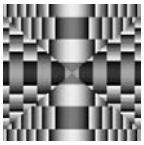
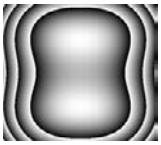
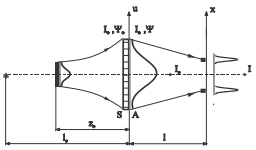
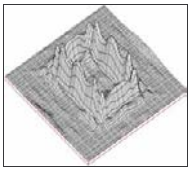
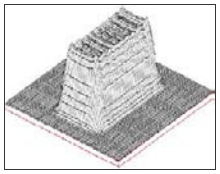
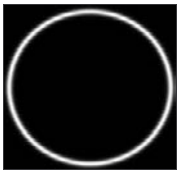
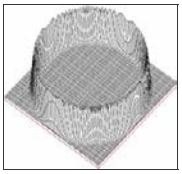
HOLO/OR

LASER COMPONENTS

# Diffractive Optics *from* Holo /Or

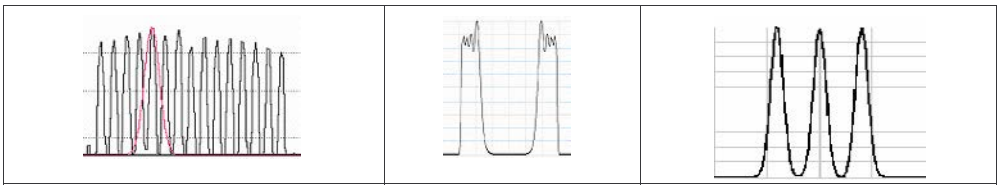
In the past 15 years we developed, designed and manufactured a variety of diffractive optical elements that accomplish difficult tasks, conventional optics fails to address effectively. Proven solutions developed for high power lasers include:

- Uniform Splitting of beams
- Tailored Shaping of spots
- 1D, 2D and 3D spot array generation
- Diffusers and Homogenizers
- Top-Hat Beam Shaping
- Lenslet Arrays, symetric and asymetric
- Beam Sampling
- Chromatic and Spherical Aberation Correction
- Intensity profile management
- Enlongating Depth of Focus
- Frame focusser
- Tailored spot SHAPES and sizes

The company employs highly skilled technical personal, and occupies a prodcution facility at the Kiryat Weizmann High-Tech Industrial Park, Rehovot, Israel. Holo-Or has a full capability of developing and manufacturing diffractive optical elements in clean room facilities. The company holds the key patents on its method of manufacturing multi-level elements. Holo-Or is cooperating with Laser Components, GmbH.

## *SERVICES & CAPABILITIES*

- Diffractive optical elements: Custom & Stock
- Diffractive design and performance analyses
- Optical design incorporating diffractive optics
- Reactive ion and wet etching and photolithography for visible and IR materials
- Mask fabrication



## *IN-HOUSE ELABORATED SOFTWARE*

**DOECAD** software for design, mask files generation and computer simulation of diffractive optical elements



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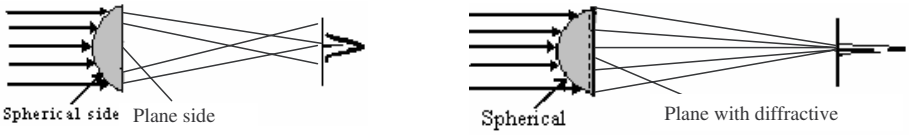
## DIFFRACTIVE-CORRECTED FOCUSING LENS

Our single diffractive-corrected focusing lens demonstrates *sharp focusing* with diffraction-limited spot-size. The lens is fabricated by etching an *aberrations-correction diffractive microrelief pattern* on the plane side of a bulky spherical plano-convex lens.




| Part number | Wavelength | Efl | Diam. |
|---|---|---|---|
| SE-1511 | 10.6 µm | 1.5 ″ | 1.1″ |
| SE-2511 | 10.6 µm | 2.5 ″ | 1.1″ |
| SE-2515 | 10.6 µm | 2.5 ″ | 1.5″ |
| SE-3711 | 10.6 µm | 3.75 ″ | 1.1″ |
| SE-5015 | 10.6 µm | 5.0 ″ | 1.5″ |

## LONG-FOCAL -DEPTH DIFFRACTIVE FOCUSING LENS

The "Easy-F" lens design yields *a longer focal depth* while still maintaining near to diffraction limited spot size, sharp and cleaner edges of the focal spot. "Easy-F" lenses achieve high cutting and drilling speeds, together with smoother and cleaner edges and the ease of focusing of longer-focal-length lenses

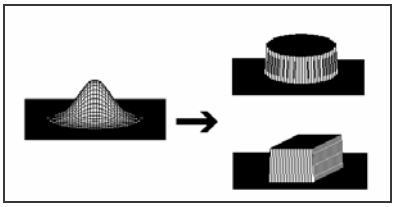
Conventional plano-convex lens

Diffractively-corrected lens

“Easy-F” diffractively-corrected lens

## TOP-HAT BEAM SHAPING

*The diffractive top-hat beam shapers* are diffractive phase optical elements used to transform a near-gaussian incident laser beam into a uniform-intensity spot of either round or rectangular shape with sharp edges. Applications include laser heat treatment, annealing of surfaces in machinery and microelectronics, optical heads of laser writers and optical information processing.



| Part No. | Function | Dia. | Wavelength | Diameter | Working dist | Spot size(1/e2) | Spot Shape |
|---|---|---|---|---|---|---|---|
| TH-001 | Top-Hat | 1.5” | 10600 | 25 mm | 250 mm | 3 mm | Round |
| TH-002 | Top-Hat | 1.1” | 10600 | 12 mm | 250 mm | 6 mm | Square |
| TH-003 | Top-Hat-1D | 0.5” | 10600 | 3.7 mm | 42.5 mm | 0.3X0.1mm | Line |
| TH-004 | Top-Hat | 1.1" | 10600 | 12 mm | 63.5 mm | 0.39 mm | Round |
| TH-005 | Top-Hat | 1.1" | 92500 | 12 mm | 63.5 mm | 0.35 mm | Round |
| TH-014 | Top-Hat-Sharp edge | 20 mm | 1064 | 7.0 mm | 42.52 mm | 0.190 mm | Round |
| TH-015 | Top-Hat-1D | 1" | 1064 | 5.1 mm | infinity | 0.83 deg x nat. divergence | Line |
| TH-016 | Top-Hat | 1" | 980 | 7.0 mm | infinity | 0.94x0.94 deg | Square |
| TH-031 | Top-Hat | 1” | 532 | 5 mm | 52.4 mm | 0.1 mm | Round |
| TH-032 | Top-Hat | 1” | 532 | 10.9 mm | 200 mm | 2 mm (FWHM) | Round |
| TH-041 | Top-Hat | 1” | 355 | 2 mm | 100 mm | 0.1 mm | Square |
| TH-042 | Top-Hat | 1” | 355 | 2.5 mm | 50 mm | 0.05mm | Round |
| TH-044 | Top-Hat | 20 mm | 337 | 8.0 mm | 49.395 mm | 0.020 mm | Round |
| TH-051 | Top-Hat | 1” | 266 | 5 mm | 42 mm | 0.015mm | Round |



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## ABERRATION-CORRECTION PLATES FOR MULTILENS OBJECTIVES

We design diffractive microrelief pattern on a surface of refractive lens or window in order to correct for chromatic, spherical and other aberrations of broad-band objectives. Diffractive pattern results in reduced of number of components

Applications include thermal imaging and FLIR systems covering wavelength range the 8-12$\mu m$ or 3-5$\mu m$.

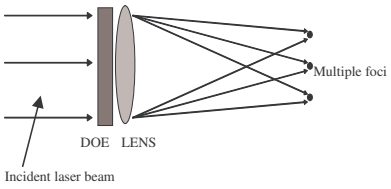
## PHASE DIFFRACTION GRATINGS

We produce transmissive phase diffraction gratings etched in materials like Fused Silica and ZnSe. Gratings can be binary rectangular-groove shaped or blazed multilevel. Grooved might be straight of curvilinear,

## BEAM MULTIPLICATION AND MULTIPLE-SPOT LENSES

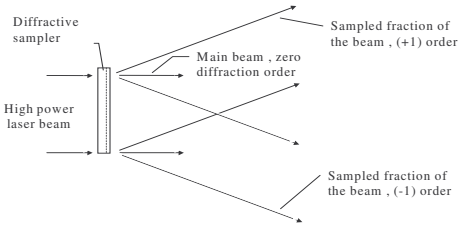
Diffractive beam-multiplication elements split a laser beam into several beams, each with the characteristics of the original beam except for power and angle of propagation. Focusing multi-spot elements provide a line or an array of identical focal spots located in the focal plane, with spacing between neighboring spots

| Part No. | Function | Dia. | Wave-length | Collimation | Angle separation |
|---|---|---|---|---|---|
| DS-001 | Double-spot | 1.1" | 10.6 µm | Collimated | 1.35 deg |
| DS-002 | Double-spot | 1.1" | 10.6 µm | Collimated | 2.70 deg |
| TS-004 | Triple-spot | 1.1" | 10.6 µm | Collimated | 1.35 deg |
| DS-006 | Double-spot | 1.0" | 1.06 µm | Collimated | 2.53 deg |
| TS-008 | Triple-spot | 1.0" | 1.06 µm | Collimated | 1.27 deg |
| DS-015 | Double-spot | 1.0" | 0.532 µm | Collimated | 1.27 deg |
| DS-016 | Double-spot | 1.0" | 0.355 µm | Collimated | 0.85 deg |
| DS-017 | Double-spot | 1.0" | 0.266 µm | Collimated | 0.64 deg |




## BEAM SAMPLER

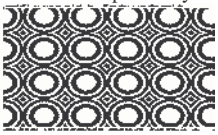
Diffractive beam samplers are used to monitor high-power lasers by extraction of exact sampled copies of the beam with only a small fraction of the total power. The passing beam corresponds to the zero diffraction order, while two sampled beams propagate at the symmetrical angles of the first diffraction orders. We offer our high quality beam samplers for various angles and power fractions of sampled beam.




| Part No. | Function | Dim. | Wave-length | Nomin. angle sep. | Ratio/ Angle |
|---|---|---|---|---|---|
| SA-010 | Sampler | 12x12mm | 1.06 µm | 15.2 deg | 0.40% |
| SA-015 | Sampler | 1.0" | 0.355 µm | 5.1 deg | 3.87% |
| SA-020 | Sampler | 1.1" | 10.6 µm | 12.8 deg | 0.40% |

## LENSLET ARRAYS

A set of small spherical, aspherical or cylindrical lenses on s a single substrate is called a lenslet array. It is used for focusing and sampling as well as for diffusing of light. The Diffractive lenslet arrays we offer have the advantage of a fill factor of 100%, and a diffraction limited focal spot size. We also have the flexibility to design each of the lens-elements independenly from its neighbor.





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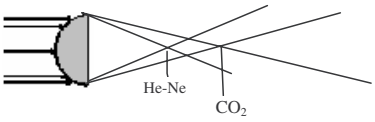
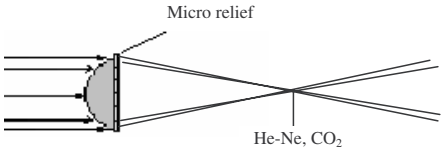
## DUAL WAVELENGTH LENS

The dual wavelength beam combiners are diffractive optical elements used to bring two incident beams with different wavelengths into the same focal point.



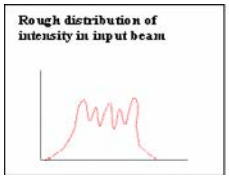

Performance of regular ZnSe lens in dual-wavelength beam of $CO_2$ and HeNe lasers

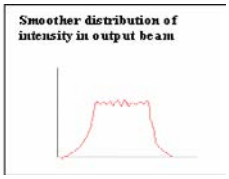



Performance of diffractive-refractive ZnSe lens in dual-wavelength beam of $CO_2$ and HeNe lasers

## HOMOGENIZERS

Unlike competing designs, Holo-Or's Diffractive Homogenizers consist of pure fused silica with an optional high power AR V-Coating on both surfaces. This can reduce the back reflection to 0.2% (0.1% per surface) depending on the coating grade ordered. Back reflection usually hinders the stable operation of the laser and should therefore be reduced to a minimum, as in this design.




| Part number | Full Diffusing angle | Wavelength | Part number | Full Diffusing angle | Wavelength |
|---|---|---|---|---|---|
| DF-106 | $0.5^0$ | 1064nm | DF-035 | $0.17^0$ | 355nm |
| DF-075 | $0.35^0$ | 755nm | DF-026 | $0.125^0$ | 266nm |
| DF-069 | $0.33^0$ | 694nm | DF-024 | $0.12^0$ | 248nm |
| DF-053 | $0.25^0$ | 532nm | DF-019 | $0.09^0$ | 193nm |

### *General specifications for All Diffractive Optical Elements*

- *Mounting:* unmounted
- *Wavelengths:* UV, visible, near IR, far IR
- *Materials:* ZnSe, Ge, Si, fused silica, PMMA
- *Power handling:* up to 3 kW
- *Coating:* AR/AR
- *Substrate:* window or lens
- *Number of output beams:* up to 100
- *Efficiency:* up to 98%

### *Special effects in lenses*

- Off-axis sharp focusing
- Introduction of a custom spherical aberration
- Chromatic correction
- Control of the shape of focal spot
- Longer depth of focus ( "Easy-F")
- Double(multiple) - spot focus

***We can customize, material, wavelength, diameter, beam size, working distance, central thickness, and other special effects***

***Ask for our***

- ***Standard Element leaflet that lists more designs and more details on them.***
- ***Tailored Optics datasheet to get a better feeling of how close we can approach your ideal optical function within one optical surface.***



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