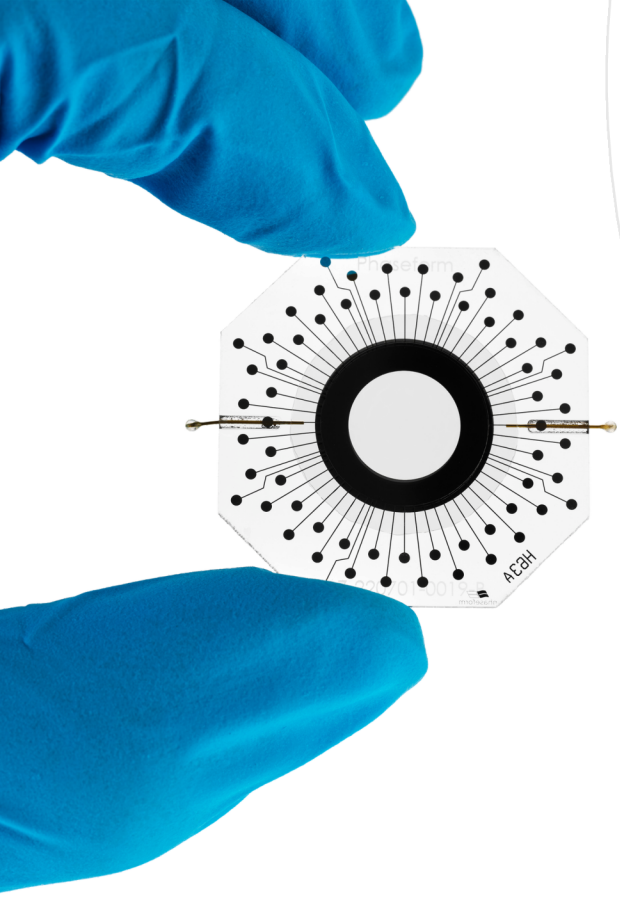


DELTA 7^{20}

TRANSMISSIVE WAVEFRONT MODULATOR

DPP TECHNOLOGY

he Delta 7^{20} is based on Deformable Phase Plate (DPP) technology, exclusively developed by Phaseform GmbH. A DPP comprises a fluidic chamber enclosed by a thin membrane that is deformed by electrostatic force. This force is generated by a two-dimensional array of transparent electrodes embedded within the optical aperture of the DPP. The sophisticated optofluidic design of the DPP enables high-quality, real-time wavefront modulation in a fully refractive architecture.

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 the standard cage system with native M32 lens tube threading

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 λ/40

Polarization-independent
Wavefront modulation independent of the light polarization for maximized efficiency

phaseform

SPECIFICATIONS

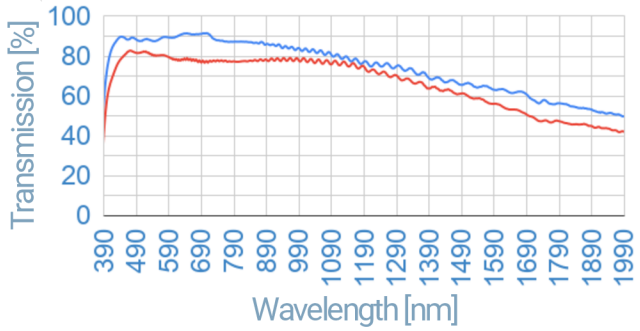
GENERAL

Modulator type	Optofluidic DPP (Deformable Phase Plate), electrostatically actuated
Clear aperture diameter	20 mm
Number of actuators	63
Connectivity	USB 2.0
Included in the Delta 7 package	Driving electronics, control software, cables, manual

OPTICAL

Wavefront RMS error of best flat	< 15 nm (DPP horizontal, optical axis vertical)
Maximum peak-to-valley of the generated wavefronts	> 10 µm
Maximum spatial frequency of the correction	7th radial order of Zernike modes
Wavefront RMS drift	< 5% after 60 min
Laser Induced Damage Threshold (LIDT)	10 W/cm² for 10s @ 1070 nm CW
Optical transmission	

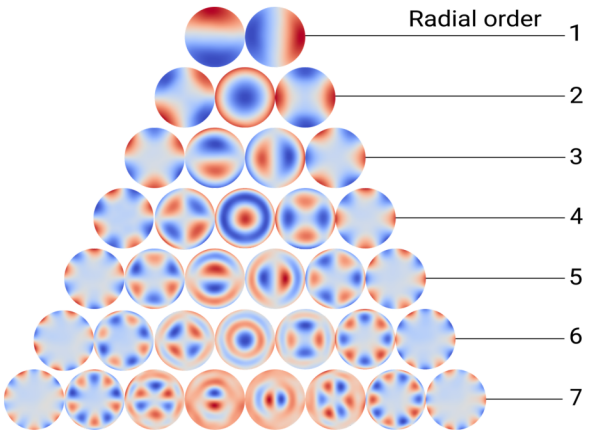
Without AR coating
With AR coated membrane



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)	3	10	97	**Z (5,3)**	0.2	1.0	92
Z (1,1)	3	10	97	**Z (5,5)**	0.22	1.5	92
Z (2,-2)	1.3	5.0	98	**Z (6,-6)**	0.12	0.8	92
Z (2,0)	1.3	5.0	98	**Z (6,-4)**	0.12	0.8	92
Z (2,2)	1.3	5.0	98	**Z (6,-2)**	0.1	0.6	82
Z (3,-3)	0.6	3.1	95	**Z (6,0)**	0.1	0.6	82
Z (3,-1)	0.6	2.5	95	**Z (6,2)**	0.1	0.6	82
Z (3,1)	0.6	2.5	95	**Z (6,4)**	0.12	0.8	92
Z (3,3)	0.6	3.1	95	**Z (6,6)**	0.12	0.8	92
Z (4,-4)	0.35	2.0	94	**Z (7,-7)**	0.1	0.6	90
Z (4,-2)	0.35	1.5	94	**Z (7,-5)**	0.1	0.6	90
Z (4,0)	0.35	1.5	94	**Z (7,-3)**	0.07	0.5	70
Z (4,2)	0.35	1.5	94	**Z (7,-1)**	0.07	0.5	70
Z (4,4)	0.35	2.0	94	**Z (7,1)**	0.07	0.5	70
Z (5,-5)	0.22	1.5	92	**Z (7,3)**	0.07	0.5	70
Z (5,-3)	0.2	1.0	92	**Z (7,5)**	0.1	0.6	90
Z (5,-1)	0.2	1.0	92	**Z (7,7)**	0.1	0.6	90
Z (5,1)	0.2	1.0	92				



*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)	0.87 mm
Response time (best flat to maximum deformation)	< 40 ms
Hysteresis	< 1%
Linearity	> 92%
Mounting orientation	Recommended horizontal only (optical axis vertical)
Mounting capability	Native M32 x 0.75 female threading, custom female to male thread adapters for other standard optics threads available upon request
Connector cable length	1.5 m

ELECTRICAL

Actuator voltage	up to 295 V DC
Maximum power consumption	< 9 W
Power supply	120/230 VAC

THERMAL

Storage temperature	10 °C to 35 °C
Operating temperature	20 °C to 25 °C

SOFTWARE

Graphical User Interface (GUI)

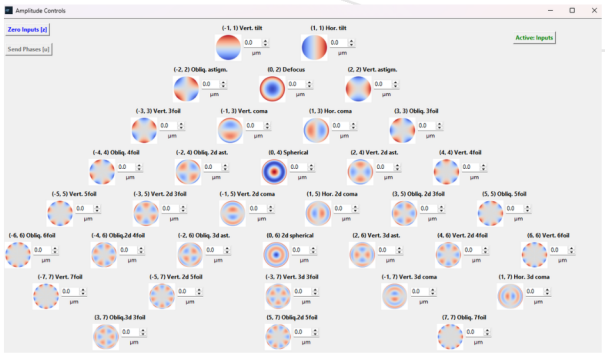
- Python-based interface using serial communication
- Direct application of phase profiles using Zernike polynomial descriptions

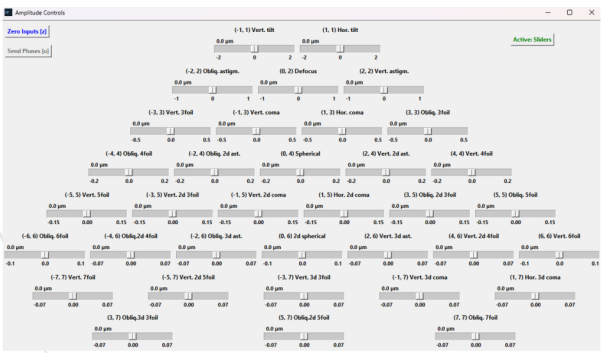
Software Development Kit (SDK)

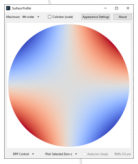
- Python scripting control interface
- MATLAB wrappers to execute Python functions
- Easy integration into custom control software
- Reference implementation of the serial communication protocol included

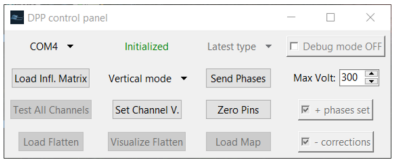
Phinden (optional add-on for Delta 7)

- 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





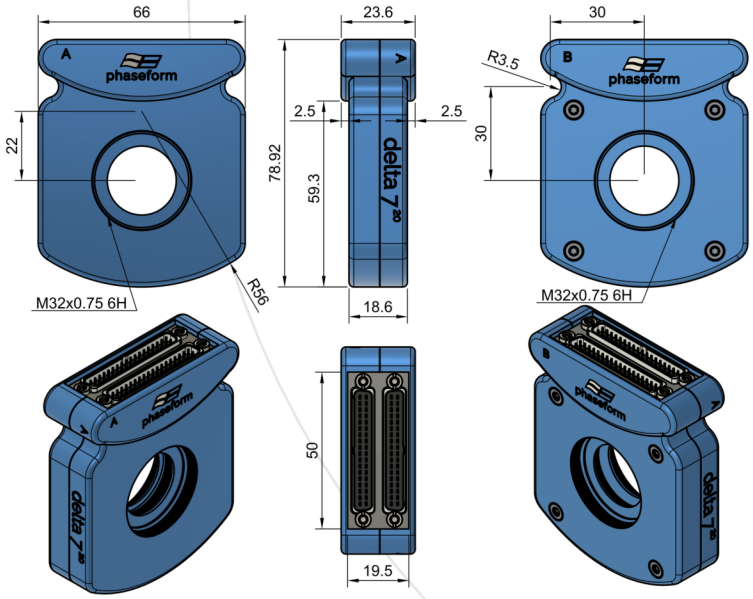




System Requirements

Operating system: Windows, Linux, macOS
Python: Minimum version 3.8, recommended - 3.11
MATLAB: Minimum version R2020b

OPTICS HOUSING MECHANICAL DRAWINGS

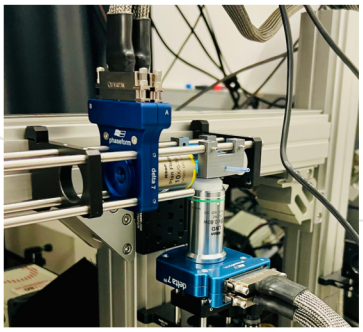


Weight: ~170 g

APPLICATION IDEA

Using a Delta 7^{10} 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 7^{20} 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



DISCLAIMER

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.

CONTACT US

Get in touch with us today for a live demo!

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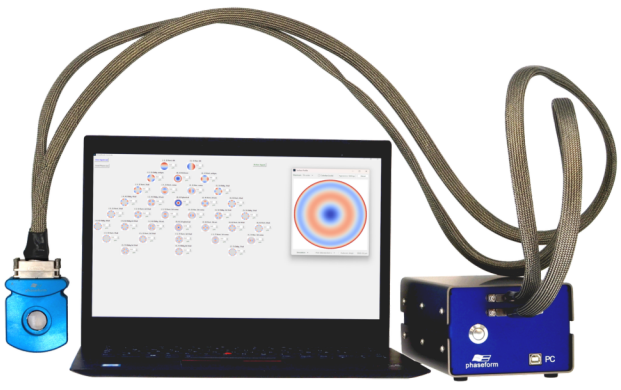

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