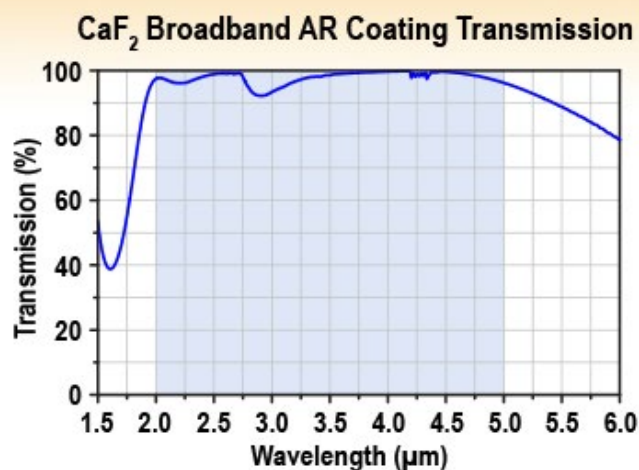
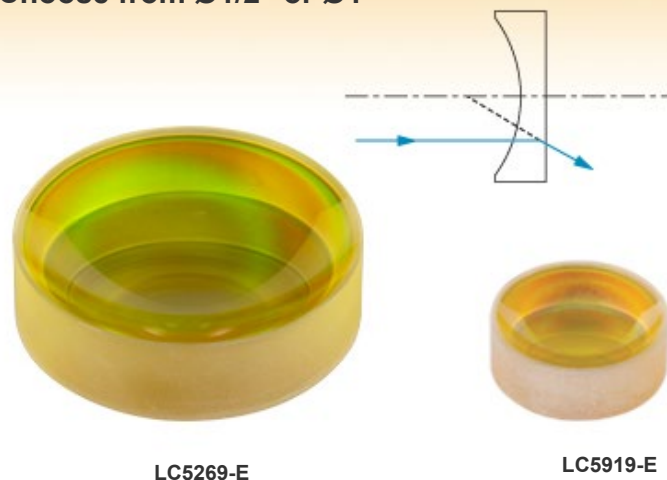


LC5401-E - April 3, 2024

Item # LC5401-E was discontinued on April 3, 2024. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

CALCIUM FLUORIDE PLANO-CONCAVE LENSES, AR-COATED: 2 - 5 MM

- ▶ **Broadband AR Coating Optimized for the 2 - 5 μm Range**
- ▶ **Choose from $\text{\O}1/2''$ or $\text{\O}1''$**



OVERVIEW

Features

- Vacuum-Grade Calcium Fluoride Substrate
- $\text{\O}1/2''$ and $\text{\O}1''$ Versions Available
- Broadband AR Coating for the 2 - 5 μm Range
- Focal Lengths from -18.0 mm to -500.0 mm

Zemax Files

Click on the red Document icon next to the item numbers below to access the Zemax file download. Our entire Zemax Catalog is also available.

Thorlabs' $\text{\O}1/2''$ and $\text{\O}1''$ Calcium Fluoride (CaF_2) Plano-Concave Lenses have a broadband AR coating optimized for the 2 μm to 5 μm spectral range deposited on both surfaces. This coating greatly reduces the surface reflectivity of the substrate, yielding an average transmission in excess of 97% over the entire AR coating range. See the *Graphs* tab for detailed information.

CaF_2 is commonly used for applications requiring high transmission in the infrared and ultraviolet spectral ranges. The material exhibits a low refractive index, varying from 1.35 to 1.51 within its usage range of 180 nm to 8.0 μm . Calcium fluoride is also fairly chemically

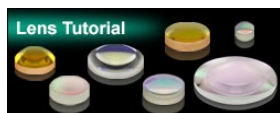
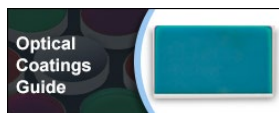


Common Specifications	
Substrate Material	Vacuum-Grade Calcium Fluoride ^a
AR Coating Range	2 - 5 μm
Reflectance over Coating Range (Avg.)	<1.25%
Diameters Available	1/2" or 1"
Diameter Tolerance	+0.0/-0.1 mm
Thickness Tolerance	± 0.1 mm
Focal Length Tolerance	$\pm 1\%$
Surface Quality	40-20 Scratch-Dig
Surface Flatness (Plano Side)	$\lambda/2$
Spherical Surface Power (Concave Side) ^b	3 $\lambda/2$
Surface Irregularity (Peak to Valley)	$\lambda/2$
Centration	<3 arcmin
Clear Aperture	>90% of Diameter
Design Wavelength	588 nm

inert and offers superior hardness compared to its barium fluoride, magnesium fluoride, and lithium fluoride cousins.

Like all plano-concave lenses, these lenses have negative focal lengths and can be used to diverge collimated beams; in this case, the curved surface should face the source in order to minimize spherical aberration. In addition, they can be employed to offset the effects of spherical aberration caused by other lenses in an optical system.

See the tables below for individual lens specifications. These lenses are also available uncoated.



- [Click Link for Detailed Specifications on the Substrate](#)
- Much like surface flatness for flat optics, spherical surface power is a measure of the deviation between the surface of the curved optic and a calibrated reference gauge, typically for a 633 nm source, unless otherwise stated. This specification is also commonly referred to as surface fit.

Selection Guide

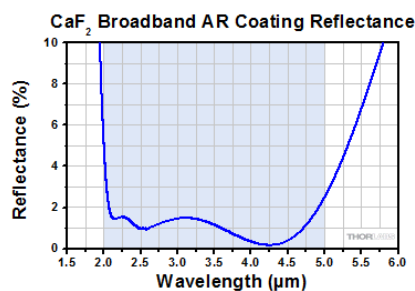
[Calcium Fluoride Lenses](#)

[Other MIR Lenses](#)

[Other Spherical Singlets](#)

GRAPHS

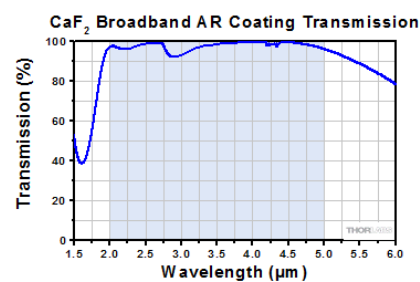
2 - 5 μm AR Coating Graphs



[Click to Enlarge](#)
[Click Here for Raw Data](#)

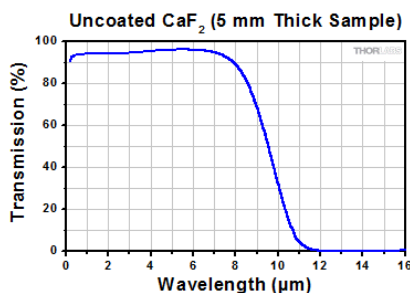
Shown above is a graph of the measured percent reflectance of the AR coating as a function of wavelength.

The average reflectance in the 2 - 5 μm range is <1.25%. The blue shading indicates the region for which the AR coating is optimized. Performance outside of the specified range is not guaranteed and varies from lot to lot. The Excel file above provides the coating curve data over an extended wavelength range.



[Click to Enlarge](#)
[Click Here for Raw Data](#)

Shown above is a graph of the measured percent transmission of the AR coating as a function of wavelength. The blue shading indicates the region for which the AR coating is optimized. Performance outside of the specified range is not guaranteed and varies from lot to lot. The Excel file above provides the coating curve data over an extended wavelength range.



[Click to Enlarge](#)
[Click Here for Raw Data](#)

Shown above is a graph of the measured transmission of an uncoated, 5 mm thick sample of CaF₂.

Total Transmission of Optic (CaF₂ Substrate, Uncoated)

The table below gives the approximate theoretical transmission of these uncoated optics for a few select wavelengths in the 0.18 - 8.0 μm range. To see an Excel file that lists all measured transmission values for this wavelength range, please [click here](#).

Wavelength (μm)	Total Transmission	Wavelength (μm)	Total Transmission	Wavelength (μm)	Total Transmission	Wavelength (μm)	Total Transmission
0.2	0.910	2.2	0.939	4.2	0.943	6.2	0.947
0.4	0.929	2.4	0.939	4.4	0.943	6.4	0.947
0.6	0.935	2.6	0.940	4.6	0.943	6.6	0.948
0.8	0.937	2.8	0.940	4.8	0.944	6.8	0.949
1.0	0.938	3.0	0.940	5.0	0.945	7.0	0.949
1.2	0.938	3.2	0.941	5.2	0.945	7.2	0.948
1.4	0.938	3.4	0.941	5.4	0.945	7.4	0.947
1.6	0.938	3.6	0.941	5.6	0.946	7.6	0.946
1.8	0.939	3.8	0.942	5.8	0.946	7.8	0.945
2.0	0.939	4.0	0.942	6.0	0.947	8.0	0.944



FOCAL LENGTH SHIFT

Wavelength-Dependent Focal Length Shift






The paraxial focal length of a lens is wavelength dependent. The focal length listed below for a given lens corresponds to the value at the design wavelength (i.e., the focal length at 588 nm). Since CaF_2 offers high transmission from 0.18 - 8.0 μm , users may wish to use these lenses at other popular wavelengths. Click on the icons below to view theoretically-calculated focal length shifts for wavelengths within the 0.18 - 8.0 μm range.

The blue shading indicates the region for which the AR coating is optimized. Please see the *Graphs* tab for more information.

Ø1/2" Plano-Concave Lenses

Item #	LC5919-E	LC5749-E
Focal Length @ 588 nm	-18.0 mm	-25.0 mm
Focal Length Shift (Click for Details)		
Raw Data (Click to Download)	Data	Data

Ø1" Plano-Concave Lenses

Item #	LC5269-E	LC5401-E	LC5289-E	LC5952-E	LC5893-E
Focal Length @ 588 nm	-40.0 mm	-75.0 mm	-100.0 mm	-200.0 mm	-500.0 mm
Focal Length Shift (Click for Details)					
Raw Data (Click to Download)	Data	Data	Data	Data	Data

MOUNTING OPTIONS



Click to Enlarge



LMR1 Fixed Mount with $\text{\O}1''$ Lens



Click to Enlarge LM2XY Translating Mount with $\text{\O}2''$ Lens

Click to Enlarge CXY1A Translation Mount and SM1 Lens Tube Mounted in a 30 mm Cage System



Click to Enlarge $\text{\O}1''$ Optic Mounted in a ST1XY-S XY Translator

Recommended Mounting Options for Thorlabs Lenses		
Item #		Mounts for $\text{\O}2$ mm to $\text{\O}10$ mm Optics
Imperial	Metric	
(Various)		Fixed Lens Mounts and Mini-Series Fixed Lens Mounts for Small Optics, $\text{\O}5$ mm to $\text{\O}10$ mm
(Various)		Small Optic Adapters for Use with Standard Fixed Lens Mounts, $\text{\O}2$ mm to $\text{\O}10$ mm
Item #		Mounts for $\text{\O}1/2''$ ($\text{\O}12.7$ mm) Optics
Imperial	Metric	
LMR05	LMR05/M	Fixed Lens Mount for $\text{\O}1/2''$ Optics
MLH05	MLH05/M	Mini-Series Fixed Lens Mount for $\text{\O}1/2''$ Optics
LM05XY	LM05XY/M	Translating Lens Mount for $\text{\O}1/2''$ Optics
SCP05		16 mm Cage System, XY Translation Mount for $\text{\O}1/2''$ Optics
(Various)		$\text{\O}1/2''$ Lens Tubes, Optional SM05RRC Retaining Ring for High-Curvature Lenses (See Below)
Item #		Mounts for $\text{\O}1''$ ($\text{\O}25.4$ mm) Optics
Imperial	Metric	
LMR1	LMR1/M	Fixed Lens Mount for $\text{\O}1''$ Optics
LM1XY	LM1XY/M	Translating Lens Mount for $\text{\O}1''$ Optics
ST1XY-S	ST1XY-S/M	Translating Lens Mount with Micrometer Drives (Other Drives Available)
CXY1A		30 mm Cage System, XY Translation Mount for $\text{\O}1''$ Optics
(Various)		$\text{\O}1''$ Lens Tubes, Optional SM1RRC Retaining Ring for High-Curvature Lenses (See Below)
Item #		Mount for $\text{\O}1.5''$ Optics
Imperial	Metric	
LMR1.5	LMR1.5/M	Fixed Lens Mount for $\text{\O}1.5''$ Optics
(Various)		$\text{\O}1.5''$ Lens Tubes, Optional SM1.5RR Retaining Ring for $\text{\O}1.5''$ Lens Tubes and Mounts
Item #		Mounts for $\text{\O}2''$ ($\text{\O}50.8$ mm) Optics
Imperial	Metric	
LMR2	LMR2/M	Fixed Lens Mount for $\text{\O}2''$ Optics
LM2XY	LM2XY/M	Translating Lens Mount for $\text{\O}2''$ Optics
CXY2		60 mm Cage System, XY Translation Mount for $\text{\O}2''$ Optics
(Various)		$\text{\O}2''$ Lens Tubes, Optional SM2RRC Retaining Ring for High-Curvature Lenses (See Below)
Item #		Adjustable Optic Mounts
Imperial	Metric	


LH1	LH1/M	Adjustable Mount for $\varnothing 0.28''$ ($\varnothing 7.1$ mm) to $\varnothing 1.80''$ ($\varnothing 45.7$ mm) Optics
LH2	LH2/M	Adjustable Mount for $\varnothing 0.77''$ ($\varnothing 19.6$ mm) to $\varnothing 2.28''$ ($\varnothing 57.9$ mm) Optics
VG100	VG100/M	Adjustable Clamp for $\varnothing 0.5''$ ($\varnothing 13$ mm) to $\varnothing 3.5''$ ($\varnothing 89$ mm) Optics
SCL03	SCL03/M	Self-Centering Mount for $\varnothing 0.15''$ ($\varnothing 3.8$ mm) to $\varnothing 1.77''$ ($\varnothing 45.0$ mm) Optics
SCL04	SCL04/M	Self-Centering Mount for $\varnothing 0.15''$ ($\varnothing 3.8$ mm) to $\varnothing 3.00''$ ($\varnothing 76.2$ mm) Optics
LH160C	LH160C/M	Adjustable Mount for 60 mm Cage Systems, $\varnothing 0.50''$ ($\varnothing 13$ mm) to $\varnothing 2.00''$ ($\varnothing 50.8$ mm) Optics
SCL60C	SCL60C/M	Self-Centering Mount for 60 mm Cage Systems, $\varnothing 0.15''$ ($\varnothing 3.8$ mm) to $\varnothing 1.77''$ ($\varnothing 45.0$ mm) Optics

Mounting High-Curvature Optics

Thorlabs' retaining rings are used to secure unmounted optics within lens tubes or optic mounts. These rings are secured in position using a compatible spanner wrench. For flat or low-curvature optics, standard retaining rings manufactured from anodized aluminum are available from $\varnothing 5$ mm to $\varnothing 4''$. For high-curvature optics, extra-thick retaining rings are available in $\varnothing 1/2''$, $\varnothing 1''$, and $\varnothing 2''$ sizes.

Extra-thick retaining rings offer several features that aid in mounting high-curvature optics such as aspheric lenses, short-focal-length plano-convex lenses, and condenser lenses. As shown in the animation to the right, the guide flange of the spanner wrench will collide with the surface of high-curvature lenses when using a standard retaining ring, potentially scratching the optic. This contact also creates a gap between the spanner wrench and retaining ring, preventing the ring from tightening correctly. Extra-thick retaining rings provide the necessary clearance for the spanner wrench to secure the lens without coming into contact with the optic surface.


$\varnothing 1/2''$ CaF₂ Plano-Concave Lenses, AR-Coated: 2 - 5 μm

Item #	Diameter	Focal Length	Diopter ^a	Radius of Curvature	Center Thickness	Edge Thickness ^b	Back Focal Length ^c	Reference Drawing
LC5919-E ^d	1/2" (12.7 mm)	-18.0 mm	-55.6	-7.8 mm	2.0 mm	5.3 mm	-19.4 mm	
LC5749-E ^e	1/2" (12.7 mm)	-25.0 mm	-40.0	-10.8 mm	2.5 mm	4.6 mm	-26.7 mm	

- Reciprocal of the Focal Length in Meters
- Edge Thickness Given Before 0.2 mm at 45°
- Typical Chamfer Measured at the Design Wavelength, 588 nm
- Suggested Fixed Lens Mounts: LMR05(/M) & SM05L03
- Suggested Fixed Lens Mount: LMR05(/M)

Part Number	Description	Price	Availability
LC5919-E	$\varnothing 1/2''$ CaF ₂ Plano-Concave Lens, f = -18.0 mm, AR-Coated: 2 - 5 μm	\$197.20	Today
LC5749-E	$\varnothing 1/2''$ CaF ₂ Plano-Concave Lens, f = -25.0 mm, AR-Coated: 2 - 5 μm	\$185.31	Today

$\varnothing 1''$ CaF₂ Plano-Concave Lenses, AR-Coated: 2 - 5 μm

Item #	Diameter	Focal Length	Diopter ^a	Radius of Curvature	Center Thickness	Edge Thickness ^b	Back Focal Length ^c	Reference Drawing
LC5269-E ^d	1" (25.4 mm)	-40.0 mm	-25.0	-17.4 mm	2.0 mm	7.5 mm	-41.4 mm	
LC5401-E ^e	1" (25.4 mm)	-75.0 mm	-13.3	-32.5 mm	2.5 mm	5.1 mm	-76.8 mm	
LC5289-E ^e	1" (25.4 mm)	-100.0 mm	-10.0	-43.4 mm	3.0 mm	4.9 mm	-102.1 mm	
LC5952-E ^e	1" (25.4 mm)	-200.0 mm	-5.0	-86.8 mm	3.5 mm	4.4 mm	-202.4 mm	

LC5893-E ^e	1" (25.4 mm)	-500.0 mm	-2.0	-216.9 mm	4.0 mm	4.4 mm	-502.8 mm	
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- a. Reciprocal of the Focal Length in Meters
- b. Edge thickness given before 0.2 mm at 45° typical chamfer.
- c. Measured at the design wavelength, 588 nm.
- d. Suggested Fixed Lens Mounts: LMR1(/M) & SM1L05
- e. Suggested Fixed Lens Mount: LMR1(/M)

Part Number	Description	Price	Availability
LC5269-E	Ø1" CaF ₂ Plano-Concave Lens, f = -40.0 mm, AR-Coated: 2 - 5 μm	\$256.59	Today
LC5401-E	Ø1" CaF ₂ Plano-Concave Lens, f = -75.0 mm, AR-Coated: 2 - 5 μm	\$244.70	Today
LC5289-E	Ø1" CaF ₂ Plano-Concave Lens, f = -100.0 mm, AR-Coated: 2 - 5 μm	\$238.78	Today
LC5952-E	Ø1" CaF ₂ Plano-Concave Lens, f = -200.0 mm, AR-Coated: 2 - 5 μm	\$230.46	Today
LC5893-E	Ø1" CaF ₂ Plano-Concave Lens, f = -500.0 mm, AR-Coated: 2 - 5 μm	\$224.51	Today

