Driver Software and Application Software
All HOLOEYE Spatial Light Modulators are controlled by a HOLOEYE driver software which runs on all Windows platforms. This software gives the opportunity to control all relevant image parameters and provides a very easy gamma control to configure the Spatial Light Modulator for different applications and wavelengths. Furthermore, a tailored Spatial Light Modulator application software allows the simple generation of diverse dynamic optical functions like gratings, lenses, axicons and apertures as well as the calculation of diffractive optical elements (DOE) from user defined images.

Spatial Light Modulator Applications
- Display Application
- Imaging & Projection
- Beam Splitting
- Laser Beam Shaping
- Coherent Wavefront Modulation
- Phase Shifting
- Optical Tweezers
- Holographic Projection
- Laser Pulse Modulation

Application fields range from bio-photonics, optical metrology, holography, optical interconnection such as switching and information encoding, interferometry to material processing.

HOLOEYE Photonics AG
Albert-Einstein-Str. 14
12489 Berlin, Germany
Phone +49 (0)30 63 92 36 60
Fax +49 (0)30 63 92 36 62
contact@holoeye.com
www.holoeye.com

HOLOEYE’s Spatial Light Modulator (SLM) systems are based on translucent or reflective liquid crystal microdisplays. These devices can modulate light spatially in amplitude and phase, so they act as a dynamic optical element. The optical function or information to be displayed can be taken directly from the optic design software or an image source and can be transferred by a computer interface. Implementation is accomplished using the VGA or DVI port of a standard PC graphics card. The SLM can be used just like an external plug & play monitor. In many cases no additional optics are necessary. The SLM can be incorporated in existing optical setups and devices. To guarantee the best performance, optical characterization measurements (e.g. phase modulation) are performed by HOLOEYE for each individual device.

Pioneers in Photonic Technology
LCOS Phase Modulators (Diffraction Applications):
Optical Tweezers - Holographic Projection - Interferometry - Wavefront / Pulse Modulation

HEO 1080 P: High Efficient Phase Only Modulator
The HEO 1080 P Phase Only Modulator is based on a reflective LCoS microdisplay with 1920 x 1080 pixel resolution. Due to the ECB (Electrically Controlled Birefringence) LC mode the phase panels provide a phase shift of $2\pi$ up to the near infrared region. Currently there are two versions available, optimized for the wavelength ranges 420 nm - 810 nm and 800 nm - 1100 nm. The hardware of this device is completely OEM capable.

<table>
<thead>
<tr>
<th>Display Type</th>
<th>Resolution</th>
<th>Pixel Pitch</th>
<th>Fill Factor</th>
<th>Adressing</th>
<th>Frame Rate</th>
<th>Signal Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reflective LCoS</td>
<td>1920 x 1080 Pixel</td>
<td>8.0 µm</td>
<td>92 %</td>
<td>8 Bit</td>
<td>60 Hz</td>
<td>DVI - HDTV Res.</td>
</tr>
</tbody>
</table>

Special Optical Features
+ Phase Only Modulation
+ $2\pi$ Phase Shift up to 1064 nm
+ 8.0 µm Small Pixel Size
+ Extended Wavelengths: up to 1550 nm
+ High Light Efficiency / High Fill Factor

LC-R 2500: Allround Spatial Light Modulator
The LC-R 2500 Spatial Light Modulator is based on a reflective LCoS microdisplay with a resolution of 1024 x 768 pixel. The advantages of the LC-R 2500 are the good phase shifting properties in the visible. Depending on the input polarisation, this spatial light modulator can be used for both, amplitude or phase modulation.

<table>
<thead>
<tr>
<th>Display Type</th>
<th>Resolution</th>
<th>Pixel Pitch</th>
<th>Fill Factor</th>
<th>Adressing</th>
<th>Frame Rate</th>
<th>Signal Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reflective LCoS</td>
<td>1024 x 768 Pixel</td>
<td>19 µm</td>
<td>93 %</td>
<td>8 Bit</td>
<td>72 Hz</td>
<td>DVI - XGA Res.</td>
</tr>
</tbody>
</table>

Special Optical Features
+ Amplitude or Phase Modulation
+ $2\pi$ Phase Shift between 400 and 700 nm
+ Intensity Ratio of 1000:1 @ 532 nm Coherent Light Source


**LC-R 1080: High Contrast Spatial Light Modulator**

The LC-R 1080 Spatial Light Modulator is based on a reflective LCoS microdisplay with a resolution of 1920 x 1200 pixels. Due to the high image frame rate of 180 Hz and the very small pixel pitch of only 8.1 µm, the LC-R 1080 offers incredible intensity ratios even for IR wavelengths. The hardware of this device is completely OEM capable.

**Special Optical Features**

- Amplitude or Phase Modulation
- High Contrast
- 1.2 π Phase Shift in the Visible
- Intensity Ratio of 2000:1 @ 633 nm Coherent Light Source
- Fully Analog Driven

This device is also available with 1280 x 768 pixel (WXGA) resolution and 12 µm pixel pitch. (LC-R 768)

---

**LC-R 720: High Speed Spatial Light Modulator**

The LC-R 720 Spatial Light Modulator is based on a reflective LCoS microdisplay with a resolution of 1280 x 768 pixels. Due to the high image frame rate of 180 Hz and the short response time (< 3 ms), the LC-R 720 Spatial Light Modulator is designed for high speed applications such as one panel color sequential projection.

**Special Optical Features**

- Amplitude or Phase Modulation
- 180 Hz Frame Rate
- Above 1 π Phase Shift (in the Visible)
- Intensity Ratio of 1000:1 Typical
- Phase Only Modulation Mode
- High Light Efficiency / High Fill Factor
- Response Time < 3 ms
- Trigger Sync

---

**Display Type** | **Resolution** | **Pixel Pitch** | **Fill Factor** | **Adressing** | **Frame Rate** | **Signal Format**
--- | --- | --- | --- | --- | --- | ---
Reflective LCoS | 1920 x 1200 Pixel | 8.1 µm | 90 % | 8 Bit | 60 Hz | DVI - WUXGA Res.

<table>
<thead>
<tr>
<th>Display Type</th>
<th>Resolution</th>
<th>Pixel Pitch</th>
<th>Fill Factor</th>
<th>Adressing</th>
<th>Frame Rate</th>
<th>Signal Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reflective LCoS</td>
<td>1280 x 768 Pixel</td>
<td>20 µm</td>
<td>92 %</td>
<td>8 Bit</td>
<td>Up to 180 Hz</td>
<td>DVI - WXGA Res.</td>
</tr>
</tbody>
</table>
Translucent LC Spatial Light Modulators: Easy to implement (for use in various phase and amplitude applications)

LC 2002 Translucent Spatial Light Modulator
The LC 2002 is an easy-to-use Spatial Light Modulator system based on a translucent liquid crystal microdisplay with a max. resolution of 800 x 600 pixel. It can be used for phase and amplitude modulation. The compact design and the transmissive display make implementation into your setup very easy. Versions with higher resolution (e.g. XGA) are available on board level.

Special Optical Features
+ Amplitude or Phase Modulation
+ $2 \pi$ Phase Shift @ 532 nm
+ Intensity Ratio of 1000:1 @ 633 nm Coherent Light Source
+ Translucent

<table>
<thead>
<tr>
<th>Display Type</th>
<th>Resolution</th>
<th>Pixel Pitch</th>
<th>Fill Factor</th>
<th>Adressing</th>
<th>Frame Rate</th>
<th>Signal Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>Translucent LC</td>
<td>800 x 600 Pixel</td>
<td>32 µm</td>
<td>85 %</td>
<td>8 Bit</td>
<td>60 Hz</td>
<td>VGA, SVGA Res.</td>
</tr>
</tbody>
</table>

OptiXplorer Flexible Education Kit:

The OptiXplorer is an educational kit that provides a variety of experiments for both introductory and advanced laboratory courses in optical physics. The primary component of the OptiXplorer is a HOLOEYE spatial light modulator (SLM), which is based on a translucent SVGA LC display.

The SLM in combination with several detailed tutorials, an easy to use application software, and a laser module are included with OptiXplorer, thus creating a powerful, low-cost, educational tool that enables the demonstration and active exploration of a wide range of optical phenomena.

The tutorial covers a theoretical part and a description of selected experiments, e.g. amplitude modulation in projection set-ups, polarization properties, LCD characterisation, diffractive optics elements, dynamic diffraction, spatial filtering and phase modulation in a Mach-Zehnder-interferometer. Each of the five parts of the tutorial contains a section about didactic intention, required components, set-up details, a questionary, and keywords for preparation. The OptiXplorer is available as BASIC and as ADVANCED version.

Experiment Topics
+ Projection
  + Amplitude modulation / contrast ratio
  + Polarisation properties
  + Display characterisation
+ Diffractive optics
  + Phase modulation
  + Diffraction properties / diffraction efficiency
  + dynamic diffraction structures
+ Spatial frequency filtering
  + High- and low pass filtering
+ Interferometry

Parts Contained in the OptiXplorer Kit
+ LC-Display modulator with opto-mechanical mount
+ Theoretical & experimental tutorial
+ Application software
+ Laser module with beam expanding telescope and opto-mechanical mount
+ Cable set

Additional Components in Advanced Version:
+ 2 Rotary polarizers
+ 1 Mounting rail
+ 4 Posts, post holders and carriers