Spatial Light Modulator – 512 x 512

Meadowlark Optics Liquid Crystal on Silicon (LCoS) Spatial Light Modulators (SLMs) are uniquely designed for pure phase applications and incorporate analog data addressing with high refresh rates. This combination provides user's with the fastest response times and highest phase stabilities commercially available. Meadowlark offers both transmissive and reflective SLMs in either one or two dimensions. Phase-only SLMs can also be used for amplitude-only or a combination of both.

The 512 x 512 SLM is good for applications requiring high speed, with synchronization / triggering capabilities. The optional dielectric mirror coating provides users with 100% fill factor, which increases optical efficiency.

Unique Features:

- High speed
- Pure analog phase control
- High bit-depth controllers (high phase resolution)
- High reflectivity option
- High power handling
- Synchronization / Triggering
- Wavelengths from 400 – 1650 nm


DVI 16-bit

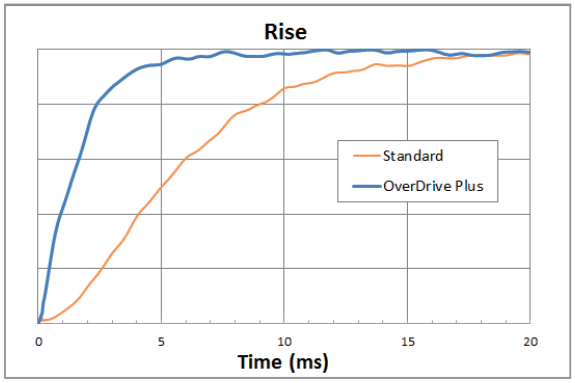

PCIe 8-bit

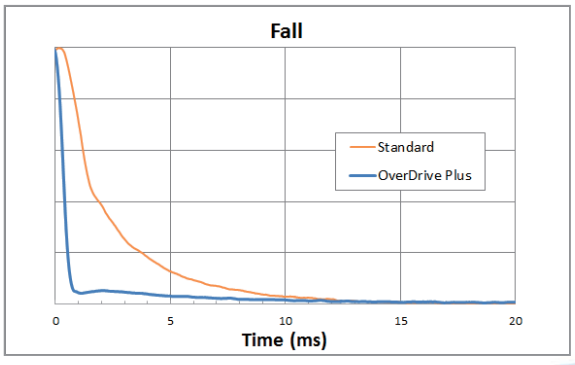

PCIe 16-bit

OverDrive Plus (ODP) for Ultra-High Speed Operation

– The use of ODP has shown reductions of the liquid crystal response times by a factor of up to 8x through use of the transient nematic effect, phase wrapping, and regional calibrations. The base technology is the transient nematic effect, utilizing intermediate transition voltages beyond the target voltage needed to achieve the desired phase value. The second technology development is the use of phase wrapping, which is based on the cyclical nature of light wherein adding or subtracting 2π from any phase value in a hologram results in an equivalent hologram. Often times it is faster to switch from φ1 → φ2 ± 2π instead of switching from φ1 → φ2. ODP automatically implements the faster of the two transitions, based on the calibration data. The third technology development is the utilization of regional calibrations of an SLM. Because most optical applications require precision on the order of a fraction of a wavelength, nearly all SLMs will have some inherent phase errors across the aperture that may impact the performance of the optical system. OverDrive Plus utilizes the phase modulation capabilities of the SLM to calibrate these errors out of the reflected wave, while also utilizing the regional calibrations when determining the length of time required for the transient nematic effect on a pixel by pixel basis.

OverDrive Plus for Ultra-High Speed modulation





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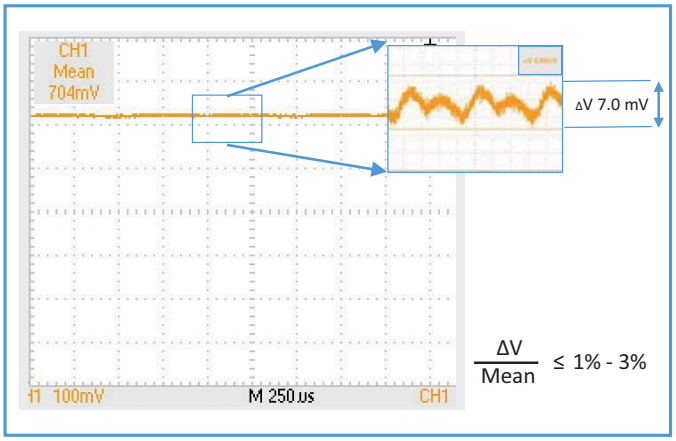
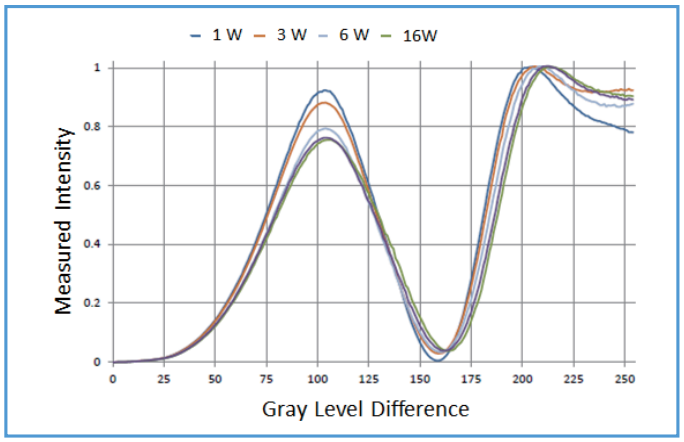
Low Phase Ripple - Meadowlark Optics' Spatial Light Modulators are known for having the highest phase stability on the market. Our backplanes are custom designed with high refresh rates and direct analog drive schemes resulting in phase ripple less than 1% - 3% (depending on SLM model). Phase ripple is quantified by measuring the 1st order ripple as compared to the mean intensity while writing a repeating linear phase ramp to the SLM.

1st order intensity when writing a phase ramp to the SLM



High Power Capability - Meadowlark Optics' Spatial Light Modulators have been tested for compatibility with high power pulsed and CW lasers*. In the measurements below, the optical response of the 512 x 512 pixel SLM was measured as the incident power was incremented up to a peak power density of 112 MW/cm^2. Thermal effects resulted in a reversible reduction in modulation depth, however no permanent damage was observed.

512 x 512 SLM tested at 1064 nm



* Average power of 1 W to 16 W with a repetition rate of 1 MHz, pulse width of 600 fs, and 5.5 mm beam diameter results in a peak power density of up to 112 MW/cm^2, without dielectric mirror coating or active cooling.

512 x 1152 Analog Spatial Light Modulator

Resolution: 512 x 512
Array Size: 7.68 x 7.68 mm
Pixel Pitch: 15 x 15 µm
Fill Factor: 83.4 - 100%
Diffraction Efficiency*: 61 - 95%
Controller: PCIe 8-bit, PCIe 16-bit, DVI 16-bit

Wavelength	Wavefront Distortion	Liquid Crystal Response Time (Standard Efficiency / High Efficiency)			AR Coatings (Ravg <1%)
		Model P512/PDM512	Model HSP512/HSPDM512	Model ODP512/ODPDM512	
405 nm	λ/5	25 ms / 33.3 ms	N/A	3 ms / 4 ms	TBD
532 nm	λ/7	33.3 ms / 45 ms	7 ms / 10 ms	3.5 ms / 4.5 ms	450 – 850 nm
635 nm	λ/8	33.3 ms / 45 ms	12 ms / 16.7 ms	4 ms / 5 ms	450 – 850 nm
785 nm	λ/10	55.5 / 80 ms	17.2 ms / 22.2 ms	4.5 ms / 5.5 ms	600 – 1300 nm
1064 nm	λ/10	66.7 / 100 ms	10 ms / 16.7 ms	5 ms / 6 ms	600 – 1300 nm
1550 nm	λ/12	100 / 130 ms	20 ms / 28.5 ms	6 ms / 7 ms	850 – 1650 nm

*Diffraction efficiency of silicon backplane. Performance varies as a function of wavelength and pixel value.

512 x 512 Controller Models

Model	PCIe 8-bit	PCIe 16-bit	DVI 16-bit
Controller Phase Levels	256 / 8-bits	65,536 / 16-bits	65,536 / 16-bits
CPU to Controller Transfer Time (Computer Dependent)	0.6 ms	2.1 ms	16.7 ms