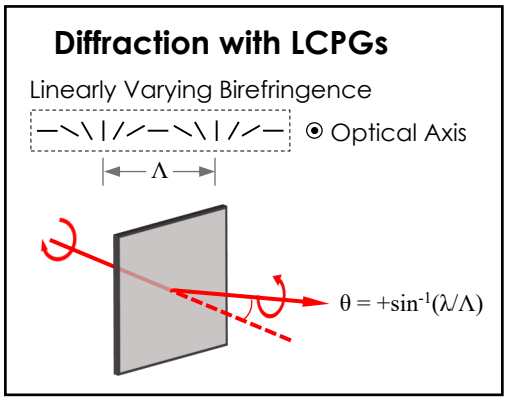
meadowlark optics

# Liquid Crystal Polarization Gratings

Meadowlark Optics' Liquid Crystal Polarization Gratings utilize spatially varying birefringence to create highly efficient polarization-sensitive gratings. Liquid crystal polarization gratings are also known as geometric phase gratings, Pancharatnam-Berry phase gratings, and diffractive waveplates.

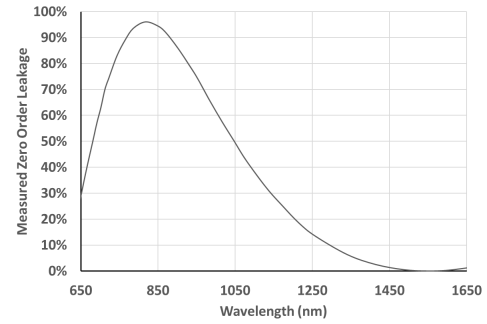
At the wavelength(s), where the birefringent layer provides a half wave of retardation, these transmissive gratings efficiently (> 99.5% typical) diffract circularly polarized light to either the +1 or -1 order depending on the handedness of the incident light. Because of the half wave of retardation, the diffracted light also changes handedness relative to the incident light. Meanwhile, when linearly polarized light is used, the light is evenly split into the two diffracted orders.



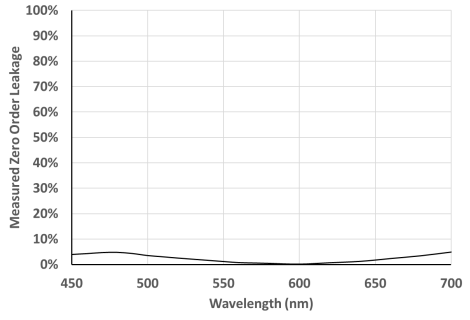

Meadowlark Optics offers a commercial product line of LCPGs at common laser wavelengths and a variety of diffraction angles. Broadband visible LCPG options are also available.

## Typical Diffraction Spectra

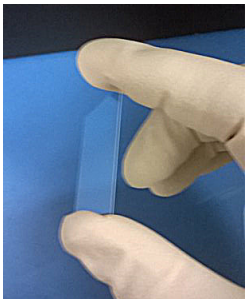
Narrowband 1550 nm LCPG




Broadband Visible LCPG




The plots above illustrate the typical diffraction spectra of narrowband (left) and broadband (right) LCPGs by measuring the leakage into the $0^{th}$ order (i.e., undiffracted transmission). Peak diffraction efficiency occurs where the plots have a null, representing >99.5% diffraction efficiency in both cases.



## Applications of Liquid Crystal Polarization Gratings

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- Thin polarized beamsplitter
- Pair with variable retarders for non-mechanical beam steering
- Spectral imaging
- Polarimetry
- Phase microscopy

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## Liquid Crystal Suite

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**Variable Retarders**
Liquid Crystal Variable Retarder
UV Variable Retarder
MWIR Variable Retarder
OEM LCVR

**Rotators**
Achromatic High-Speed Rotator
Binary Rotator
Polarization Rotator

**Shutters / Attenuators**
Achromatic High-Speed Shutter
High Contrast Shutter
Variable Attenuator

**Controllers**
Analog Controller
FLC Controller
LC Digital Interface Controller
Temperature Controller
Two Channel High Voltage Controller

| NARROWBAND LCPG SPECIFICATIONS | |
|---|---|
| **Design Wavelengths** | 532 nm, 1064 nm, 1550 nm (please specify) |
| **Diffraction Angles** | **532 nm**: ±1˚, ±2˚, ±4˚<br>**1064 nm:** : ±1˚, ±2.5˚, ±5˚<br>**1550nm:** ±1˚, ±2.5˚, ±5˚, ±10˚ |
| **Diffraction Efficiency** | ≥ 99% |
| **Total Efficiency** | ≥ 90% |

| BROADBAND VISIBLE LCPG SPECIFICATIONS | |
|---|---|
| **Wavelength Bandwidth** | 450 – 700 nm |
| **Diffraction Angles at 532 nm / (Grating Pitches)** | ±1˚, ±2˚, ±4˚/ (30.5 µm, 15.2 µm, 7.6 µm) |
| **Diffraction Efficiency** | ≥ 90% over 450 nm – 700 nm<br>≥ 95% over 550 nm – 650 nm |
| **Total Efficiency** | ≥ 80% over 450 nm – 700 nm<br>≥ 85% over 550 nm – 650 nm |

| SHARED SPECIFICATIONS | | |
|---|---|---|
| **Substrate Material** | Corning EAGLE XG | |
| **Substrate Sizes / Clear Apertures** | 0.5 in. × 0.5 in. (12.7 mm × 12.7 mm)<br>1.0 in. × 1.0 in. (25.4 mm × 25.4 mm) | 0.34 in. × 0.34 in. (8.7 mm × 8.7 mm)<br>0.76 in. × 0.76 in. (19.4 mm × 19.4 mm) |
| **Substrate Thickness** | 0.02 in. (0.5 mm) | |
| **Transmitted Wavefront Distortion** | ≤ λ/4 RMS at 532 nm (Typical) | |
| **Surface Quality** | 60 – 40 scratch-dig | |

†Diffraction Efficiency defined as the power in the desired first-order beam divided by the sum of all power in all diffracted orders. Assumes circularly polarized incident light.
‡Total Efficiency defined as the power in the desired first-order beam divided by the power in the incident beam. Includes surface reflection losses.

## *Don't see what you're looking for?*

Our commercial product line consists of unmounted LCPGs without integrated anti-reflection (AR) coatings so that we can provide customers with the best price. Please contact our knowledgeable Solutions Engineers regarding custom options, including custom diffraction angles, aperture sizes, and wavelengths through the visible to mid-wave infrared.

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