Phase Only Spatial Light Modulators

The PLUTO phase modulator models are based on reflective LCOS microdisplays with 1920 x 1080 pixel resolution and a small 8.0 µm pixel pitch and are optimized to provide a phase shift above 2 π up to 1550 nm. The devices are packaged in an very small housing to ensure an easy integration into optical setups and applications. The PLUTO phase modulator series comprises 6 versions, optimized for the visible, a broad wavelength band centered at 850 nm, a version specialized for the near infrared around 1064 nm and a version optimized for typical telecommunication wavelength around 1550 nm (C-Band). Furthermore 2 high retardance display panels are available (visible and broadband 400-1100 nm) which enable a modulo 4 Pi or 6 Pi encoding of optical functions depending on the wavelength. Applications range from holography, lithography, optical metrology, interferometry, optical tweezers, wave front corrections to phase shifting applications. The high fill factor of the display also ensures a high light efficiency.

PLUTO displays show a reflectivity of approx. 60% and diffraction efficiencies of more than 80%. Thereby a total light efficiency of more than 50% per addressable diffractive device is possible. The driving of the PLUTO devices is as easy as with all HOLOEYE Spatial Light Modulators. A HDTV graphics card is sending HDTV resolution images to the device (via DVI) with a frame rate of 60 Hz. The Pluto Modulators are easily addressed as an external monitor.

PLUTO – Optimized for different Wavelengths Ranges

PLUTO-VIS:
This version is optimized for the visible because of a broadband AR (anti reflection) coating for this spectral range.

PLUTO-NIR:
This version is optimized for the near infrared around 1064 nm with an AR coating for 1064 nm and a thicker LC layer.

PLUTO-BB (PLUTO-NIR-II):
This version is usable for a broad wavelength band around 850 nm and due to a broadband AR coating in the lower visible.

PLUTO-TELCO:
This version is optimized for common telecommunication wavelengths ranges around 1550 nm.

Special Optical Features
- Reflective LCOS Microdisplay
- Phase Only Modulation
- 2 π Phase Shift up to 1550 nm
- 8.0 µm Small Pixel Size

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PLUTO Spatial Light Modulator – Microdisplay Features
Display Type: Reflective LCOS (Phase Only)
Resolution: 1920 x 1080
Pixel Pitch: 8.0 µm
Fill Factor: 87 %
Active Area: 15.36 x 8.64 mm (0.7” Diagonal)
Addressing: 8 Bit (256 Grey Levels)
Signal Formats: DVI – HDTV Resolution
Frame Rate: 60 Hz
PLUTO-VIS-HR and PLUTO-BB-HR (High Retardance SLM Display Versions):
HOLOEYE developed two new phase only panels (PLUTO-VIS-HR and PLUTO-BB-HR version) which show a considerably higher phase retardation compared to the standard panels which enables mod 4 Pi or even mod 6 Pi phase functions to be addressed. This can be beneficial for wave front functions as this enables higher slopes and can reduce transition points in the addressed function compared to mod 2 Pi encoding.

For some applications a stable phase response is required. This can be accomplished driving the High Retardance panels with adapted settings for 2π phase retardation, however compromising the response time. The driving forces to the LC molecules in such a configuration are reduced and the phase signal typically shows a standard deviation of 0.2-0.7% (wavelength dependent).

Due to the high programmability of the drive electronics the same SLM can be adapted for different requirements.
- PLUTO-VIS-HR: High retardance version for the visible (high phase shift, low phase fluctuations)
- PLUTO-BB-HR: High retardance version for a broad wavelength band 400-1100 nm (high phase shift, low phase fluctuations)

PLUTO Spatial Light Modulator Kit – Contents:

**PLUTO Spatial Light Modulator – Scope of Supply**
- PLUTO SLM Driver Box
- Phase Only Display incl. Flex Cable (1920 x 1080 Pixel)
- DVI-cable & DVI/HDMI-adaptor
- Serial Port Cable (RS232)
- Power Supply (6V DC, 3A)
- Display Mount
- Device Mount
- Operating Instruction / Manual
- Data Medium (CD or USB Flash Drive) with Manual, User Software and Application Software and PLUTO Software Package

**Driver Dimensions (Unit: mm):**

![Driver Dimensions Diagram]

**Display Dimensions (Unit: mm):**

![Display Dimensions Diagram]