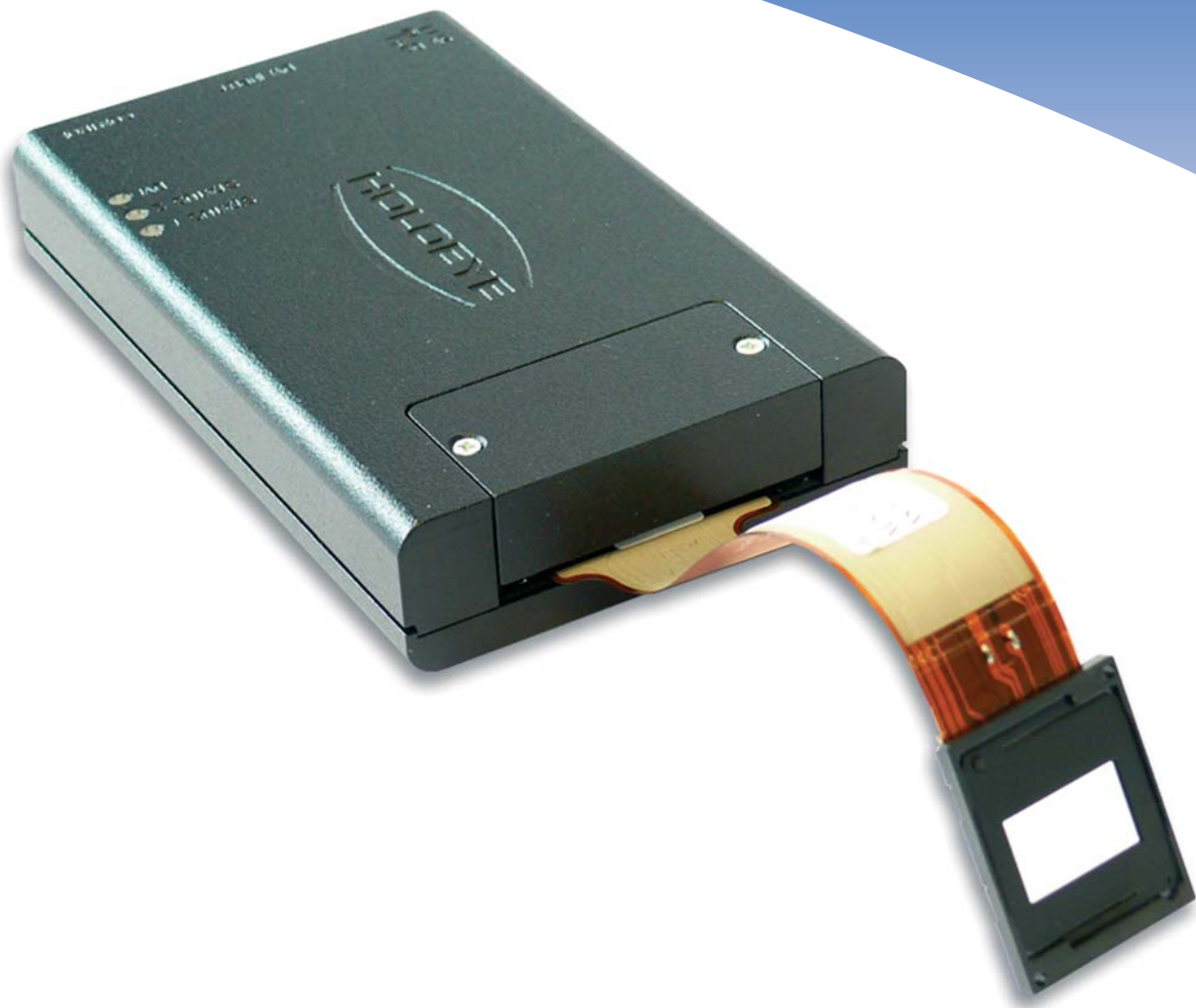


# PLUTO-NIRO

Phase Only SLM: 1100 - 1400 nm



**Pioneers in Photonic Technology**



## PLUTO - 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  $\mu\text{m}$  pixel pitch. The PLUTO phase modulator series covers different versions optimized for different applications and wavelength ranges.

Display Type	Reflective LCOS
Resolution	1920 x 1080 Pixel
Pixel Pitch	8.0 $\mu\text{m}$
Fill Factor	87 % - 93 %
Max. Spatial Resolution	62.5 lp/mm
Addressing Bit Depth	8 Bit
Signal Format	DVI - HDTV Res.
Input Frame Rate	60 Hz

### Plug&Play and Flexible Calibration

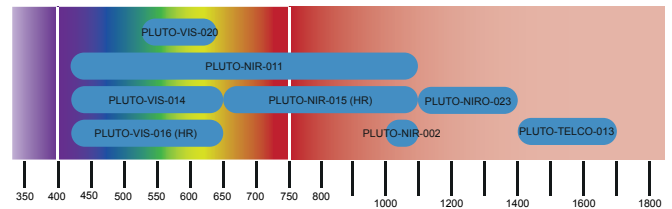
The PLUTO SLM is a plug & play phase modulator and can be addressed with phase functions via standard graphics cards as extended monitor device. The green color channel of the video signal is used for addressing 8 bit gray level patterns. Addressing can be done using the supplied "Application Software" or standard image viewer software.

A certain gray level represents a defined average voltage across the LC cell. This voltage leads to a variable tilt of the LC molecules due to their electrical anisotropy. As LC molecules also show optical anisotropy this tilt changes the refractive index of the LC molecules (for incident polarization along the long display axis) which causes a modified optical path length within the LC cell and the addressed gray level is converted into a phase level.

The PLUTO driver unit is equipped with a RS 232/USB interface that allows changing the voltage vs. gray level distribution (gamma control) and dynamic range (voltage across the LC cell) in order to calibrate the SLM for different wavelengths.



## Available PLUTO SLM Versions



Device	$\lambda$ Range	Fill Factor	Maximum Phase	Average Reflectivity
PLUTO-VIS-014	420-650 nm	93 %	$2.7 \pi$ @ 633 nm	65 %
PLUTO-VIS-016	420-650 nm	93 %	$5.4 \pi$ @ 633 nm	65 %
PLUTO-VIS-020	530-640 nm	93 %	$8.2 \pi$ @ 532 nm	74 - 80 %
PLUTO-NIR-011	420-1100 nm	93 %	$2.0 \pi$ @ 1064nm	65 - 75 %
PLUTO-NIR-015	650-1100 nm	93 %	$3.7 \pi$ @ 1064 nm	65 - 75 %
PLUTO-NIR-002	1000-1100 nm	87 %	$2.0 \pi$ @ 1064 nm	62 %
PLUTO-NIRO-023	1100-1400 nm	93 %	$4.1 \pi$ @ 1300 nm	74 %
PLUTO-TELCO-013	1400-1700 nm	93 %	$3.5 \pi$ @ 1550 nm	80 %

### New PLUTO Version for 1300 nm Range

The new PLUTO-NIRO-023 version features an AR coating



which assures a front reflection of less than 0.2% between 1100 and 1400nm. The display enables  $2 \pi$  phase retardation up to 1400nm. The device offers a high fill factor of 93% and a reflectivity of 74 % at 1300 nm.

The PLUTO-NIRO-023 also provides a phase shift up to  $4 \pi$  at 1300 nm.

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Wavelength	Maximum Phase Shift	Average Reflectivity
1300 nm	$4.1 \pi$	74 %

### Stable Phase Response

The pulse code modulation for digitally addressed devices leads to a slight superimposed phase flicker. For some applications a stable phase response is required. This can be accomplished driving the panels with low voltage settings for  $2 \pi$  phase retardation, however compromising the response time. In the table below we show the flicker value (standard deviation) and response time (rise + fall time) for a linearized  $2 \pi$  configuration at 1300 nm.

Device	Max. Phase Shift @ 1300 nm	Flicker (Standard Deviation) $2 \pi$ @ 1300 nm*	Response Time $2 \pi$ @ 1300 nm* (Rise + Fall Time)
PLUTO-NIRO-023	$4.1 \pi$	0.01 $\pi$	25ms+147ms

\* Measurements performed at room temperature

