

# Circular Variable Neutral Density (CVND)

*Custom variable neutral density filters*



## DESCRIPTION:

CVND Filters are best used in high quality optical systems to change the intensity of light from 100% to less than 0.1%. As the filter rotates the beam intensity is reduced due to the density variation of a gradient metallic coating around the filter. Available from the UV to the far Infrared, density neutrality can be achieved for narrow band applications, such as lasers, to wide band applications, such as the spectrum of white light. These filters are fully customizable in optical density gradient function, transmission gradient function, substrate type, coating materials, and size to match your application requirements.

These filters are typically specified as a linear optical density function. But, since all optical systems are not linear in operation, Reynard Corporation offers the capability of customizing the density gradient based on user defined functions. The filters can be made on a variety of substrates including BK-7, Fused Silica, Ge and ZnSe, among several others. The typical coating material is an Inconel for room temperature, low-power applications. The ND coating can be enhanced to increase survivability in hostile environments using other common precious metals to match the absorption, spectral, and environmental characteristics.

In imaging systems, large aperture neutrality with constant density can be achieved by configuring two filters of equal design back-to-back. Counter-rotating the two filters allows for a variable setting of the density or transmission requirement in both the rotational and radial directions. "For large aperture imaging, the two-filter solution offers adjustment flexibility that cannot be physically achieved by any other means," says Randy Reynard, President of Reynard Corporation, "High-resolution cameras can operate with full aperture while still being able to attenuate light."

## KEY FEATURES:

### BETTER PERFORMANCE

CVND filters change light intensity from 100% to less than 0.1%

### CUSTOM WAVELENGTHS

Gradient coatings & substrates can be supplied to operate from the UV to far IR.

### DENSITY RANGE OPTIONS

CVND gradients are available from (specify) 0 - 1, 2, 3, 4 or 5.

### SUBSTRATE MATERIALS

BK-7, Fused Silica, Ge, Si, ZnSe & others.

### WIDE APERTURE

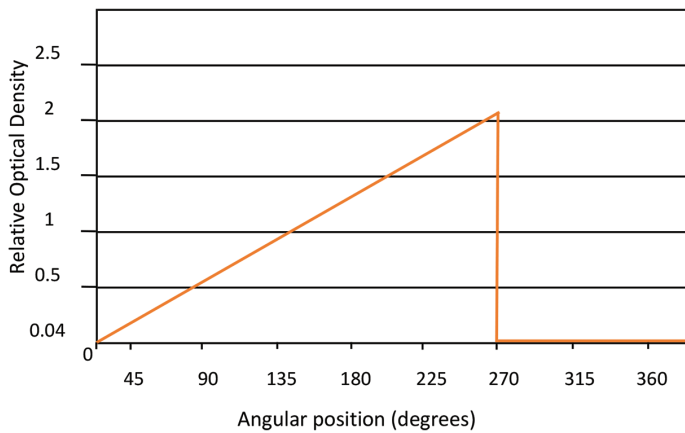
Two CVND filters positioned back to back produce a large aperture of fixed density.

### DIMENSIONS

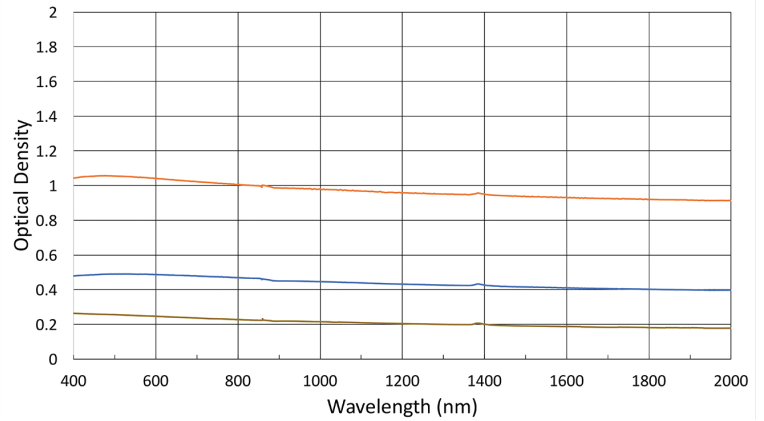
CVND's are available from 25mm to over 200mm in diameter.

**Contact us to see how we can help your system achieve the highest levels of performance. We will tune a design that meets the needs of YOUR system!**

Circular Variable ND Filter



Optical Density vs.  $\lambda$ (nm)



## SPECIFICATIONS:

Property	Value
<b>Substrate Materials:</b>	BK-7, Fused Silica, Ge, Si, ZnSe & others
<b>Outside Diameter:</b>	25mm to over 200mm
<b>Inside Diameter:</b>	7.5mm – 25.4mm
<b>Optical Density Range:</b>	Specify: 0-1, 2, 3, 4, or 5
<b>Wavelength Calibration:</b>	510nm
<b>Wavelength:</b>	UV – far IR
<b>Parallelism:</b>	< 3 Arc Minutes
<b>Gradient Range:</b>	270° Typical (custom gradient coatings available from 45° to 360° of rotation)
<b>Environmental:</b>	MIL-PRF-13830B, MIL-C-48497A, MIL-C-675C or similar
<b>Damage Threshold:</b>	CW: 75 W/cm <sup>2</sup> Pulsed: 10mJ/cm <sup>2</sup> with 10ms pulses

## APPLICATIONS:

- Attenuation of white light and laser sources
- Maintain light intensity consistency and calibration
- Large aperture attenuation
- Can be used as a variable beamsplitter

