SLM Developer System

Liquid Crystal Spatial Light Modulator and dual head PC system for smart optics developers

Modulator Features

- High spatial resolution - SXGA *(1280 x 1024 pixels)*
- Very high fill factor (93%)
- Ferroelectric Liquid Crystal on Silicon (FLCOS) technology
- Fast frame rate (kHz)
- Configurable for binary amplitude or phase modulation
- *PURE* binary phase modulation
- Separate interface electronics with flexible connecting cable
- Lightweight and portable SLM module

System Features

- PC with Linux operating system, pre-installed and configured
- Dual head video card
- Separate PC monitor and SLM control
- Digital Video Interface (DVI)
- 'C' programming environment
- Includes 'C' compiler
- Programs available for dual head operation with source code
- Re-configurable / programmable diffraction patterns
- Custom Addressing Sequences

Applications

- Optical Correlators
- Printing
- Laser beam steering
- Materials processing
- Micro-machining
- Optical Tweezers
- Optical Metrology
- Adaptive & Diffractive Optics
- Re-configurable Holograms
- Holographic displays
- Medical imaging
- Microscopy
- Ophthalmic Equipment
- Real-time beam shaping
- Wave front manipulation
- Free-space optical switching (telecomms)

Description

The SLM Developer System provides a versatile means of incorporating a spatial light modulator (SLM) in to a variety of applications. The kit can be used to provide amplitude modulation, for example in printing, or phase modulation, say in beam steering. In non-display applications needing a controllable diffractive optical element, CRL Opto's proprietary FLC based technology is uniquely suited as it can be configured to give pure binary phase modulation without any amplitude artefacts. The fast switching FLC enables applications where speed is important; the compact SLM module allows easy positioning of this high-resolution device where space is limited.

A time saving and cost effective solution, the SLM Developer System is supplied to end-users as an instant plug and play unit, designed to significantly reduce integration time. A dual head system allows the user to run control software on the PC and to easily manage the fast data flow to the SLM through the second video interface; importantly, the control interface is displayed on the monitor screen independently of the data image supplied to the slave SLM. The PC is Linux based, as this operating system is well suited to running two independent video channels and avoids the problems often associated with other operating systems. Example dual head programs and source code are provided to allow users to develop their own systems.

General Configuration

The SLM Developer's kit consists of a plug and play solution. A PC that is connected to a monitor and a set of interface electronics; the interface electronics drive down a cable to an LVDS receiver that is connected to the SLM by a short flexi connector. The SLM can be mounted on a mechanical mount for fixing and alignment.

The system configuration is shown below.
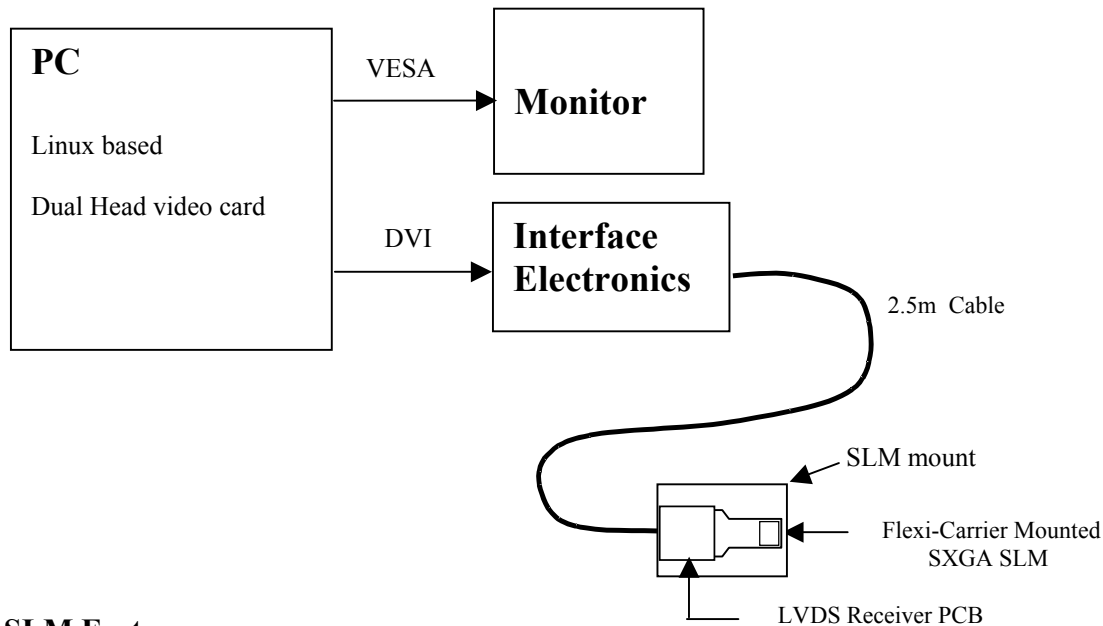
SLM Features

The SLM is a digital Liquid Crystal On Silicon (LCOS) device based on a 0.3um CMOS process. The silicon backplane forms a 1280 × 1024 active pixel plane for the LCD. The liquid crystal cell is constructed on top of the backplane using fast switching Ferroelectric LC with a sub micron cell gap.

The SLM is mounted on a flexi-rigid circuit and driven by a small LVDS Receiver (Rxr) PCB. The SLM module and LVDS Rxr PCB are connected to the main interface electronics via a 2.5m connecting cable.
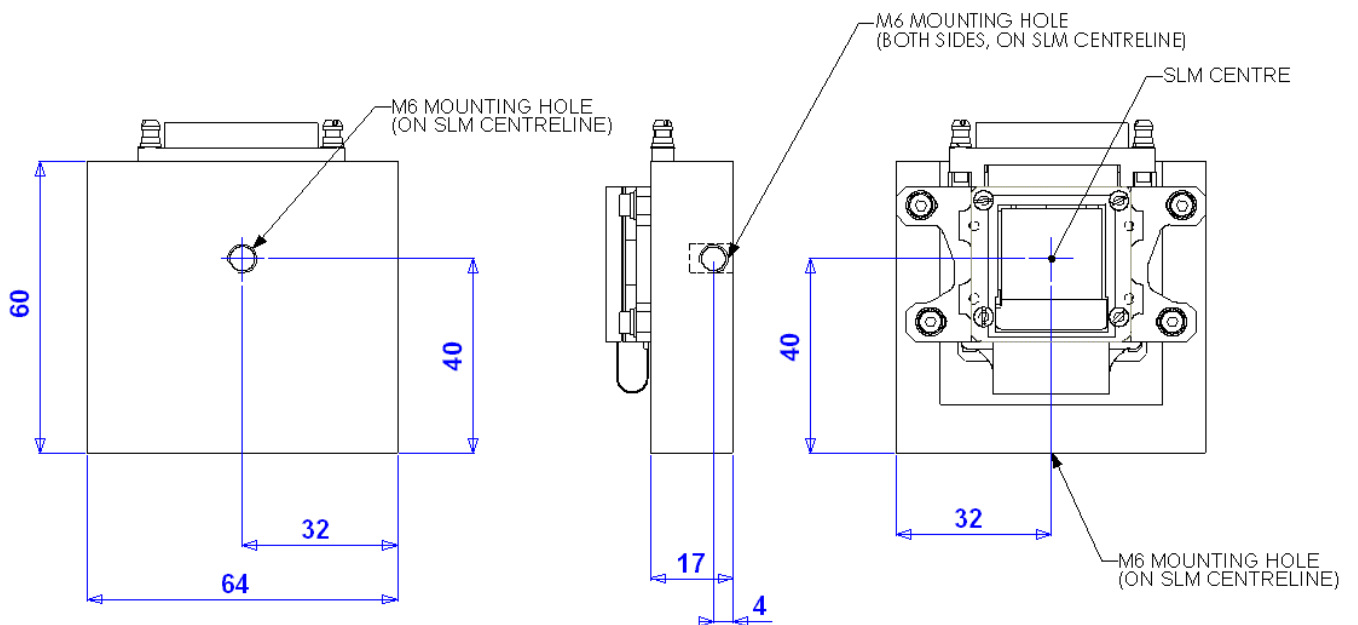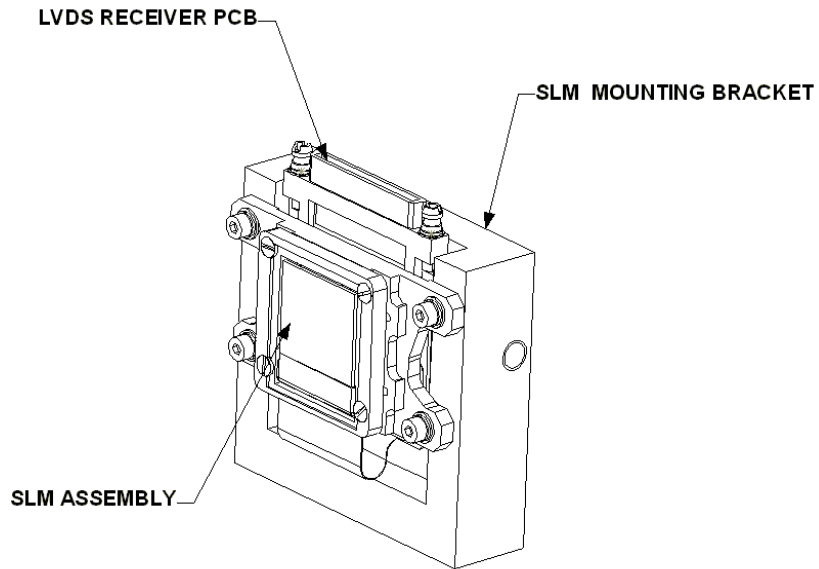
The main interface electronics accepts SXGA VESA standard graphics input in DVI formats and generates the addressing sequence and control signals for the SLM. Binary input images can be supplied as single bit colour or as pre-formatted 24-bit colour frames. The data for the SLM is transmitted to the LVDS Rxr PCB via the 2.5m connecting cable

The PC is supplied with Control software (including C source code) that provides a Graphical User Interface (GUI), allowing the user to control the current image on the SLM in one window, whilst controlling other aspects of the system from other windows. The user is also able to access SLM configuration data in the interface electronics, to change addressing sequences and to flip the image horizontally/vertically through a configuration utility.
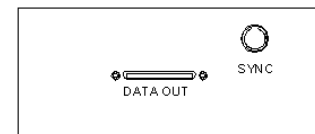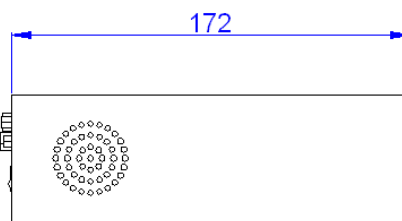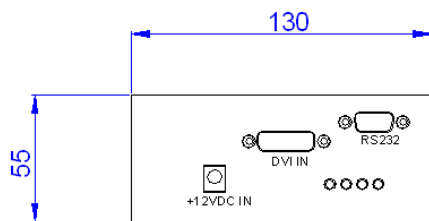
On starting up an icon on the desktop, the computer will cycle through some pre-prepared diffractive gratings. A second version of this software allows the user to display or cycle through images that they create and save in the standard portable bitmap format. We will provide the source code for these programs, and the compilers and libraries that will allow the user to adapt the code for their own requirements. Also provided are other sample programs that address the SLM directly from a C program (for example calculating a grating that will steer a beam to a specified position).

CRL Opto also offers custom development of addressing sequences for specific applications.

1. SXGA SLM Module and LVDS Receiver PCB

LVDS RECEIVER PCB

SLM MOUNTING BRACKET

SLM ASSEMBLY

M6 MOUNTING HOLE
(ON SLM CENTRELINE)

60

40

32

64

M6 MOUNTING HOLE
(BOTH SIDES, ON SLM CENTRELINE)

SLM CENTRE

40

32

17

4

M6 MOUNTING HOLE
(ON SLM CENTRELINE)

For further information please contact the CRL Opto Limited Sales department
Tel: +44 (0) 20 8848 6421   Fax: +44 (0) 20 8848 6653   Email: sales@crlopto.com   http://www.crlopto.com

2. SLM Electronics Unit
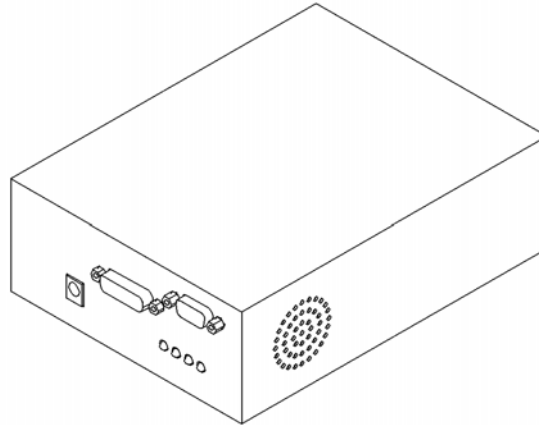
SLM and Interface Electronics Specification

SLM	
Type	FLCOS, reflective mode
Spatial resolution	1280 (H) by 1024 (V) pixels
Active area	17.43mm (H) x 13.95mm (V)
Pixel pitch	13.62μm (H) x 13.62μm (V)
Fill factor / Aperture Ratio	93%
Reflectivity (amplitude modulation)	>70% (including backplane, ITO and cover glass losses)
Optical efficiency (phase modulation)	>10% in to combined first diffractive orders in visible Enhanced efficiency and custom wavelengths available.
Modulation mode	Binary amplitude OR binary phase (0 or π)
Operating temperature range	+10°C to +60°C
Storage temperature range	-40°C to +85°C
Interface Electronics	
Input format	Digital (DVI) VESA standard graphics, SXGA 60Hz
SLM cable	Low voltage differential signalling cable (LVDS). Light weight, flexible cable, 2.5m long (standard). Shorter or longer custom cables are available on request.
Repetition rate	Up to 1440 Hz
Interface Module dimensions	Approx. 170mm x 130mm x 55mm

Specification of PC and Control Software

PC	
Make/Model	Up to date PC from major manufacturer. >250kb RAM, >20Gb hard disc capacity, flat screen monitor
Graphics Card	Compatible Dual head video card (SXGA 60Hz)
Supply voltage range	120-240V
Optional Outputs	Synchronisation signal from interface box
Software	
Operating System	Linux (Mandrake 8.2 or later version)
Control software	OpenGL based, gcc compiler
SLM config utility (SXProg)	GUI software provides control Image flip (left-right and top-bottom invert) and a soft system reset. The GUI also enables different SLM display sequences to be loaded up and updates of ASIC (SLM driver) microcode to be installed.

Product Ordering

To place an order please quote:

Product Configuration

SLM Developer System consisting of :

A mounting bracket; 1 off SXGA resolution reflective SLM; LVDS Receiver PCB; connected via 2.5m LVDS cable to Interface Electronics module; PC with dual head video card, installed with Linux operating system; C based control software and SLM configuration utility, programming pack, example dual head programs, source code, and User's Manual on CD ROM.

Optional Accessories

CRLCMAX Mains cable - USA
CRLCMOX Mains cable – UK
CRLCMEX Mains cable - Europe
      Custom lengths of LVDS connecting cable between 0.5 and 5 metres
      Custom wavelength and diffraction efficiency optimisation
      Standard 6 mm or ¼" mounting posts to allow easy mounting into existing optical systems

If you wish more information, including further advice on how to use our SLMs in your application, please visit our web site **http://www.crlopto.com** or contact CRL Opto directly: sales@crlopto.com

For further information please contact the CRL Opto Limited Sales department
Tel: +44 (0) 20 8848 6400 Fax: +44 (0) 20 8848 6653 Email: sales@crlopto.com Http://www.crlopto.com