Programmable Liquid-Crystal Light Projector – LC-PROJ

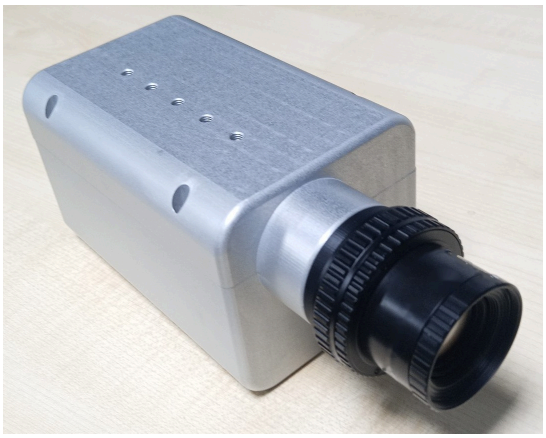
FEATURES

Spatially shaped, reconfigurable and factory-calibrated LED light source.

Python interface included, ready for AI workflows and closed-loop systems.

Intensity modulation provided by an integrated liquid-crystal spatial light modulator (SLM), with a calibrated linear response: the output intensity is proportional to the gray level of the image.

Optical power and wavelength (420 – 890 nm, or white light) customizable depending on the application. Working distance customizable from a few centimetres.



APPLICATIONS

- **Optical addressing:** writing-light patterns for optically addressed light valves (OASLM) and other photosensitive devices
- **Maskless exposure:** grayscale photopolymerization and lithography of photopolymers, resists and hydrogels
- **Photo-alignment:** patterned, linearly polarized exposure of alignment layers
- **Structured illumination:** patterned light for microscopy, photostimulation and photobleaching
- **Metrology and machine vision:** fringe projection, 3D profilometry, calibrated test patterns for cameras and sensors
- **Optical computing:** programmable intensity inputs for optical neural networks, driven in closed loop from Python
- **Education:** imaging, diffraction and Fourier-optics experiments

DESCRIPTION

LC-PROJ is a reconfigurable light projector specifically developed for the needs of shaped-light applications and, in general, lighting applications.

The output light is amplitude modulated by an integrated liquid-crystal spatial light modulator, which gives real, calibrated grey levels of the light intensity: no gamma correction and no user calibration are needed.

The output light spot is arbitrarily shaped on its transverse section. At the standard magnification of 3.8× it has a diameter of 35 mm, with 1080 pixels over it.

An HDMI port is used for communication: the computer sees the LC-PROJ as a second monitor. The included control software (Linux, Windows, macOS) displays images, videos or live frames computed in Python on the LC-PROJ.

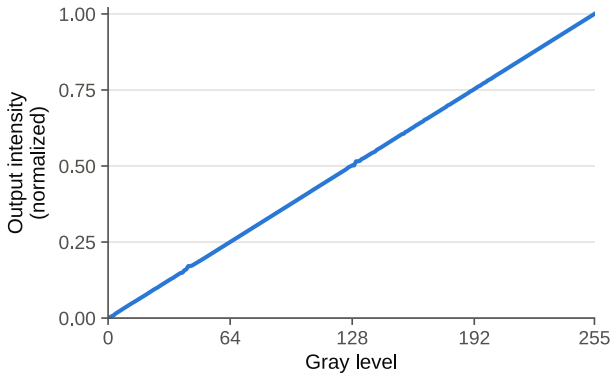
Common properties

- SLM panel 1920 × 1080 pixels, pitch 8.5 µm
- Magnification 0.6× to 7.5× (standard 3.8×)
- Output spot size 35 mm at 3.8×
- Linearly polarized output (vertical)
- Response time 15 ms, contrast 500:1
- Calibrated linear intensity response
- Dimensions 156 mm × 100 mm × 95 mm
- Weight 1.57 kg
- Power supply 19 – 24 V DC

FACTORY-CALIBRATED LINEAR RESPONSE

Each LC-PROJ is individually calibrated at its operating wavelength before shipment: a look-up table stored in the projector makes the output intensity proportional to the gray level of the image (0 – 255). The calibration is permanent and transparent to the user.

Deviation from linearity below 1 % of full scale (typically 0.1 % rms).

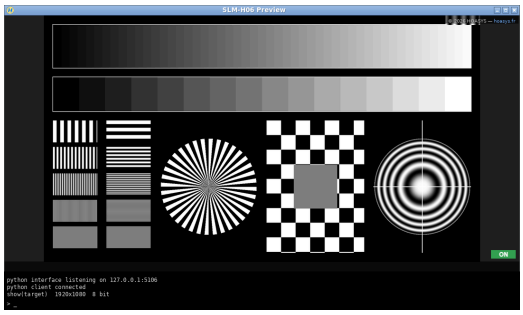


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CONTROL SOFTWARE

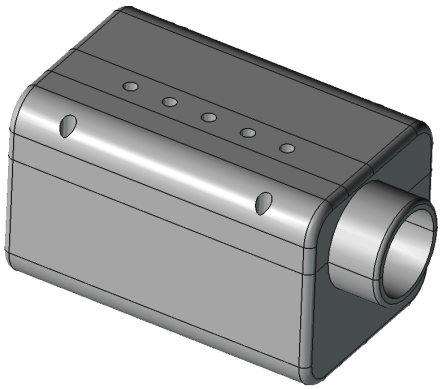
Reconfigurable intensity masks are displayed from a live preview window with a built-in command console (zoom, rotation, shift, gain, regions of interest).

Python client included: a NumPy array is projected in real time with a single line of code, `slm.show(image)`. The LC-PROJ thus plugs naturally into scientific Python and AI workflows, where the patterns are computed by machine-learning models or by an AI assistant.



MECHANICAL DRAWING

Power supply (19 – 24 V DC)
HDMI port



156 mm × 100 mm × 95 mm (without output optics)
Weight 1.57 kg

PROJECTED IMAGE



Text projected with one-pixel-wide lines at 532 nm and 0.68× magnification, recorded directly on a camera sensor.
Line width 5.8 µm.

CHARACTERISTICS

Item	LC-PROJ
SLM panel resolution	1920 × 1080 (Full HD)
SLM panel pixel pitch	8.5 µm
Frame rate	60 Hz
Response time	15 ms
Contrast ratio	500:1
Bit depth	8 bit (gray levels 0 – 255)
Intensity response	Factory calibrated, linear in gray level (deviation < 1 % of full scale)
Light source	LED, single wavelength (420 – 890 nm) or white light, on request
Magnification	3.8× standard, 0.6× to 7.5× on request
Output	35 mm spot at 3.8×
Light polarization	Linear (vertical)
PC connection	HDMI
Power supply	19 – 24 V DC
Dimensions (without output optics)	156 mm × 100 mm × 95 mm
Weight	1.57 kg