Sintec Optronics

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Featured Product

High Speed Liquid Crystal Variable Retarder

Sintec Optronics newest liquid crystal (LC) product, the high speed LC variable retarder (HS LCVR) has a 10X speed improvement over our award winning standard LCVR. The sub-millisecond speeds are achieved without the 50/50 duty cycle drive scheme required by our ferroelectric liquid crystal components, but are nearly as fast. The new LCVR uses nematic liquid crystal materials to electrically control polarization and provide tunable retardation by changing the effective birefringence of the material with applied voltage, thus altering the input polarized light to any chosen elliptical, linear or circular polarization. Our precision HS LCVR requires unique fabrication and assembly steps. We construct these retarders using optically flat fused silica windows coated with our transparent conductive Indium Tin Oxide (ITO). Our ITO coating is specially designed for maximum transmission from 400 – 700 nm. Liquid Crystal Variable Retarder response time depends on several parameters, including layer thickness, viscosity, temperature, variations in drive voltage and surface treatment. Liquid crystal response time is proportional to the square of the layer thickness and therefore, the square of the total retardance.

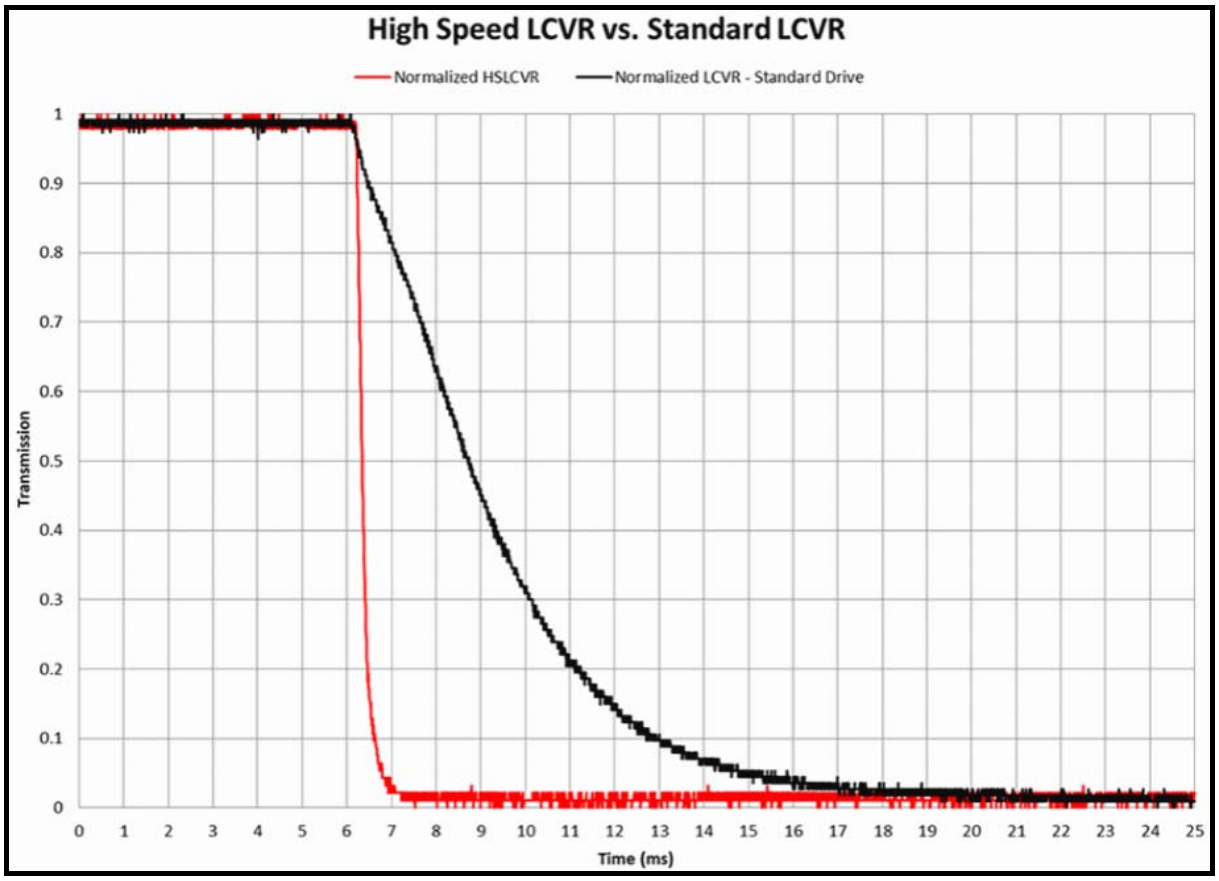
Features:

- Sub-millisecond speeds
- Standard LC Drive Schemes
- Includes heated housing
- Precision non-mechanical retardation control

Technical specifications:

Retarder Material	Nematic liquid crystal
Substrate Material	Optical quality synthetic fused silica
Wavelength Range	450 - 700 nm
Typical LC Rise Time (10 – 90%)	50 µs @ 532 nm
Typical LC Fall Time (90 – 10%)	500 µs @ 532 nm
Retardance	0 to λ/2
Transmitted Wavefront Distortion (at 632.8 nm)	≤ λ/4
Surface Quality	40-20 scratch-dig
Beam Deviation	≤ 2 arc min
Reflectance (per surface)	≤ 0.5% at normal incidence
Temperature Range	50°C
Recommended Safe Operating Limit	500 W/cm 2, CW; 300 mJ/cm2, 10 ns, visible

Diameter, D (in.)	Clear Aperture, CA (in.)	Thickness, t (in.)	Part Number
2	0.8	0.75	STM-HSLRC-200


High Speed LCVR vs. Standard LCVR
Normalized HSLCVR
Normalized LCVR - Standard Drive
Transmission
Time (ms)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

Polarizers

Precision Linear Polarizers

Sintec Optronics manufactures Precision Linear Polarizers using dichroic sheet polarizer material laminated between high quality glass substrates. For visible wavelength polarizers, this construction produces a peak-to-valley transmitted wavefront distortion of less than λ/5. Various polarizer materials are used to cover wavelengths within 320 and 2000 nm. Both visible and near infrared polarizers are supplied with a high-efficiency, broadband antireflection (AR) coating; single-layer AR coatings are optional on our ultraviolet polarizers. Both mounted and unmounted Precision Linear Polarizers are offered as standard products. To facilitate use, our Precision Linear Polarizers have the transmission axis marked on the part.

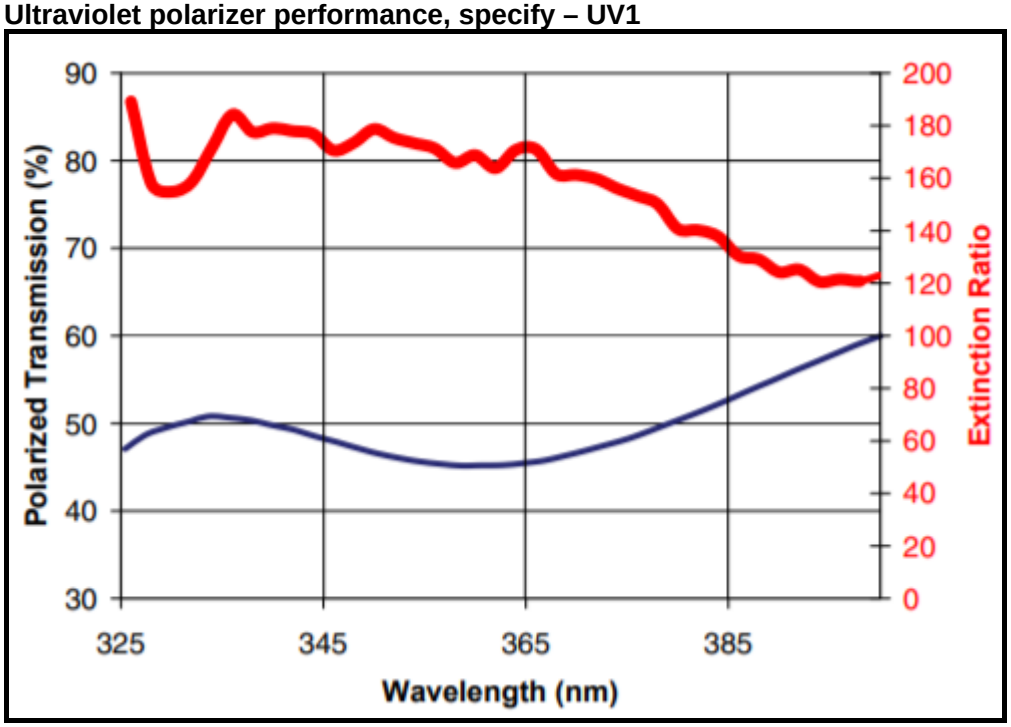
Features:

- High extinction ratios
- Excellent surface quality
- Wide angular acceptance
- Low transmitted wavefront distortion
- Ultraviolet, visible, near infrared wavelengths

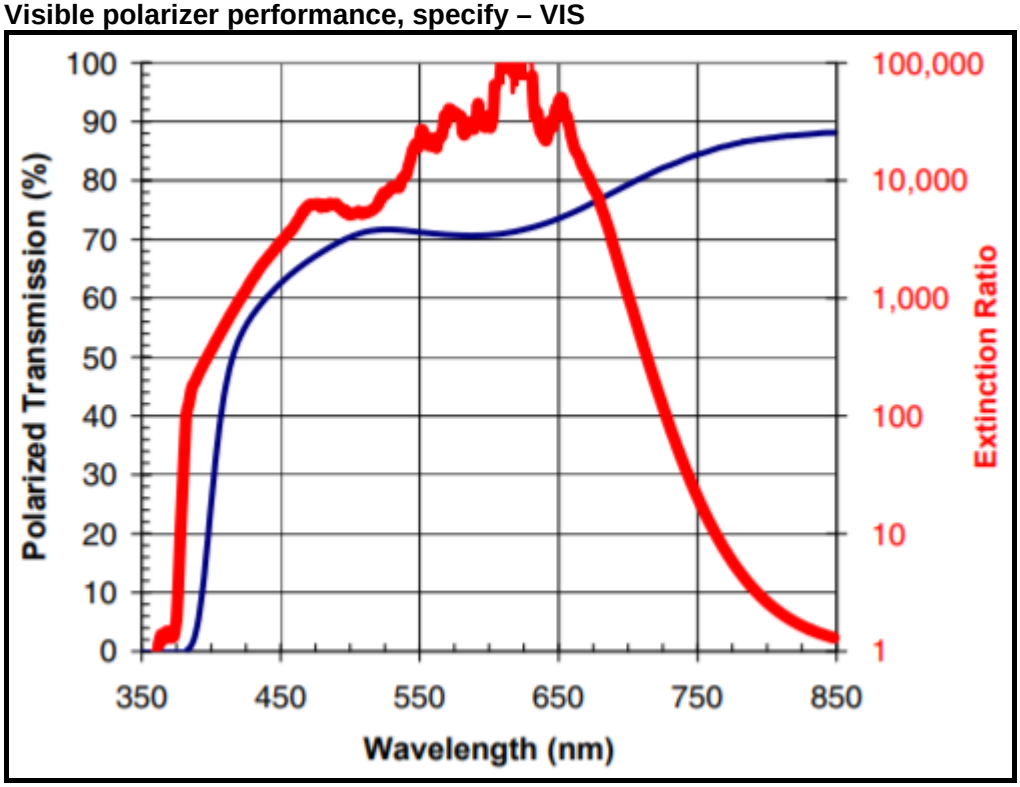
Technical specifications:

Substrate Material	
Ultraviolet	UV Grade Fused Silica
Visible	N-BK7
Near Infrared	N-BK7
Polarizer Material	Dichroic Polymer
Transmitted Wavefront Distortion (P-V @ 632.8 nm)	
Ultraviolet	≤ λ/2
Visible	≤ λ/5
Near Infrared	≤ λ/2
Surface Quality (scratch-dig)	40-20
Beam Deviation	
Ultraviolet	≤ 2 arc-min
Visible	≤ 1arc-min
Near Infrared	≤ 2 arc-min
Reflectance (per surface, at normal incidence)	
Ultraviolet	~4.25% (uncoated)
Visible	≤ 0.5%
Near Infrared	≤ 0.5%
Storage Temperature	
Ultraviolet	-50˚C to +50˚C
Visible	-50˚C to +50˚C
Near Infrared	-50˚C to +50˚C
Operating Temperature	
Ultraviolet	-50˚C to +50˚C
Visible	-50˚C to +50˚C
Near Infrared	-50˚C to +50˚C
Laser Damage Threshold	1W/cm2, CW
	200 mJ/cm2, 20 ns, visible
	2 J/cm2, 20 ns, 1064 nm

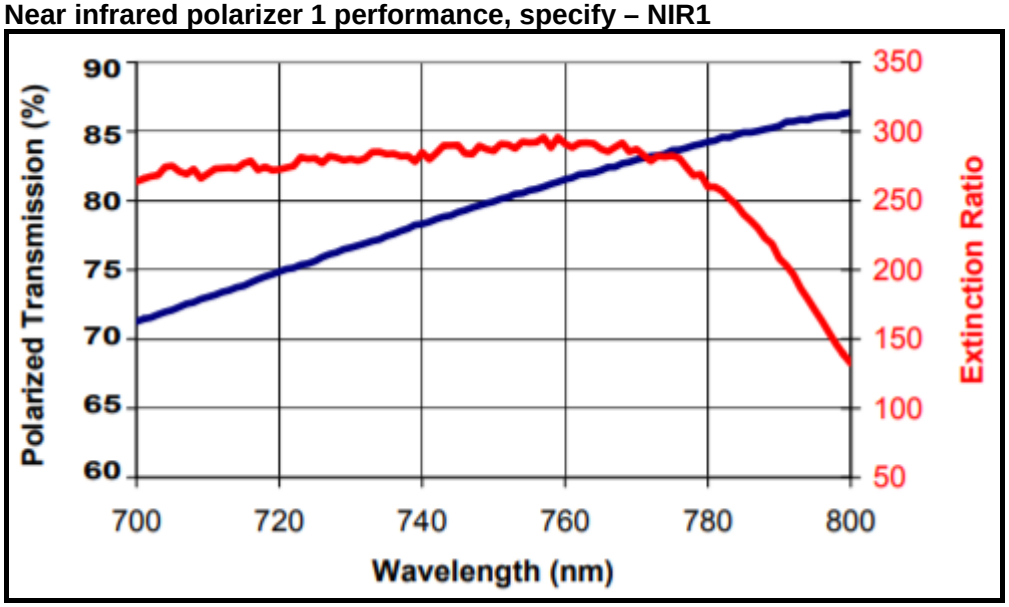
Ultraviolet polarizer performance, specify – UV1



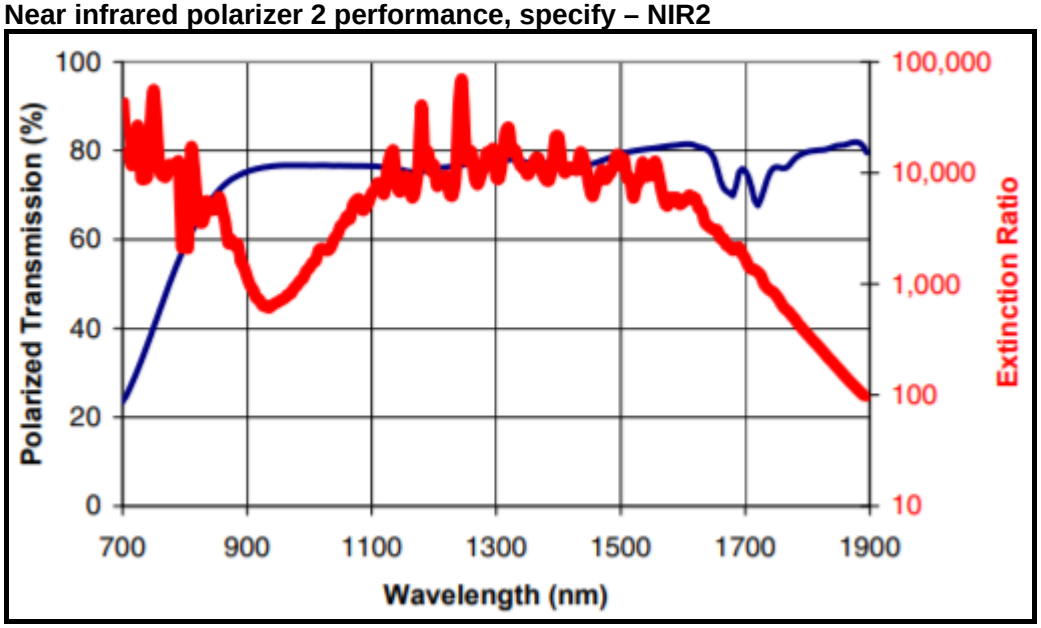
Visible polarizer performance, specify – VIS



Near infrared polarizer 1 performance, specify – NIR1



Near infrared polarizer 2 performance, specify – NIR2



Mounted			
Diameter (in.)	Clear aperture (in.)	Thickness (in.)	Part number
1.00	0.40	0.25	STM-DPM-050-UV1
1.00	0.40	0.25	STM-DPM-050-VIS
1.00	0.40	0.25	STM-DPM-050-NIR1
1.00	0.40	0.25	STM-DPM-050-NIR2-n
1.00	0.70	0.35	STM-DPM-100-UV1
1.00	0.70	0.35	STM-DPM-100-VIS
1.00	0.70	0.35	STM-DPM-100-NIR1
1.00	0.70	0.35	STM-DPM-100-NIR2-n
2.00	1.20	0.50	STM-DPM-200-UV1
2.00	1.20	0.50	STM-DPM-200-VIS
2.00	1.20	0.50	STM-DPM-200-NIR1
2.00	1.20	0.50	STM-DPM-200-NIR2-n
Unmounted			

0.50	0.40	0.13	STM-DP-050-UV1
0.50	0.40	0.13	STM-DP-050-VIS
0.50	0.40	0.14	STM-DP-050-NIR1
0.50	0.40	0.14	STM-DP-050-NIR2-n
1.00	0.80	0.26	STM-DP-100-UV1
1.00	0.80	0.26	STM-DP-100-VIS
1.00	0.80	0.27	STM-DP-100-NIR1
1.00	0.80	0.27	STM-DP-100-NIR2-n

* Custom AR coatings are available on all polarizers. For NIR2 polarizers, please choose from the following AR coating options: NIR2 – 1 covers 650 – 950 nm; NIR2 – 2 covers 900 – 1250 nm; NIR2 – 3 covers 1200 – 1700 nm

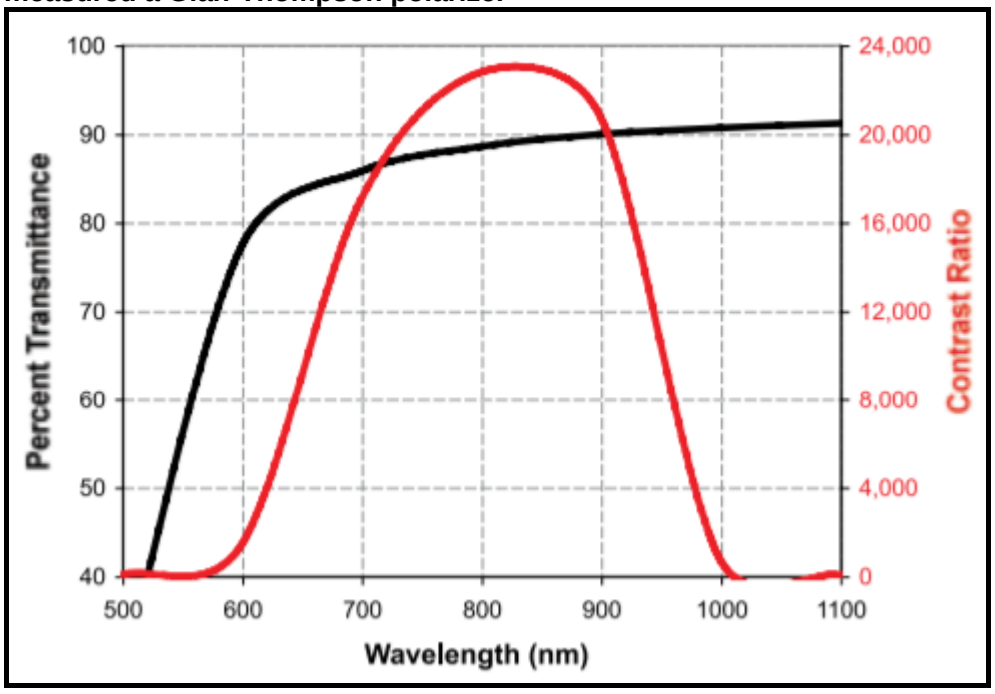
High Contrast Linear Polarizer

In response to the need for improved contrast in the near infrared region, Sintec Optronics now offers a line of High Contrast Linear Polarizers. These polarizers are constructed by laminating Polarcor™ dichroic glass polarizers between high quality glass substrates to achieve superior wavefront performance and surface quality. Sintec Optronics High Contrast Linear Polarizers offer the performance of calcite polarizers in large apertures. Contrast ratios are available as high as 10,000:1. Custom wavelength ranges from 630 to 1580 nm with 60 to 80 nm bandpasses and sizes from 10 to 25 mm are available.

Features:

- High Contrast
- High Transmission
- Absorptive Dichroic Glass

Typical transmission for a High Contrast Linear Polarizer centered at 800 nm. Extinction ratio is measured a Glan-Thompson polarizer



Technical specifications:

Substrate Material	N-BK7
Polarizer Material	Dichroic Glass
Transmitted Wavefront Distortion (P-V @ 632.8 nm)	≤ λ/4
Surface Quality (scratch-dig)	40-20
Beam Deviation	≤ 3 arc-min
Reflectance (per surface, at normal incidence)	≤ 0.5%
Storage Temperature	-50˚C to +70˚C
Operating Temperature	-50˚C to +70˚C
Laser Damage Threshold	1W/cm2, CW 200 mJ/cm2, 20 ns, visible 2 J/cm2, 20 ns, 1064 nm

Clear aperture in. [mm]	Thickness ±0.020 in. [±0.51 mm]	Diameter ± 0.005 in. [±0.13 mm]	Part Number
0.4	0.25	Ø1.00	STM-PPM-050-λ
[10.2]	[6.35]	[Ø25.4]	
0.7	0.35	Ø1.00	STM-PPM-100-λ
[17.8]	[8.89]	[Ø25.4]	

Ultra-High Contrast Linear Polarizer

Our UHPUV series polarizers offer high contrast in the UV from 360 to 400 nm and our UHP-LNIR series polarizers offer high contrast over the exceptionally broad range from 650 to 5000 nm.

Features:

- Extremely high contrast, greater than 10,000,000:1
- Unlaminated part usable to 400° C
- Wavelength ranges within 340 to 5000 nm
- Absorptive dichroic glass

Technical specifications:

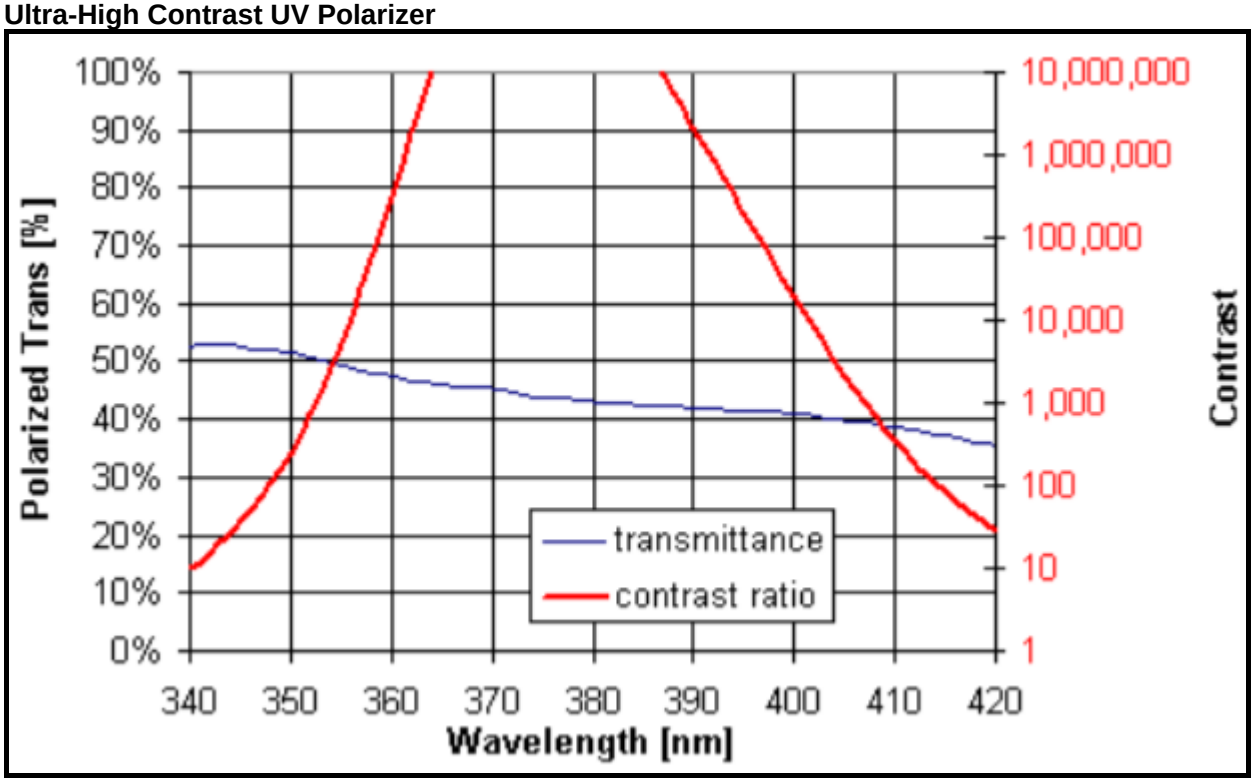
Substrate Material	
Ultraviolet	UV Grade Fused Silica
Visible	N-BK7
Infrared	N-BK7
WIR/MWIR	Design dependent
Polarizer Material	Dichroic Glass
Transmitted Wavefront Distortion (P-V @ 632.8 nm)	
Ultraviolet	≤ 1λ per Ø10mm
Visible	≤ 1λ per Ø10mm
Infrared	≤ 1λ per Ø10mm
SWIR/MWIR	Design Dependent
Surface Quality (scratch-dig)	40-20
Beam Deviation	
Ultraviolet	≤ 5arc-min

Visible	≤ 5arc-min
Infrared	≤ 5arc-min
SWIR/MWIR	≤ 10 arc-min/12.5 mm
	≤ 5 arc-min/25mm
Reflectance (per surface, at normal incidence)	~4.25%
Storage Temperature	
Ultraviolet	-20˚C to +50˚C
Visible	-20˚C to +50˚C
Infrared	-20˚C to +50˚C
SWIR/MWIR	-50˚C to +400˚C
Operating Temperature	
Ultraviolet	-20˚C to +50˚C
Visible	-20˚C to +50˚C
Infrared	-20˚C to +50˚C
SWIR/MWIR	-50˚C to +400˚ C

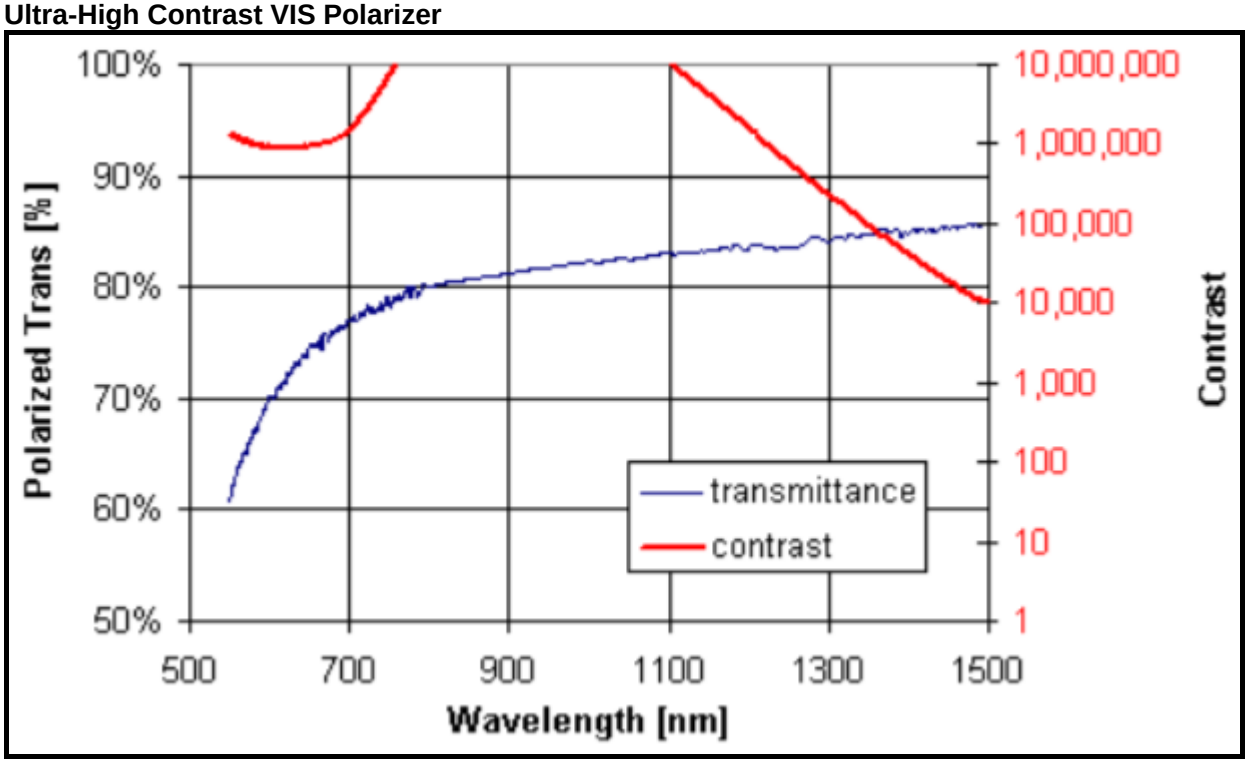
Mounted and Laminated			
Clear aperture in. [mm]	Thickness in. [mm]	Diameter ± 0.005 in. [± 0.13 mm	Part Number
0.4	0.25	Ø1.00	STM-UPM-050-UV
[10.2]	[6.35]	[Ø25.4]	
0.4	0.25	Ø1.00	STM-UPM-050-VIS
[10.2]	[6.35]	[Ø25.4]	
0.4	0.25	Ø1.00	STM-UPM-050-IR
[10.2]	[6.35]	[Ø25.4]	
0.7	0.35	Ø1.00	STM-UPM-100-UV
[17.8]	[8.89]	[Ø25.4]	
0.7	0.35	Ø1.00	STM-UPM-100-VIS
[17.8]	[8.89]	[Ø25.4]	
0.7	0.35	Ø1.00	STM-UPM-100-IR
[17.8]	[8.89]	[Ø25.4]	
Mounted and Unlaminated			
0.4	0.185	Ø1.00	STM-UPM-050-MIR
[10.2]	[4.70]	[Ø25.4]	
0.7	0.185	Ø1.00	STM-UPM-100-MIR
[17.8]	[4.70]	[Ø25.4]	
Unmounted and Laminated			
Clear aperture in. [mm]	Thickness in. [mm]	Diameter ± 0.010 in. [±0.25 mm]	Part Number
0.4	0.14	Ø0.50	STM-UHP-050-UV
[10.2]	[3.56]	[Ø12.7]	
0.4	0.14	Ø0.50	STM-UHP-050-VIS
[10.2]	[3.56]	[Ø12.7]	
0.4	0.14	Ø0.50	STM-UHP-050-IR
[10.2]	[3.56]	[Ø12.7]	
0.8	0.26	Ø1.00	STM-UHP-100-UV
[20.3]	[6.60]	[Ø25.4]	
0.8	0.26	Ø1.00	STM-UHP-100-VIS
[20.3]	[6.60]	[Ø25.4]	
0.8	0.26	Ø1.00	STM-UHP-100-IR
[20.3]	[6.60]	[Ø25.4]	
Unmounted and Unlaminated			

0.4	0.008	Ø0.50	STM-UHP-050-MIR
[10.2]	[0.203]	[Ø12.7]	
0.8	0.008	Ø1.00	STM-UHP-100-MIR
[20.3]	[0.203]	[Ø25.4]	

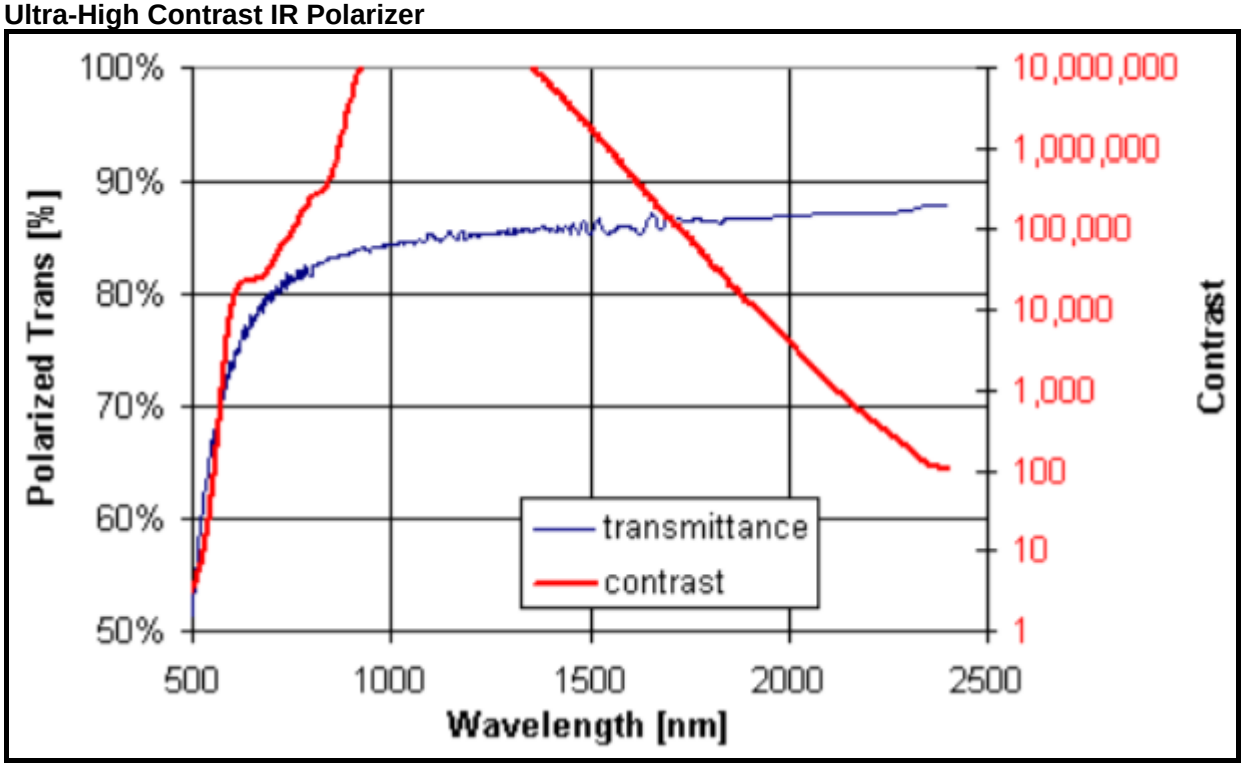
Ultra-High Contrast UV Polarizer



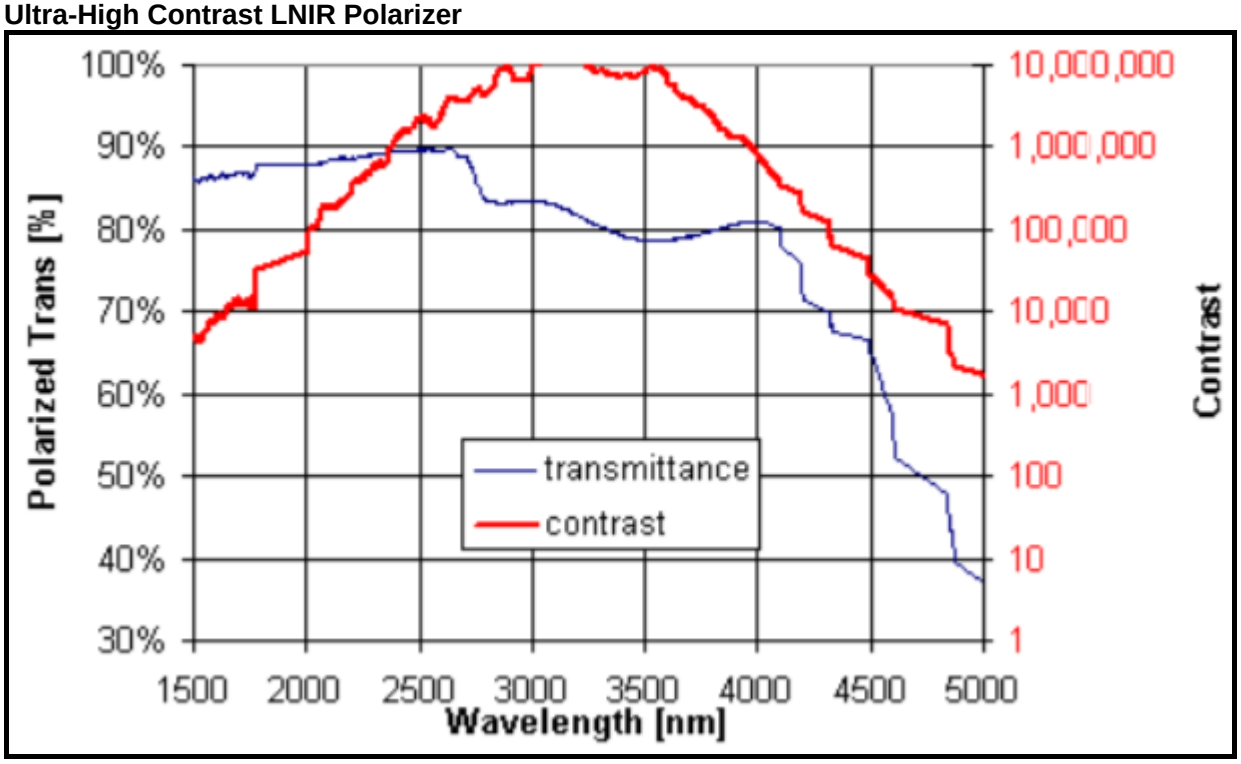
Ultra-High Contrast VIS Polarizer



Ultra-High Contrast IR Polarizer



Ultra-High Contrast LNIR Polarizer



Glan-Thompson Polarizer

By precisely controlling internal prism angles in these calcite polarizers, a very efficient linear polarizer is produced. Sintec Optronics offers Glan-Thompson Polarizers, intended for precision optical instrumentation and low power laser applications. Key advantages of Glan-Thompson Polarizers include excellent extinction ratio performance and a broad spectral range. Our Glan-Thompson Polarizers are supplied in a black anodized cylindrical housing for easy mounting.

Features:

- Broad spectral range
- Excellent extinction ratio

Technical specifications:

Wavelength Range	320 - 2300 nm
Substrate Material	Grade A Optical Calcite
Beam Deviation	± 3 arc-min
Reflectance (per surface, at normal incidence)	
Uncoated	~4.5%
Single Layer MgF2	~1.5%
Contrast Ratio	10,000:1 over central
	2/3 of clear aperture
Acceptance Angle	± 5°
Laser Damage Threshold	25-30 W/cm2 CW

Clear aperture (mm)	Wavelength range (mm)	AR coating	Part Number
.197 [5.0]	320-2300	none	STM-GTP-M05
.197 [5.0]	400-700	MgF2	STM-GTP-M05-0550
.197 [5.0]	650-1000	MgF2	STM-GTP-M05-0825
.197 [5.0]	1000-1500	MgF2	STM-GTP-M05-1250
.31 [7.9]	320-2300	none	STM-GTP-M08
.31 [7.9]	400-700	MgF2	STM-GTP-M08-0550
.31 [7.9]	650-1000	MgF2	STM-GTP-M08-0825
.31 [7.9]	1000-1500	MgF2	STM-GTP-M08-1250
.39 [9.9]	320-2300	none	STM-GTP-M08
.39 [9.9]	400-700	MgF2	STM-GTP-M10-0550
.39 [9.9]	650-1000	MgF2	STM-GTP-M10-0825
.39 [9.9]	1000-1500	MgF2	STM-GTP-M10-1250

Ultra Broadband Polarizer

Sintec Optronics provides an extremely broadband polarizer solution. Manufactured for a wavelength range of 300 to 2700 nm rivaling the span of a Glan-Thompson calcite polarizer, this optic is ideal for broadband applications. The proprietary composition of the Ultra Broadband Polarizer allows for an unprecedented width of spectral range at a fraction of the cost of other competing polarizers. This cost savings is coupled with a thickness of only 0.182" including mount and solid contrast ratio through the entire range from UV to IR.

Features:

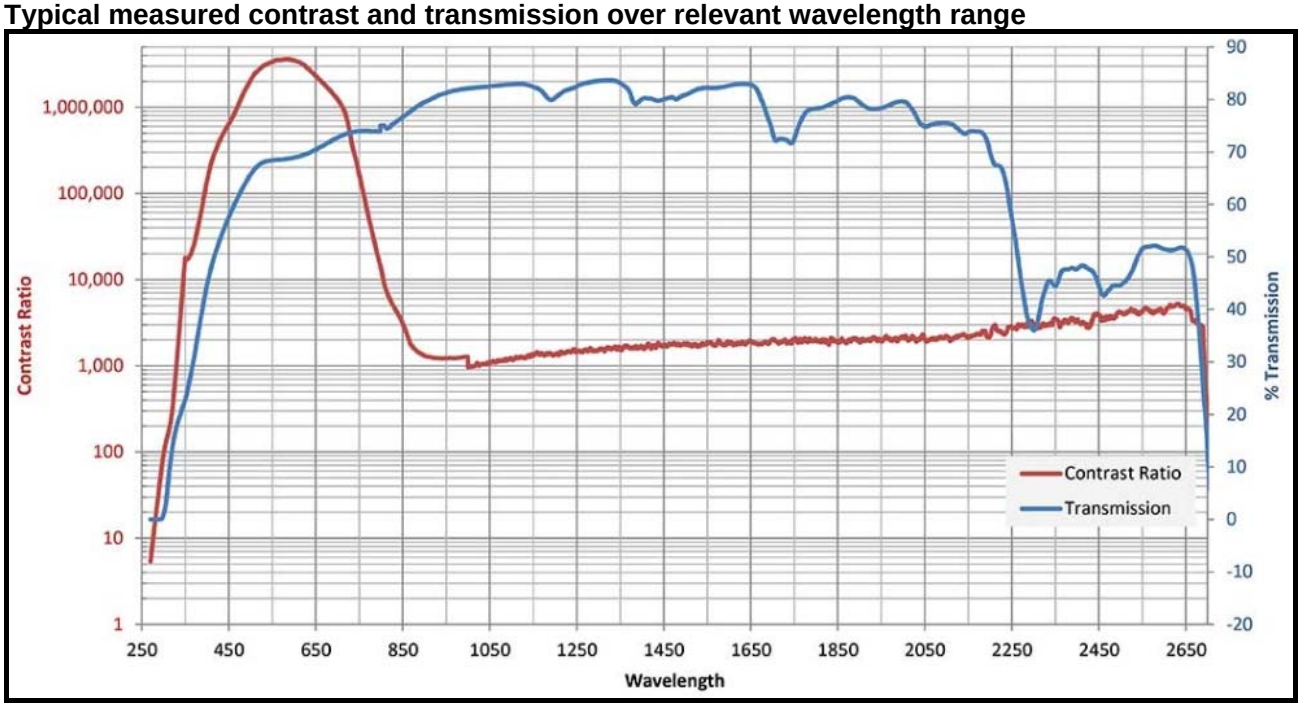
- Extremely broadband
- Wide acceptance angle
- Custom sizes and shapes
- Excellent transmitted contrast
- Thin, compact design

Technical specifications:

Stock Options	
Substrate Material	UV Grade Fused Silica
Wavelength Range	300-2700 nm, uncoated
Transmitted Wavefront Distortion	± 3.5 λ per inch (P-V@ 633 nm)
*Custom options available for	[≤ 1 λ per inch (RMS @ 633 nm)]
Improvement of TWD	
Surface Quality	80-50 scratch-dig
Acceptance Angle	± 40˚
Laser Damage Threshold	0.80 J/cm2 at 355 nm
	0.20 J/cm2 at 532 nm
	0.30 J/cm2 at 1064 nm
Operating Temperature	-50˚C to + 50˚C
Substrate Thickness	Polarizer Thickness ~ 0.087 in.
	Mount Thickness 0.182 in.
Custom Options	
Size	0.5"- 4.0"
Shape	Customer specified

Clear Aperture in. (mm)	Dimensions in. (mm)	Part number
Ø0.75	Ø1.00	STM-GPM-100-UNC
[19.3 mm]	[Ø25.4 mm]	
Ø1.25	Ø1.50	STM-GPM-150-UNC
[32.0 mm]	[Ø38.1 mm]	
Ø1.75	Ø2.00	STM-GPM-200-UNC
[44.7 mm]	[Ø50.8 mm]	

Typical measured contrast and transmission over relevant wavelength range



MWIR Polarizer

This polarizer is a wire grid on an antireflection coated silicon substrate optimized for 3 to 6 microns. The ring mounting provides for ease of handling and has the polarization transmission direction marked. The wire grid surface is quite delicate and should only be cleaned non-mechanically. Standard outer diameters are one and two inch but custom sizes, shapes and unmounted polarizers are also available.

Features:

- Excellent contrast ratio
- Thin profile
- High transmission
- Custom apertures > 2 inches available

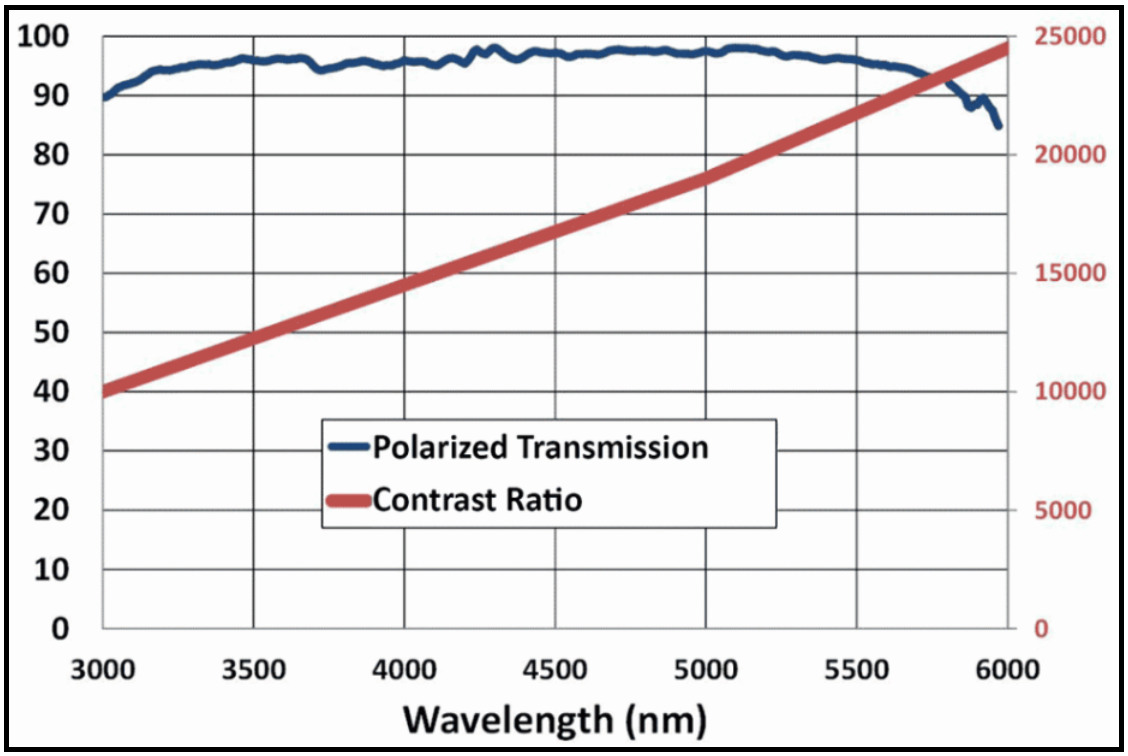
Technical specifications:

Substrate Material	Silicon, 0.7 mm thickness
AR Coating	Doubled sided AR
Wavelength Range	3 µm to 6 µm
Contrast Ratio	See graph
Acceptance Angle	≤ 20˚
Transmitted Wavefront Distortion	≤ 1.5 λ (P - V at 4 mm)
(per inch)	[≤ λ/3 (RMS at 4 mm)]
Beam Deviation	≤ 2 arc min
Maximum Aperture	Up to 4 in. circular
Surface Quality	80-50 scratch-dig

Clear aperture in. [mm]	Thickness in. [mm]	Diameter in. [mm]	Part Number
Ø0.76	0.182	Ø1.00	STM-MPM-100
[19.3]	[4.62]	[Ø25.4]	
Ø1.76	0.182	Ø2.00	STM-MPM-200
[44.7]	[4.62]	[Ø50.8]	

* Custom wavelengths are available between 420-3000 nm.

Typical measured contrast and transmission over relevant wavelength range


100
90
80
70
60
50
40
30
20
10
0
25000
20000
15000
10000
5000
0
3000
3500
4000
4500
5000
5500
6000
Wavelength (nm)
Polarized Transmission
Contrast Ratio

Deep Ultraviolet Polarizer

Developed for wavelengths between 245 and 285 nm, this polarizer is ideal for applications around 266 nm. Additionally, this polarizer is transparent in the visible range, allowing visible light to easily pass through. The UV Polarizer has a proprietary structure that allows for a high laser damage threshold. Custom shapes and sizes are possible due to the large manufactured substrates.

Features:

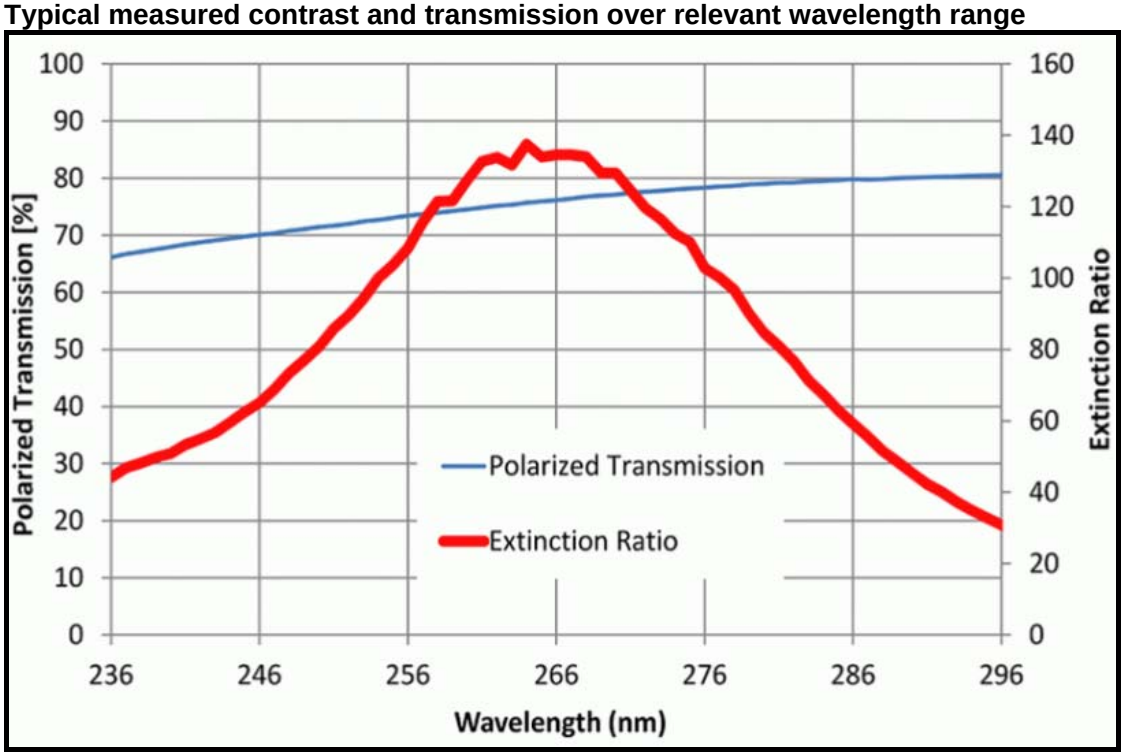
- Works between 245 to 285 nm
- Wire grid polarizer
- High damage threshold
- Transmission of > 60%
- Contrast ratio of up to 50:1

Technical specifications:

Substrate Material	Fused Silica, 1.0 mm thick
Wavelength Range	245 - 285 nm
Transmitted Wavefront Distortion	≤ λ/2 (P - V @ 633 nm)
	[≤ λ/8 (RMS @ 633 nm)]
Surface Quality	40-20 scratch-dig
Beam Deviation	≤ 5 arc-min
Acceptance Angle	0˚± 6˚

Clear aperture in. [mm]	Dimensions in. [mm]	Part number
Mounted Square		
Up to 1.20 [30.5]	Up to 2.00 [50.8]	Custom options available – please inquire
Unmounted Square		
0.4	0.5	STM-DUV-050-0266S
[10.2]	[2.7]	
0.8	1	STM-DUV-100-0266S
[20.3]	[25.4]	

Typical measured contrast and transmission over relevant wavelength range

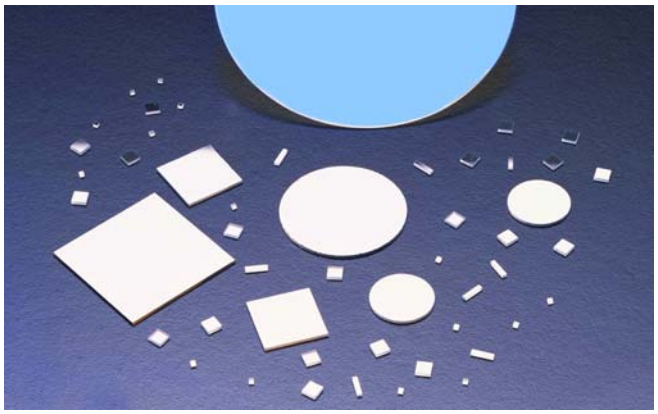


Wire Grid Versalight™ Polarizer

VersaLight™ is constructed of a thin layer of aluminum MicroWires® on a glass substrate and sets a new standard for applications requiring high durability, contrast and a wide field of view for visible through infrared wavelengths. VersaLight™ offers the performance quality of dichroic sheet polarizers while extending the operating temperature to 200° C. The nature of VersaLight's MicroWire construction allows it to perform as an exceptional polarizing beam splitter. In operation, VersaLight™ reflects one polarization state and transmits another, both with high contrast. VersaLight™ offers the broadest band and highest field of view of any polarizer material presently available. VersaLight™ can be shaped as needed and stacked to achieve very high contrast ratios. Large aperture VersaLight™ Polarizers are available on a custom basis, up to 200mm rounds.

Features:

- Broadband use
- Reflective polarizer
- Large acceptance angle

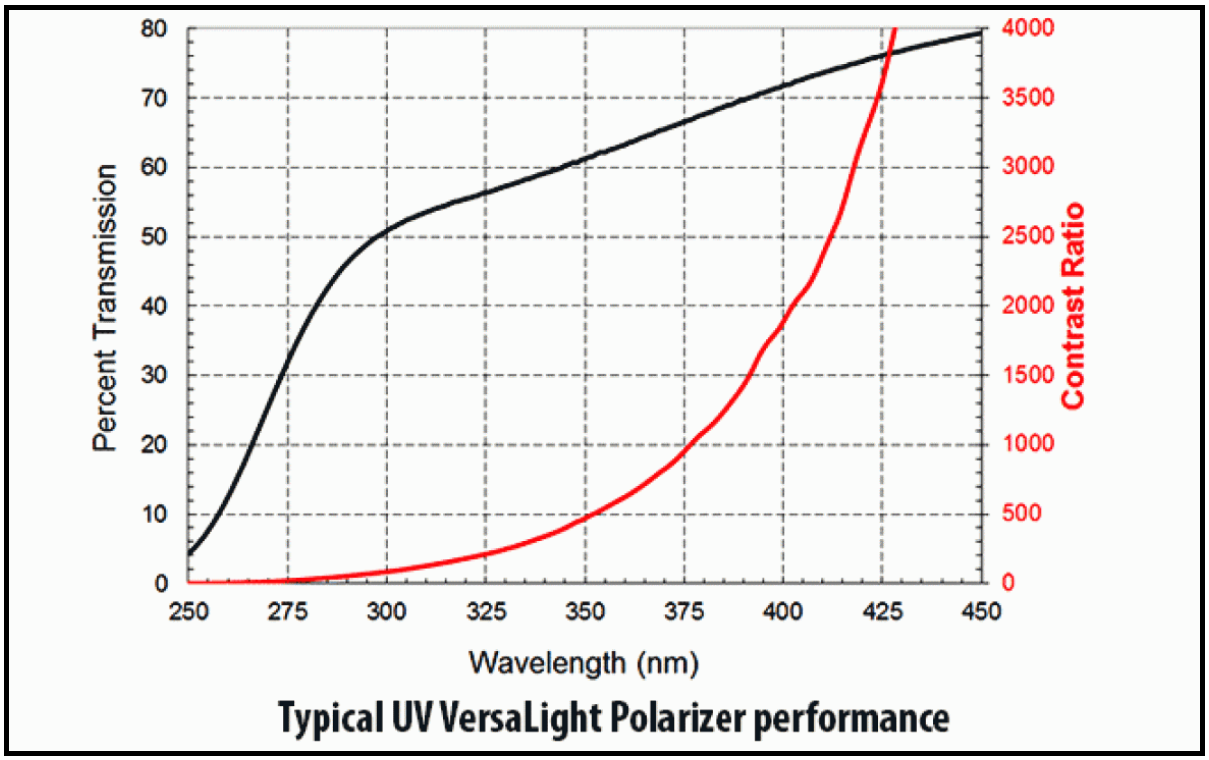


Technical specifications:

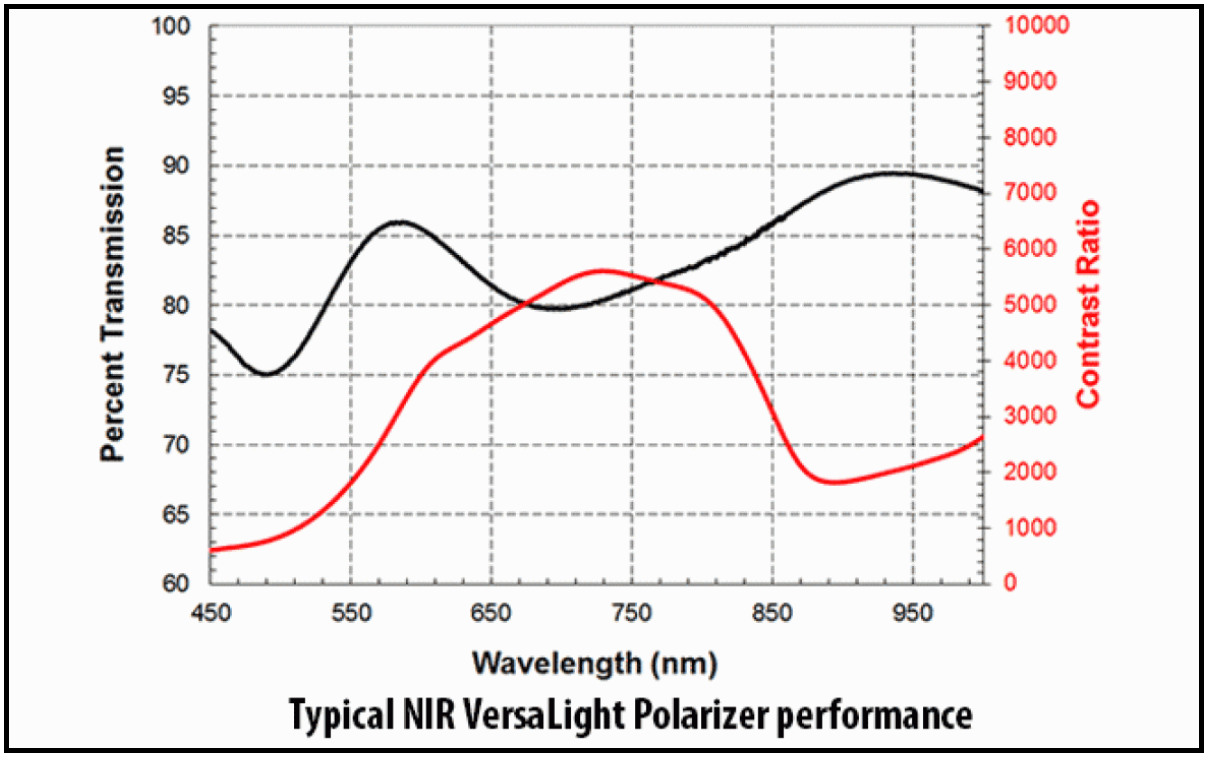
Wavelength Range	
Ultraviolet	325 nm to 450 nm
Near infrared	450 nm to 1000 nm
Infrared	1000 nm to 2000 nm
Substrate Material	
Ultraviolet	UV Grade Fused Silica
Near nfrared	Eagle XG®
Infrared	Eagle XG®
Transmitted Wavefront Distortion (P-V @ 632.8 nm)	
Ultraviolet	~ λ/4 per in.
Near Infrared	~ 5λ per in.
Infrared	~ 5λ per in.
Surface Quality (scratch-dig)	80-50
Beam Deviation	≤ 1arc-min
Contrast Ratio (see graph)	Typ. Reflection > 80:1
	Typ. Transmission > 2000:1
Maximum Temperature	200° C for single layer
Laser Damage Threshold	10 KW/cm2, CW, 1540 nm

* On ultraviolet Versalight, the wire grid surface will be unprotected, fragile and cannot be touched. UV VersaLight is optimized for 300-450 nm; NIR VersaLight is optimized for 450-1000 nm; IR VersaLight is optimized for 1000-2000 nm.

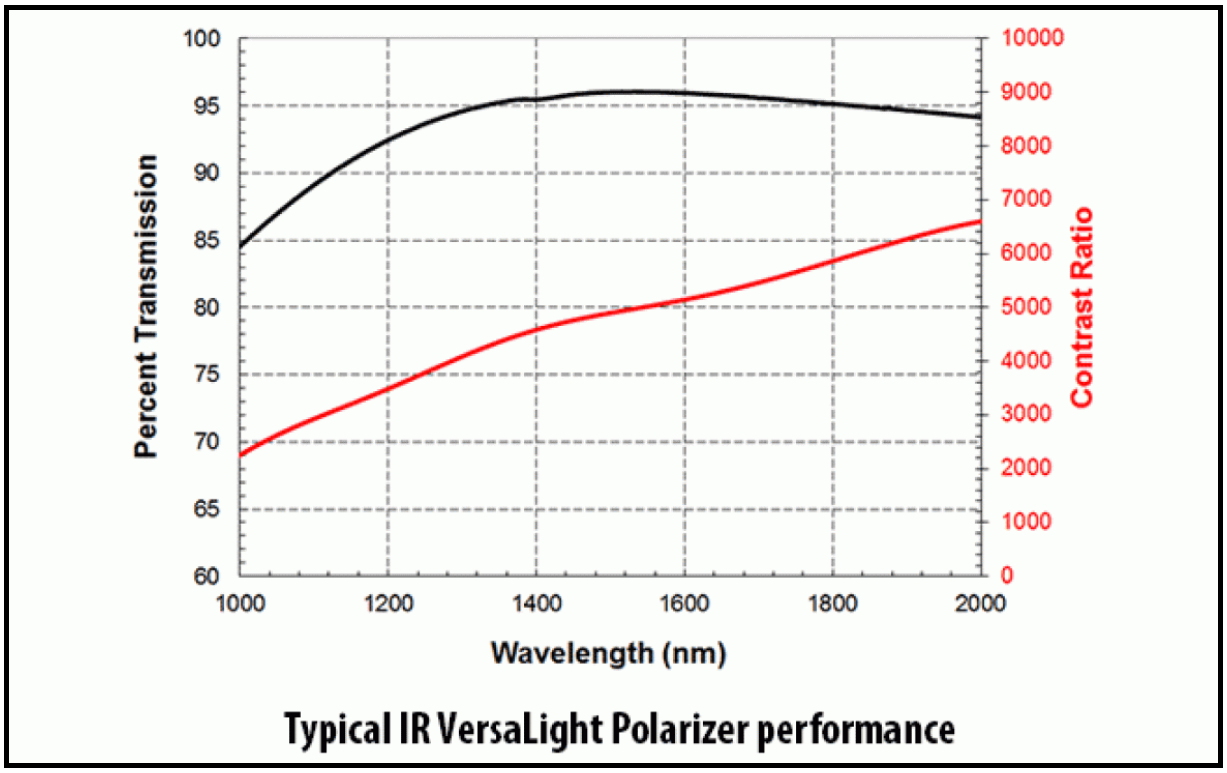
Square		
Thickness ± .002 in. [± 0.05 mm]	Diameter +0/-0.010 in. [+0/-0.25 mm]	Part number
0.039	0.5 × 0.5	STM-VLS-050-UV
[1.0]	[12.7 × 12.7]	
0.028	0.5 × 0.5	STM-VLS-050-NIR
[0.7]	[12.7 × 12.7]	
0.028	0.5 × 0.5	STM-VLS-050-IR
[0.7]	[12.7 × 12.7]	
0.039	1.0 × 1.0	STM-VLS-100-UV
[1.0]	[25.4 × 25.4]	
0.028	1.0 × 1.0	STM-VLS-100-NIR
[0.7]	[25.4 × 25.4]	
0.028	1.0 × 1.0	STM-VLS-100-IR
[0.7]	[25.4 × 25.4]	
0.039	2.0 × 2.0	STM-VLS-200-UV
[1.0]	[50.8 × 50.8]	
0.028	2.0 × 2.0	STM-VLS-200-NIR
[0.7]	[50.8 × 50.8]	
0.028	2.0 × 2.0	STM-VLS-200-IR
[0.7]	[50.8 × 50.8]	
Round		
0.039	Ø0.5	STM-VLR-050-UV
[1.0]	[Ø12.7]	
0.028	Ø0.5	STM-VLR-050-NIR
[0.7]	[Ø12.7]	
0.028	Ø0.5	STM-VLR-050-IR
[0.7]	[Ø12.7]	
0.039	Ø1.0	STM-VLR-100-UV
[1.0]	[Ø25.4]	
0.028	Ø1.0	STM-VLR-100-NIR
[0.7]	[Ø25.4]	
0.028	Ø1.0	STM-VLR-100-IR
[0.7]	[Ø25.4]	
0.039	Ø2.0	STM-VLR-200-UV
[1.0]	[Ø50.8]	
0.028	Ø2.0	STM-VLR-200-NIR
[0.7]	[Ø50.8]	
0.028	Ø2.0	STM-VLR-200-IR
[0.7]	[Ø50.8]	



Typical UV VersaLight Polarizer performance

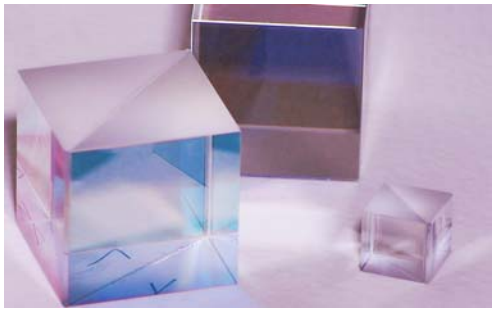


Typical NIR VersaLight Polarizer performance



Wire Grid Polarizing Beam Splitter

Sintec Optronics presents its Versalight wire grid polarizing beam splitters. Manufactured for wavelength ranges between 420 and 2600 nm, this polarizer is ideal for broadband and wide field-of-view applications. Wire grid polarizing beam splitters are manufactured out of our Versalight wire grid polarizer sandwiched between right angle prisms. No AR coatings are standard for maximum wavelength usage. Broadband AR coatings are available on the faces of the cube covering either visible (450 to 1100 nm) or IR (1000 to 2400 nm.)



Features:

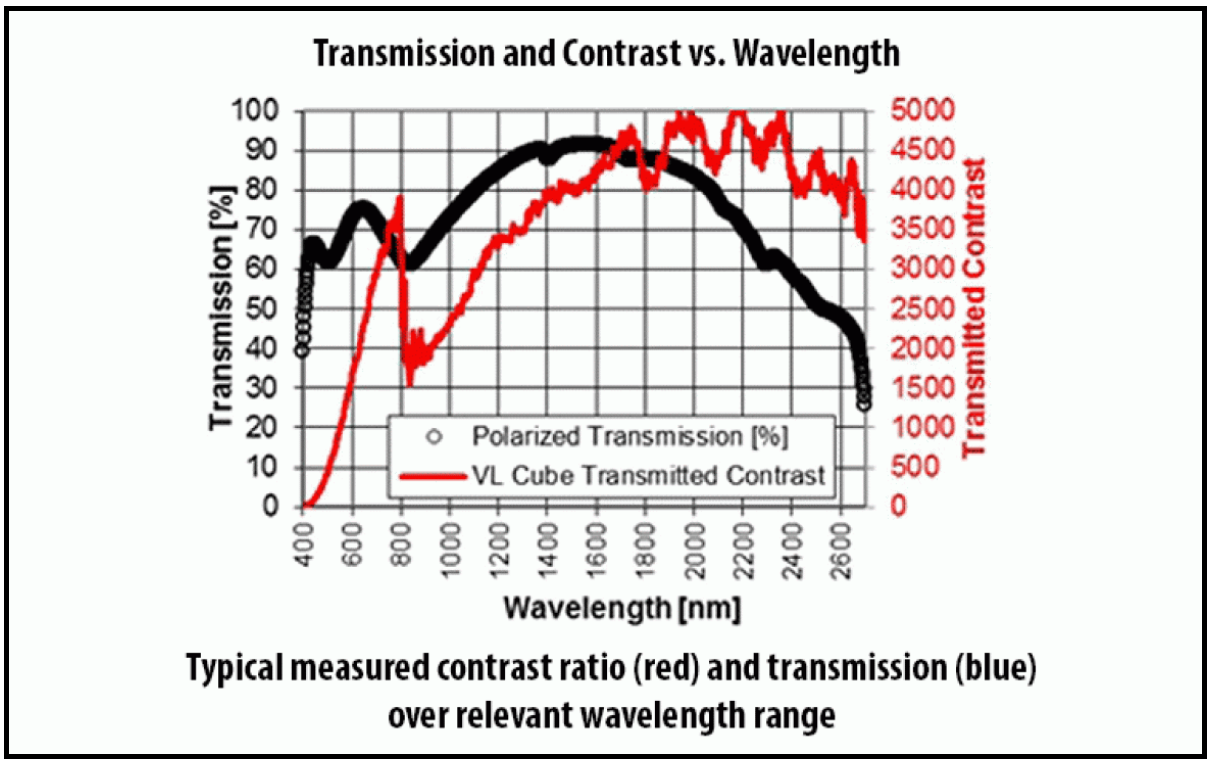
- Broadband wavelength range, 420-2600 nm
- Wide acceptance angle
- Custom sizes and shapes
- Excellent transmitted contrast

Technical specifications:

Substrate Material	N-BK7 (or equivalent)
Average Reflectivity	450-1100 nm - VIS - < 2.0 %
	Infrared1000-2400 nm - IR - < 2.0 %
	420-2600 nm - UNC - ~4.25%
Transmitted Wavefront Distortion	≤ λ/2 (P-V @ 633 nm)
	[≤ λ/8 (RMS @ 633 nm)]
Surface Quality	80-50 scratch-dig
Beam Deviation (transmittance)	≤ 5 arc-min
Dimensional Tolerance	± 0.020 in.
Acceptance Angle	± 40˚

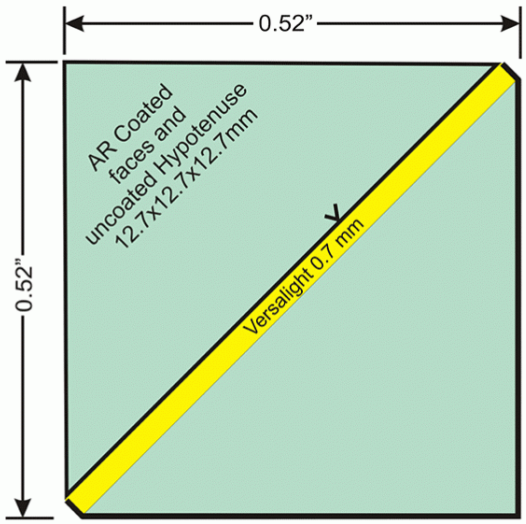
Operating Temperature	-40˚C to +75˚C

Unmounted		
Clear aperture in. [mm]	Dimensions in. [mm]	Part number
0.40 in. [10.2]	0.52 × 0.52 × 0.50 [13.2 × 13.2 × 12.7]	STM-BV-050-VIS
		STM-BV-050-IR
		STM-BV-050-UNC
0.80 in. [20.3]	1.02 × 1.02 × 1.00 [25.9 × 25.9 × 25.4]	STM-BV-100-VIS
		STM-BV-100-IR
		STM-BV-100-UNC
1.60 in. [40.6]	2.02 × 2.02 × 2.00 [51.3 × 51.3 × 50.8]	STM-BV-200-VIS
		STM-BV-200-IR
		STM-BV-200-UNC

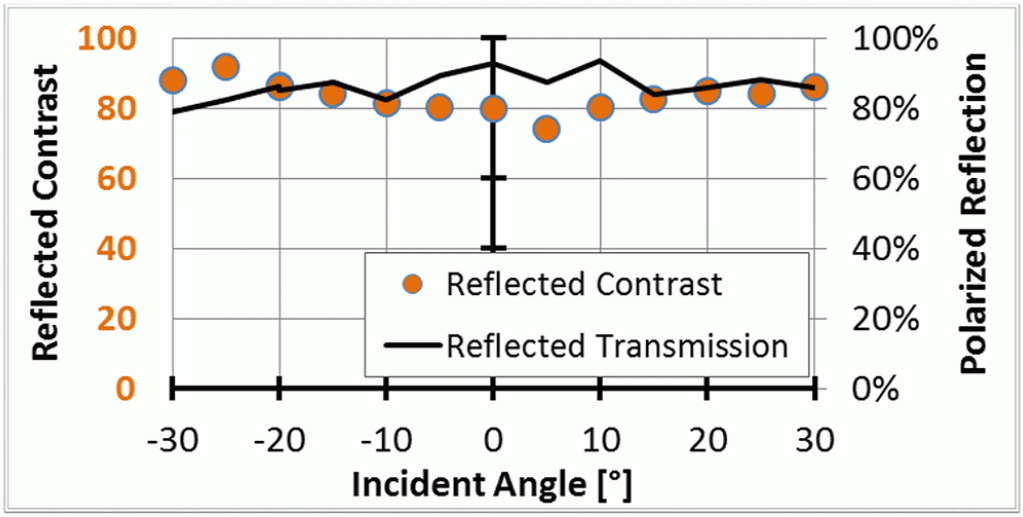


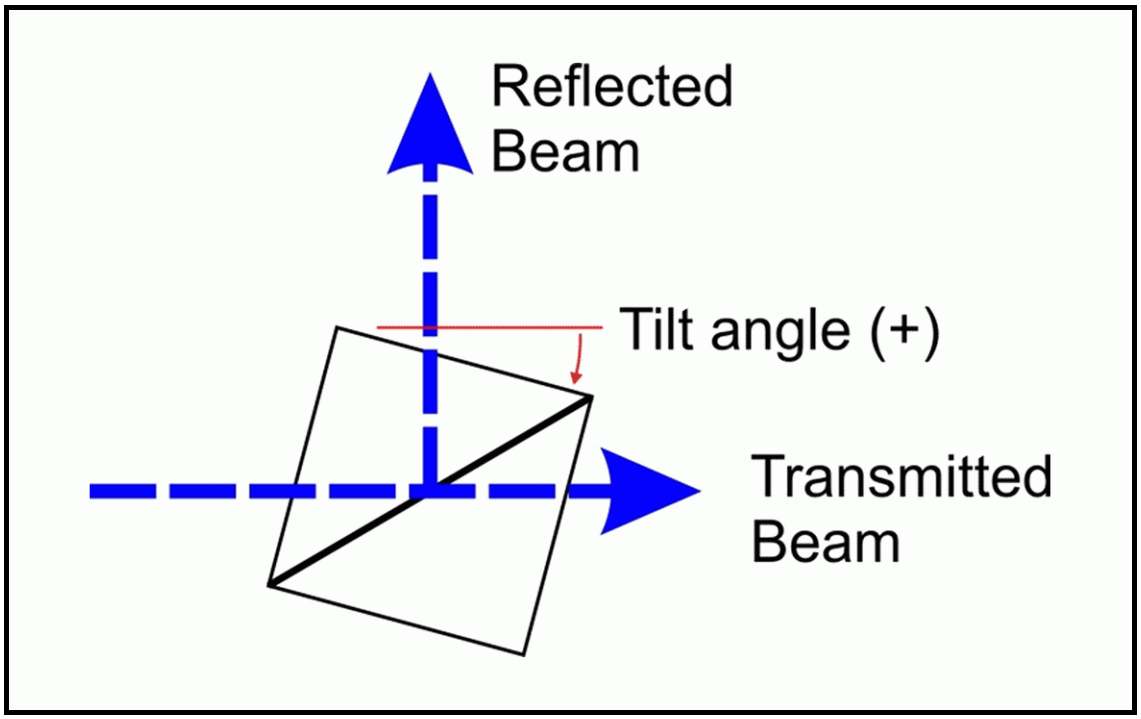
Typical measured contrast ratio (red) and transmission (blue) over relevant wavelength range

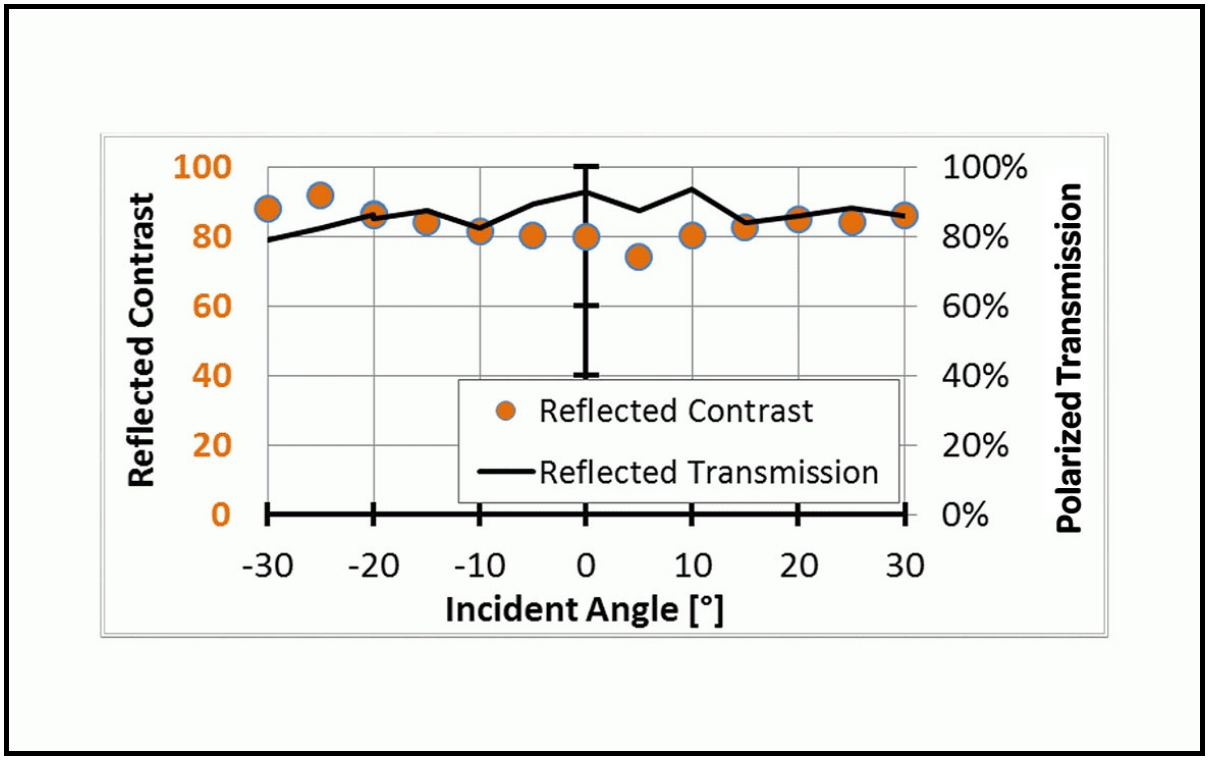
Mechanical configuration of wiregrid polarizer cube



One face of wire grid is index matched to right angle prism to avoid ghost reflections.




Reflected
Beam
Tilt angle (+)
Transmitted
Beam

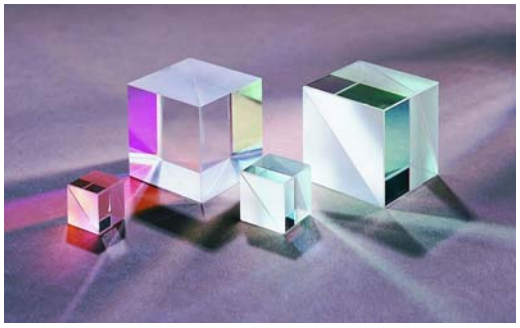

Reflected Contrast
Polarized Transmission
100
80
60
40
20
0
100%
80%
60%
40%
20%
0%
-30
-20
-10
0
10
20
30
Incident Angle [°]
Reflected Contrast
Reflected Transmission

Laser Line Beamsplitting Polarizer

Right-angle prisms are matched in pairs to produce high quality laser line beamsplitting polarizers with superior wavefront quality in both transmission and reflection. The hypotenuse face of one prism is coated with a multilayer dielectric beamsplitting coating optimized for laser performance. Two prisms are cemented together, protecting the critical coating from performance-degrading environmental factors. Each cube separates an unpolarized incident beam into two orthogonal, linearly polarized components with negligible absorption. Following the principle of pile-of-plates polarizers, p-polarized light is transmitted with approximatley 1000:1 contrast and s-polarization is reflected with approximatley 20:1 contrast. These polarizers perform best with collimated or near-collimated light.

Features:

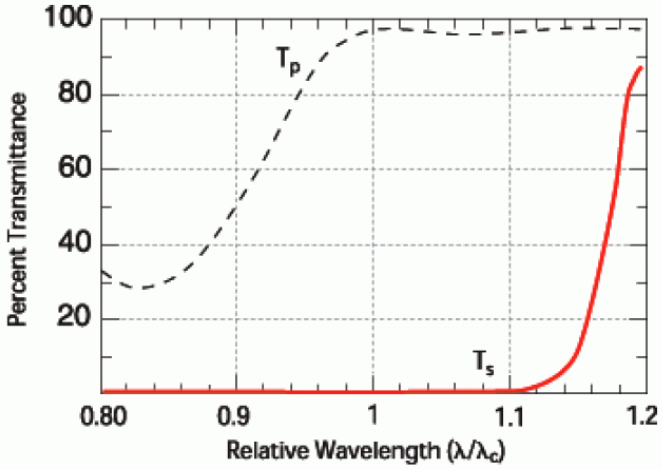
- High contrast
- Low reflectance
- Low transmitted wavefront distortion



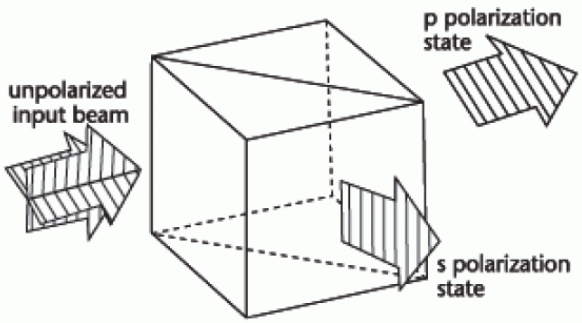
Technical specifications:

Substrate	N-BK7
Transmitted Wavefront Distortion	≤ λ/5 for p-polarized beam
(P-V @ 632.8 nm)	
(P-V @ 632.8 nm)	
Surface Quality (scratch-dig)	40-20
Beam Deviation	
Transmitted	≤ 3 arc-min
Reflected	≤ 6 arc-min
Reflectance (per surface)	≤ 0.5%
Contrast Ratio	
Transmitted	≤ 500:1
Reflected	≤ 20:1
Transmission	
p-polarized light	≥ 95% transmitted
s-polarized light	≥ 99% reflected
Acceptance Angle	± 2˚
Storage Temperature	-40˚C to +100˚C
Operating Temperature	-40˚C to +100˚C
Laser Damage Threshold	500 W/cm2, CW
	300 mJ/cm2, 10 ns, visible
	200 mJ/cm2, 10 ns, 1064 nm

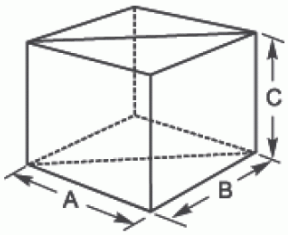
Dimensions ± 0.020 in. [± 0.51 mm]	Part number
0.50 × 0.50 x 0.50	STM-BP-050-λ
[12.7 x 12.7 x 12.7]	
1.00 × 1.00 × 1.00	STM-BP-100-λ
[25.4 × 25.4 × 25.4]	



Typical performance of a Laser Line Beamsplitting Polarizer



Beamsplitting polarizers provide two orthogonally polarized beams, conveniently separated by 90°



Beamsplitting polarizers provide two orthogonally polarized beams, conveniently separated by 90°

Broadband Beamsplitting Polarizer

For applications involving broadband or tunable wavelength sources, Sintec Optronics presents a line of Broadband Beamsplitting Polarizers covering the visible to near infrared region. These cubes offer increased utility for a range of polarization needs. As with the Laser Line Beamsplitting Polarizers, two usable polarization forms result, conveniently separated by 90°. For unpolarized input, incident light will be equally split, 50% transmitted and reflected. Varying the input polarization axis will change the split ratio. These broadband designs require well-collimated input and accurate angular alignment for optimal performance. All four entrance and exit faces are antireflection coated to minimize losses.

Features:

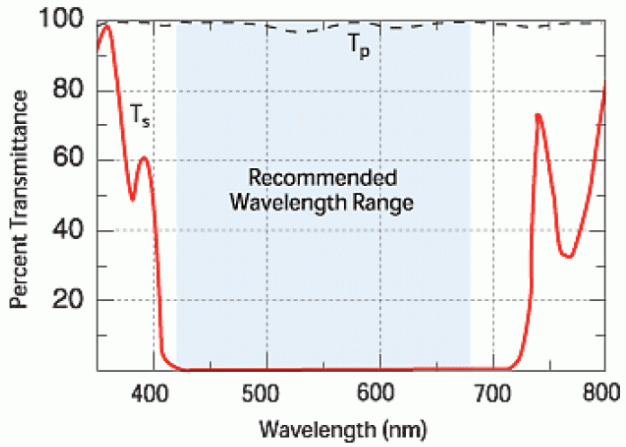
- High contrast
- Low reflectance
- Broad spectral range
- High damage threshold

Technical specifications:

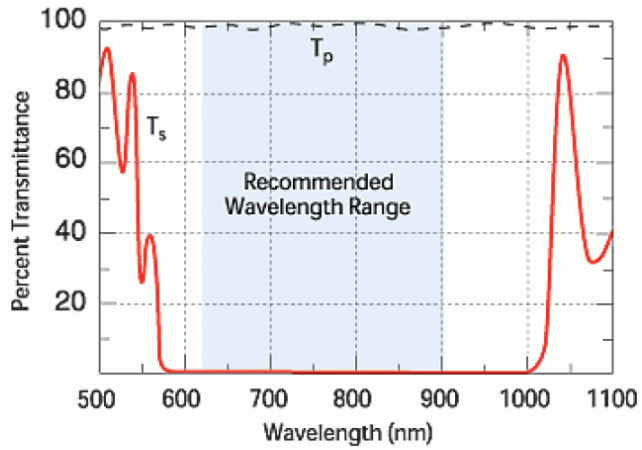
Wavelength Range	
Visible	440-680 nm
Near IR1	620-900 nm
Near IR2	820-1250 nm
Near IR3	1150-1600 nm
Substrate Material	SF 2
Transmitted Wavefront Distortion	≤ λ/5 for p-polarized beam
(P-V @ 632.8 nm)	
(P-V @ 632.8 nm)	

Beam Deviation	
Transmitted	≤ 3 arc-min
Reflected	≤ 6 arc-min
Reflectance (per surface)	≤ 0.5%
Contrast Ratio	
Transmitted	≥ 500:1
Reflected	≥ 20:1
Transmission	
p-polarized light	≥ 95% transmitted
s-polarized light	≥ 98% reflected
Clear Aperture	Central 80% diameter
Acceptance Angle	± 2˚
Storage Temperature	-40˚C to +100˚C
Operating Temperature	-40˚C to +100˚C
Laser Damage Threshold	500 W/cm2, CW
	300 mJ/cm2, 10 ns, visible
	200 mJ/cm2, 10 ns, 1064 nm

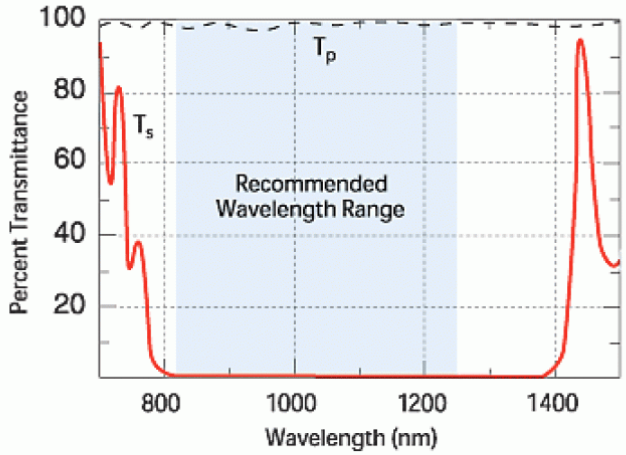
Clear aperture	Dimensions ± 0.020 in. [± 0.51 mm]	Part number
Visible (440-680)		
0.40 × 0.40 × 0.40	0.50 × 0.50 × 0.50	STM-BB-050-VIS
[10.2 x 10.2 x 10.2]	[12.7 x 12.7 x 12.7]	
0.80 × 0.80 × 0.80	1.00 × 1.00 × 1.00	STM-BB-100-VIS
[20.3 × 20.3 × 20.3]	[25.4 × 25.4 × 25.4]	
Near IR1 (620-900 nm)		
0.40 × 0.40 × 0.40	0.50 × 0.50 × 0.50	STM-BB-050-IR1
[10.2 x 10.2 x 10.2]	[12.7 x 12.7 x 12.7]	
0.80 × 0.80 × 0.80	1.00 × 1.00 × 1.00	STM-BB-100-IR1
[20.3 × 20.3 × 20.3]	[25.4 × 25.4 × 25.4]	
Near IR2 (820-1250 nm)		
0.40 × 0.40 × 0.40	0.50 × 0.50 × 0.50	STM-BB-050-IR2
[10.2 x 10.2 x 10.2]	[12.7 x 12.7 x 12.7]	
0.80 × 0.80 × 0.80	1.00 × 1.00 × 1.00	STM-BB-100-IR2
[20.3 × 20.3 × 20.3]	[25.4 × 25.4 × 25.4]	
Near IR3 (1150-1600 nm)		
0.40 × 0.40 × 0.40	0.50 × 0.50 × 0.50	STM-BB-050-IR3
[10.2 x 10.2 x 10.2]	[12.7 x 12.7 x 12.7]	
0.80 × 0.80 × 0.80	1.00 × 1.00 × 1.00	STM-BB-100-IR3
[20.3 × 20.3 × 20.3]	[25.4 × 25.4 × 25.4]	



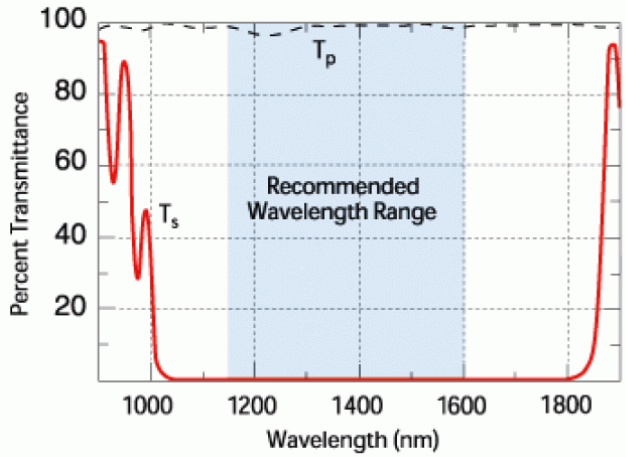
Design Performance of Visible Broadband Beamsplitting Polarizer



Design Performance of IR1 Broadband Beamsplitting Polarizer



Design Performance of IR2 Broadband Beamsplitting Polarizer



Design Performance of IR3 Broadband Beamsplitting Polarizer

Dichroic Circular Polarizer

Dichroic Circular Polarizers consist of a dichroic linear polarizer and true zero-order quarterwave retarder. Precisely aligning the retarder fast axis at 45° to the linear polarization direction ensures optimum performance. True zero-order retarders are used in the assembly of our Dichroic Circular Polarizers and tight retardance tolerances contribute to the final performance.

Features:

- High isolation
- Large diameters available
- Low transmitted wavefront distortion

Technical specifications:

Standard Wavelengths	532, 632.8, 670, 780, 850, 1064, and 1550 nm
Substrate Material	N-BK7
Polarizer Material	Dichroic Polymer
Retarder Material	Birefringent Polymer
Transmitted Wavefront Distortion (P-V @ 632.8 nm)	
Visible	≤ λ/5
Near Infrared	≤ λ/2
Beam Deviation	
Visible	≤ 1 arc-min
Near Infrared	≤ 2 arc-min
Surface Quality (scratch-dig)	40-20
Reflectance (per surface)	≤ 0.5%
Isolation	>99.8%
Storage Temperature	-20˚C to +50˚C
Operating Temperature	-20˚C to +50˚C
Laser Damage Threshold	1 W/cm2, CW

Mounted			
Clear aperture in. [mm]	Thickness in. [mm]	Diameter ± 0.005 in. [± 0.13 mm]	Part number
0.4	0.25	Ø1.00	STM-CPM-050-λ
[10.2]	[6.35]	[Ø25.4]	
0.7	0.35	Ø1.00	STM-CPM-100-λ
[17.8]	[8.9]	[Ø25.4]	
1.2	0.5	Ø2.00	STM-CPM-200-λ
[30.5]	[12.7]	[Ø50.8]	
Unmounted			
Clear aperture in. [mm]	Thickness in. [mm]	Diameter +0/-0.010 in. [+0/-0.25 mm]	Part Number
0.4	0.13	Ø0.50	STM-CP-050-λ
[10.2]	[3.3]	[Ø12.7]	
0.8	0.26	Ø1.00	STM-CP-100-λ
[20.3]	[6.6]	[Ø25.4]	

Beam Separator

Beam Separators are designed for laser line applications and consist of a true zero-order quarter-wave retarder aligned with its fast axis at 45° to the transmission axis of a Laser Line Beamsplitting Polarizer. The transmitted beam is circularly polarized, regardless of the input beam polarization state. Our true zero-order Precision Retarders are quarter-wave within ± λ/350 and aligning the fast axis to within 1° ensures greater than 99.8% source isolation from specular back reflections.

Features:

- High isolation
- Large diameters available
- Low transmitted wavefront distortion

Technical specifications:

Standard Wavelengths	532, 632.8, 670, 780, 850, 1064, and 1550 nm
Substrate Material	N-BK7
Transmitted Wavefront Distortion(P-V @ 632.8 nm)	≤ λ/5
Surface Quality (scratch-dig)	40-20
Beam Deviation	≤ 3 arc-min
Reflectance (per surface, at normal incidence)	≤ 0.5%
Acceptance Angle	± 2˚
Storage Temperature Range	-20˚C to +50˚C
Operating Temperature	-20˚C to +50˚C
Laser Damage Threshold	500 W/cm2, CW 300 mJ/cm2, 10 ns, visible 200 mJ/cm2, 10 ns, 1064 nm

Clear aperture in. [mm]	Cube Dimensions ± 0.020 in. [± 0.51 mm]	Part number
0.4	0.50 × 0.50 × 0.50	STM-BS-050-λ
[10.2]	[12.7 x 12.7 x 12.7]	
0.8	1.00 × 1.00 × 1.00	STM-BS-100-λ
[20.3]	[25.4 × 25.4 × 25.4]	

Waveplate Retarders

Precision Achromatic Retarder

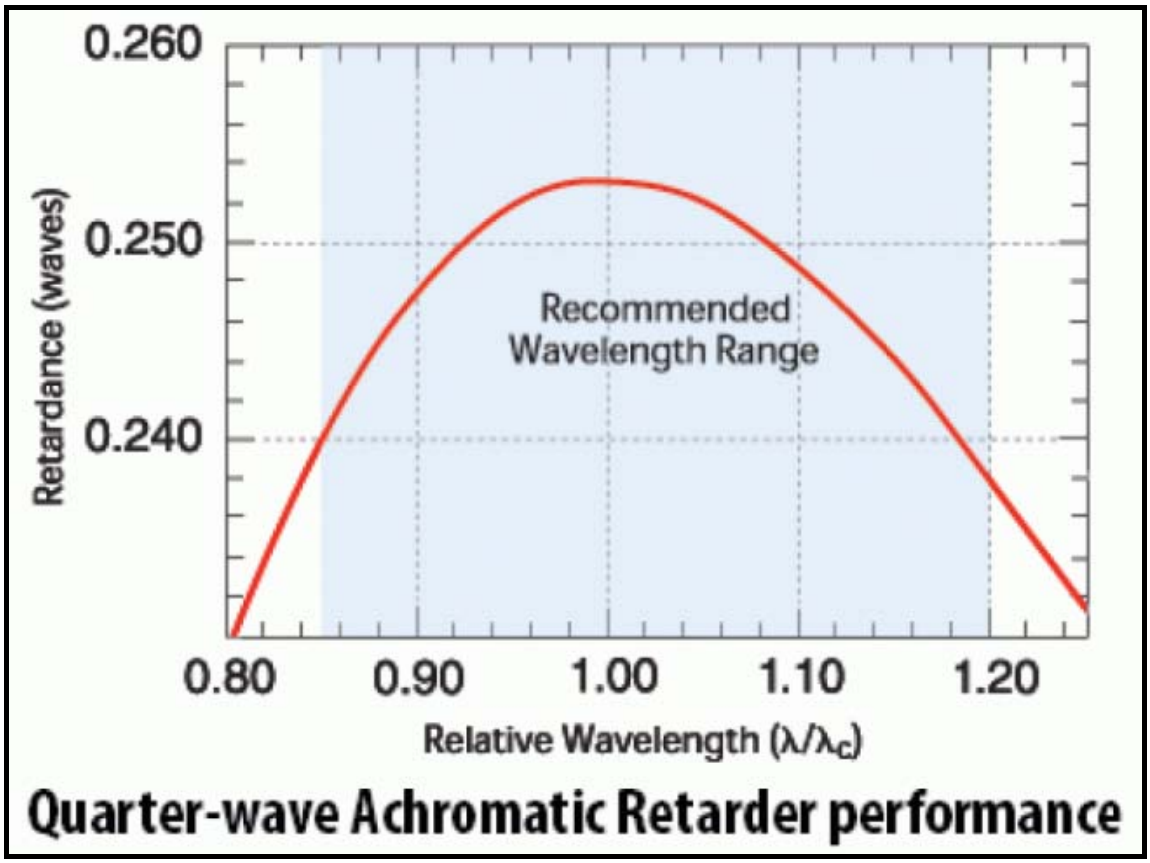
Sintec Optronics Precision Achromatic Retarders are designed to provide a nearly constant retardance over a broad wavelength region. Standard quarter- and half-wave devices are available for common wavelength regions in the visible and near infrared.

Features:

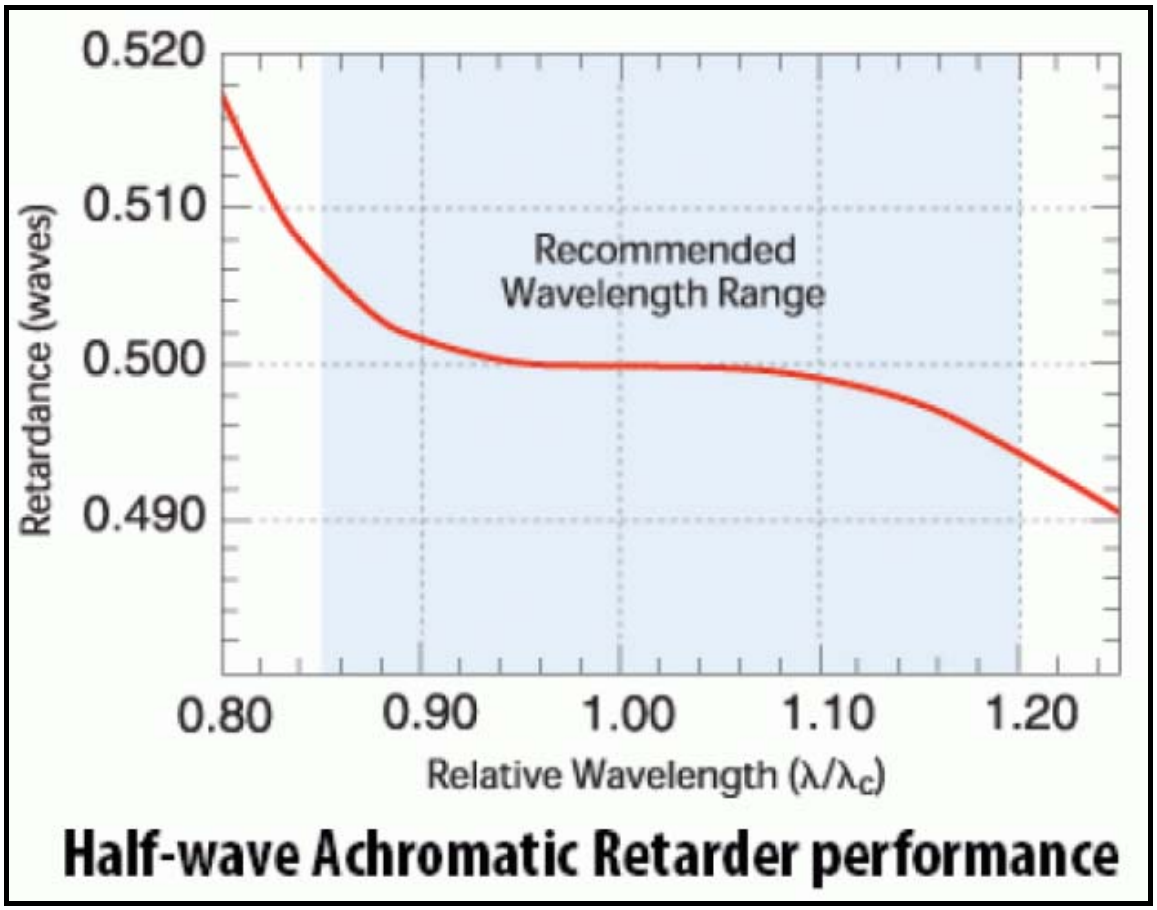
- Broad spectral range
- Superior field of view

Technical specifications:

Retarder Material	Birefringent Polymer
Substrate Material	N-BK7
Standard Wavelengths	
545	(485-630 operating range)
630	(555-730 operating range)
720	(630-835 operating range)
840	(735-985 operating range)
1060	(920-1240 operating range)
1400	(1200-1650 operating range)
Custom Wavelengths	400-1800 nm (specify)
Retardance	λ/4 and λ/2
Retardance Accuracy	≤ λ/100
Transmitted Wavefront Distortion	≤ λ/4
Surface Quality (scratch-dig)	40-20
Beam Deviation	≤ 1 arc-min
Reflectance (per surface)	≤ 0.5% at normal incidence
Threshold	500 W/cm2, CW; 600 mJ/cm2, 20 ns, visible; 4 J/cm2, 20 ns, 1064 nm
Operating Temperature	-20˚C to +50˚C



Quarter-wave Achromatic Retarder performance



Half-wave Achromatic Retarder performance

Mounted			
Clear Aperture in. [mm]	Dimensions ± 0.005 in. [± 0.13 mm]	Thickness ± 0.020 in.[±0.51 mm]	Part Number
Quarter Wave			
0.4 [10.2]	Ø1.00 [Ø25.4]	0.25 [6.35]	STM-AQM-050-λ
0.7 [17.8]	Ø1.00 [Ø25.4]	0.35 [8.9]	STM-AQM-100-λ
1.2 [30.5]	Ø2.00 [Ø50.8]	0.5 [12.7]	STM-AQM-200-λ
Half Wave			
0.4 [10.2]	Ø0.50 [Ø12.7]	0.25 [6.4]	STM-AHM-050-λ
0.7 [17.8]	Ø1.00 [Ø25.4]	0.35 [8.9]	STM-AHM-100-λ
1.2 [30.5]	Ø2.00 [Ø50.8]	0.5 [12.7]	STM-AHM-200-λ
Unmounted			
Clear Aperture in. [mm]	Dimensions =+ 0/-0.01 [+0/-0.25mm]	Thickness ± 0.020 in. [±0.51 mm]	Part Number
Quarter Wave			
0.4 [10.2]	Ø0.50 [Ø12.7]	0.14 [3.6]	STM-AQ-050-λ
0.8 [20.3]	Ø1.00 [Ø25.4]	0.28 [7.1]	STM-AQ-100-λ
1.6 [40.6]	Ø2.00 [Ø50.5]	0.5 [12.7]	STM-AQ-200-λ
Half Wave			
0.4 [10.2]	Ø0.50 [Ø12.7]	0.14 [3.6]	STM-AH-050-λ
0.8 [20.3]	Ø1.00 [Ø25.4]	0.28 [7.1]	STM-AH-100-λ
1.6 [40.6]	Ø2.00 [Ø50.5]	0.5 [12.7]	STM-AH-200-λ

Precision Superachromatic Retarder

Sintec Optronics is proud to introduce our new Precision Superachromatic Retarder - now with the broadest wavelength coverage of our entire retarder product line. These are available standard for two wavelength ranges - 420 to 1100 nm and 800 to 1700 nm - and in both quarter and half wave retardances. Custom devices are available for other wavelength ranges and retardances. Stock items are not anti-reflection coated due to the broad wavelength coverage but custom coatings can be provided. The Superachromatic Retarders contain carefully aligned birefringent polymer sheets laminated between precision polished optically flat N-BK7 windows. While assembly is quite similar to that of our Precision Retarders, optical transmission is slightly reduced because there are more polymer layers and there is no antireflection coating.These retarders are accurate to ± λ/50 over the entire wavelength range; we ship retardance measurements at more than 25 wavelengths accurate to ±0.001 waves with every Precision Superachromatic Retarder.

Features:

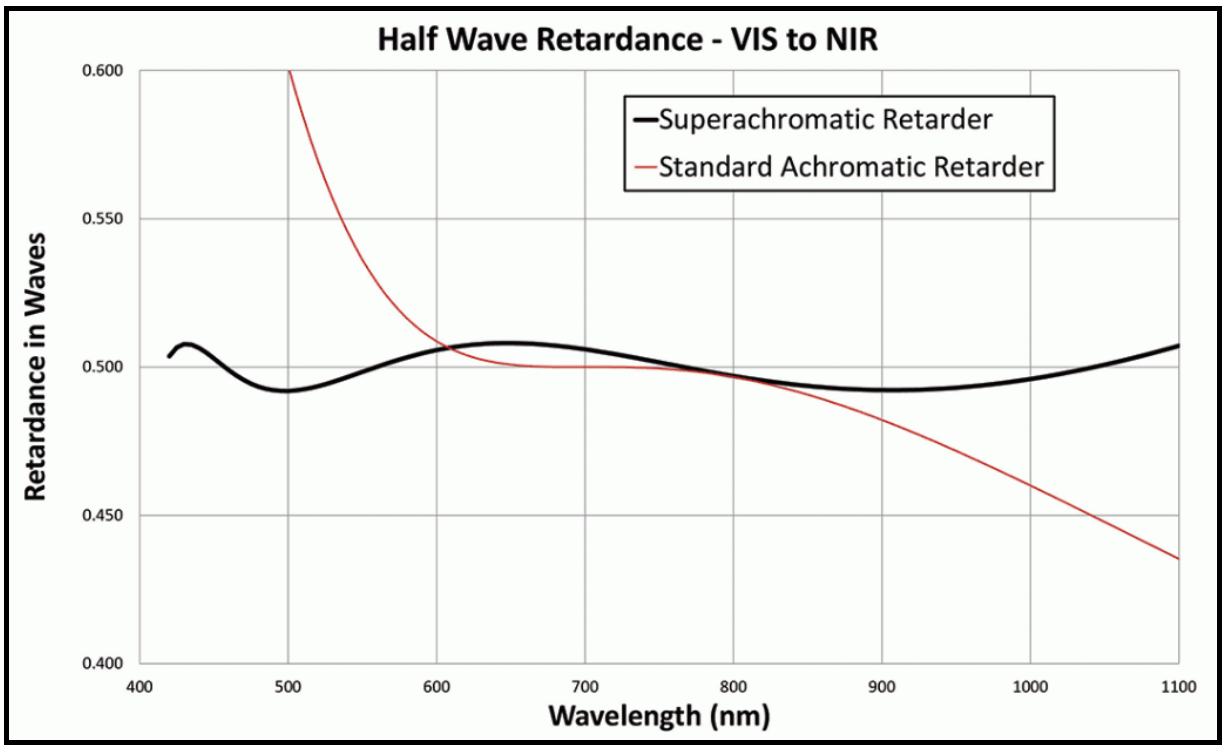
- Ultra-broadband wavelength range
- 420 to 1100 nm and 800 to 1700 nm
- Custom wavelength ranges available
- Custom retardances available
- Superior field of view

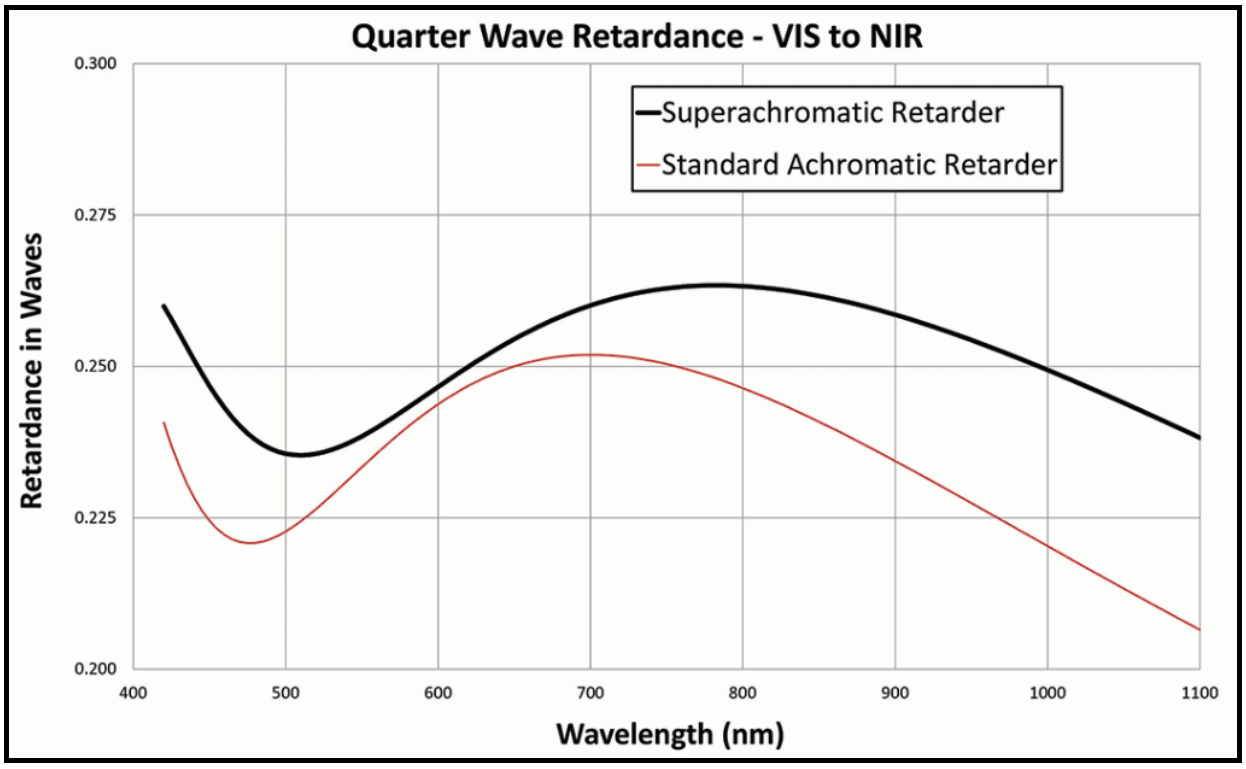
Technical specifications:

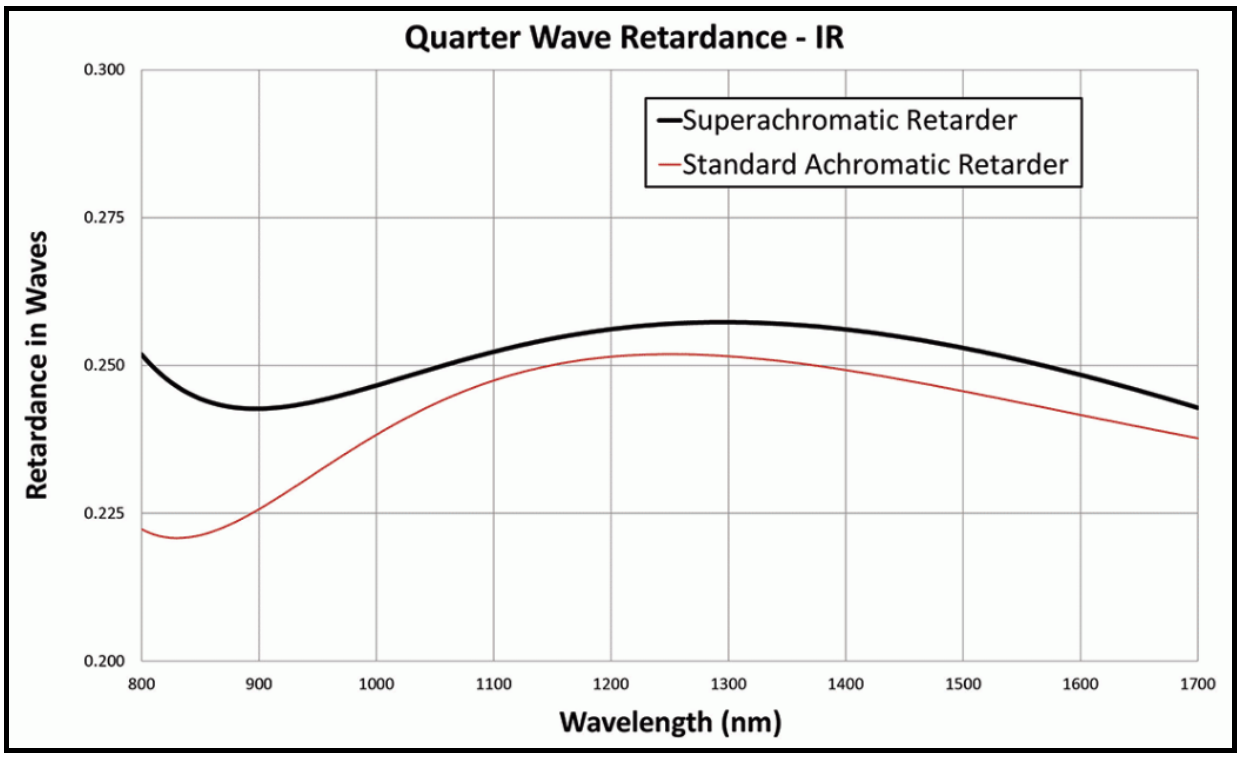
Retarder Material	Birefringent Polymer
Substrate Material	N-BK7
Wavelength Ranges	420-1100 nm, 800-1700 nm
TWD (1.00 in.)	λ/2 (P-V@ 633), [λ/8 (RMS @ 633)]

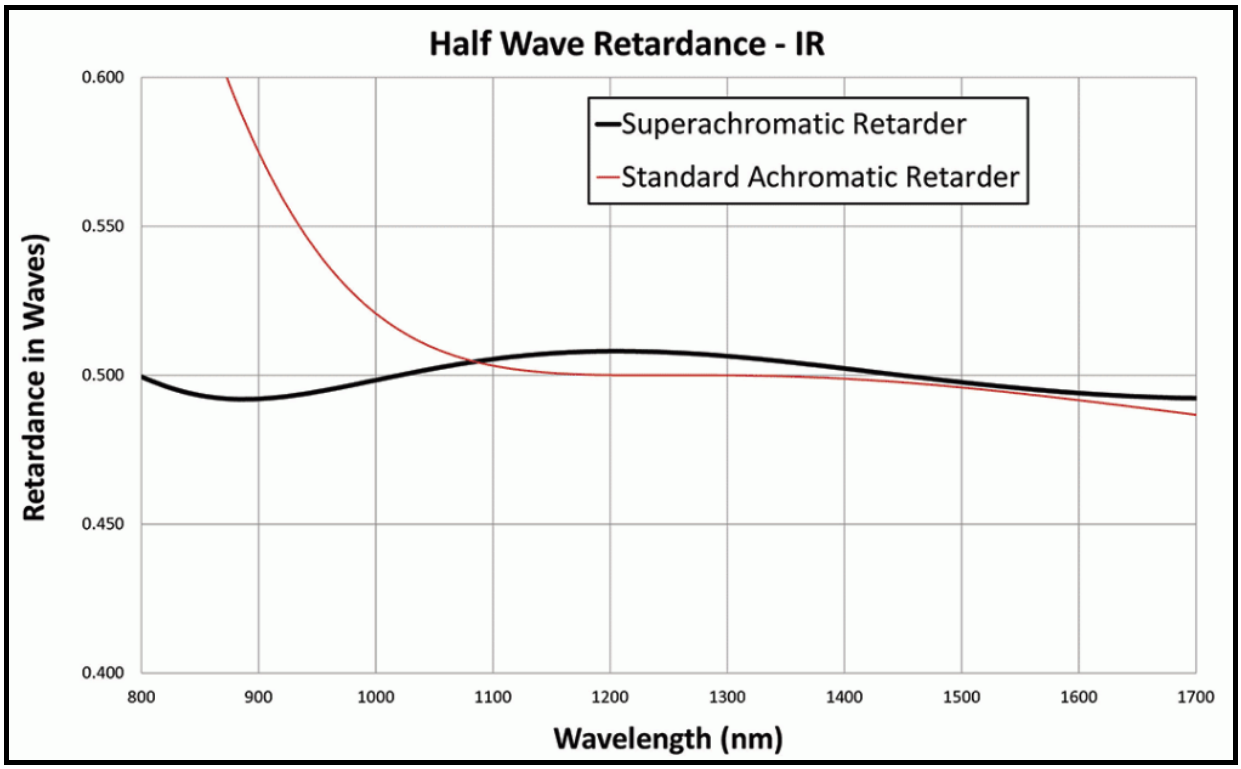
Retardance Accuracy	≤ λ/50
Acceptance Angle	±10°
Surface Quality	80-50 scratch-dig
Beam Deviation	≤ 2 arc-min
Temperature Range	10°C to 50°C (Operating)
Laser Damage Threshold	500 W/cm 2, CW; 300 mJ/cm2, 10ns, VIS; 500 mJ/cm2, 10ns, 1064 nm

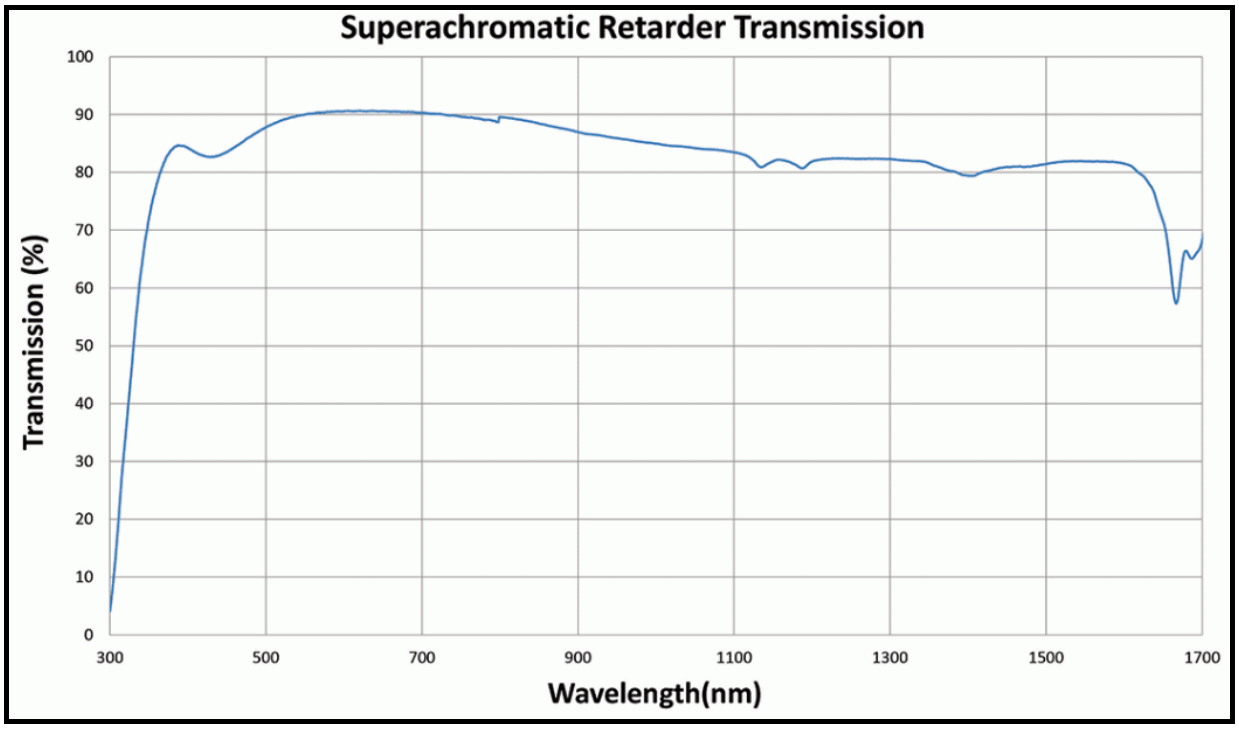
Mounted					
Diameter ±0.005 in. [±0.13 mm]	Clear Aperture in. [mm]	Thickness ±0.020 in. [±0.51 mm]	Wavelength Range [nm]	λ/4 Part Number	λ/2 Part Number
1.00 [25.4]	0.70 [17.8]	0.36 [9.1]	420 - 1100	STM-AQM-100S	STM-AHM-100S
1.00 [25.4]	0.70 [17.8]	0.36 [9.1]	800 - 1700	STM-AQM-100L	STM-AHM-100L
2.00 [50.8]	1.20 [30.5]	0.50 [12.7]	420 - 1100	STM-AQM-200S	STM-AHM-200S
2.00 [50.8]	1.20 [30.5]	0.50 [12.7]	800 - 1700	STM-AQM-200L	STM-AHM-100L
Unmounted					
Diameter ±0.010 in. [±0.25 mm]	Clear Aperture in. [mm]	Thickness ±0.020 in. [±0.51 mm]	Wavelength Range [mm]	λ/4 Part Number	λ/2 Part Number
1.00 [25.4]	0.80 [20.3]	0.27 [6.9]	420 - 1100	STM-AQ-100S	STM-AH-100S
1.00 [25.4]	0.80 [20.3]	0.27 [6.9]	800 - 1700	STM-AQ -100L	STM-AH-100L
2.00 [50.8]	1.60 [40.6]	0.51 [13.0]	420 - 1100	STM-AQ-200S	STM-AH-200S
2.00 [50.8]	1.60 [40.6]	0.51 [13.0]	800 - 1700	STM-AQ-200L	STM-AH-200L

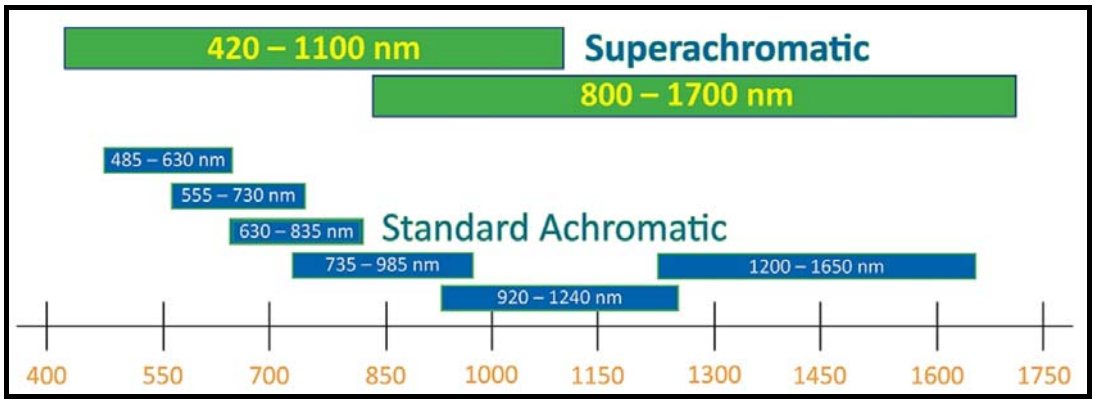



Quarter Wave Retardance - VIS to NIR
Superachromatic Retarder
Standard Achromatic Retarder
Retardance in Waves
0.300
0.275
0.250
0.225
0.200
400
500
600
700
800
900
1000
1100
Wavelength (nm)


Quarter Wave Retardance - IR
Superachromatic Retarder
Standard Achromatic Retarder
Retardance in Waves
0.300
0.275
0.250
0.225
0.200
800
900
1000
1100
1200
1300
1400
1500
1600
1700
Wavelength (nm)







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Precision Retarder

Sintec Optronics specializes in precision polymer retarders for the visible to near infrared region. Our Precision Retarders have the highest optical quality and tightest retardance tolerance of all polymer retarders. These true zero-order Precision Retarders consist of a birefringent polymer cemented between two precision polished, optically flat BK 7 windows. The retarder fast axis is conveniently marked for quick and easy reference. Precision Retarders are supplied with a broadband antireflection coating. Optical transmittance of a Precision Retarder is typically greater than 97%. The retardance at a wavelength λ that is different from the center wavelength λc is given by: δ ˜ δc(λc /λ) where δc is the retardance at λc. This relationship is very important when using sources which vary in wavelength from their nominal value. The 2 graphs show the retardance behavior as a function of relative wavelength for a quarter- and half-wave retarder, respectively. The Mueller calculus can be used to calculate the transmitted polarization state based upon the retardance differences from the ideal case. Since polymer retarders are true zero-order devices, they offer the significant advantage of improved angular performance. You can expect less than 1% retardance change over ±10° incidence angle. Sintec Optronics has developed precision ellipsometric techniques that can measure retardance to λ/1000.Our metrology for these measurements is the best in the industry. You can have absolute confidence that the calibration measurements supplied with your retarder are of the highest accuracy obtainable.

Features:

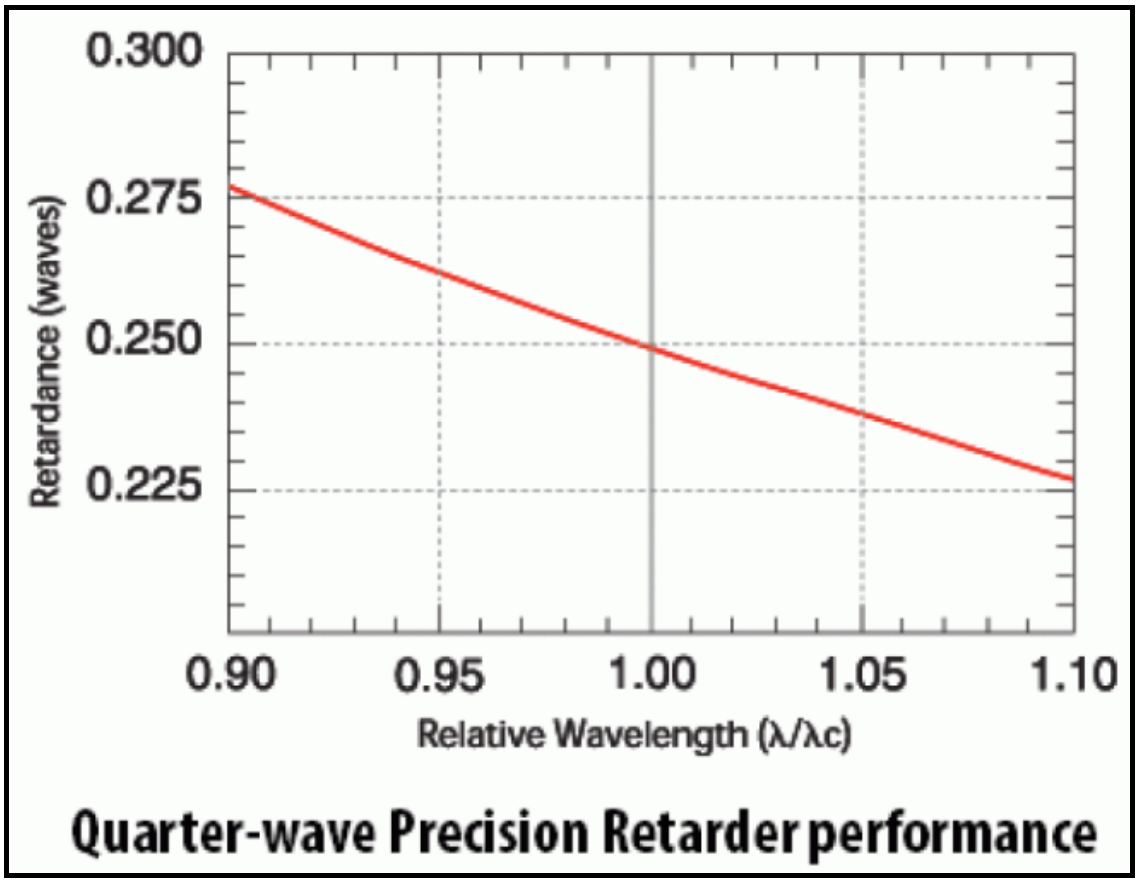
- True zero-order retarders
- Excellent off-axis performance
- Unequaled measured accuracy
- Less temperature dependence than quartz waveplates
- Lower cost than compound zero-order quartz waveplates
- Better angular acceptance than compound zero-order quartz waveplates

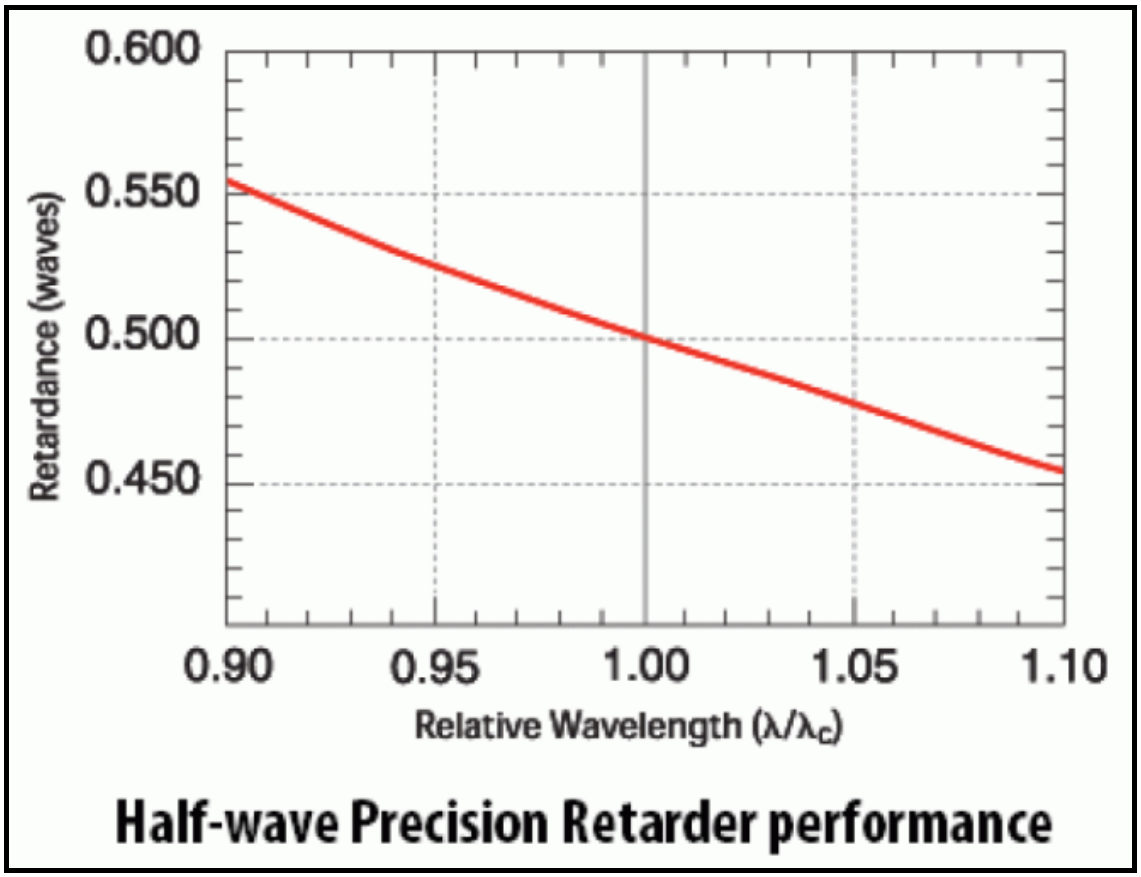
Technical specifications:

Retarder Material	Birefringent Polymer
Substrate Material	N-BK7
Stardard Wavelengths	532, 632.8, 670, 780, 850, 1064, and 1550 nm
Custom Wavelengths	400-1800 nm (specify)
Standard Retardances	λ/2 and λ/4
Retardance Accuracy	≤ λ/350
Retardance Change (at 30˚tilt)	≤ λ/40 and ≤ λ/80
Transmitted Wavefront Distortion	≤ λ/5
Surface Quality (scratch-dig)	40 -20
Beam Deviation	≤ 1 arc-min
Reflectance (per surface)	≤ 0.5% at normal incidence
Threshold	500 W/cm2, CW; 600 mJ/cm2, 20 ns, visible; 4 J/cm2, 20 ns, 1064 nm
Operating Temperature Range	-20˚C to -50˚C

Mounted			
Clear Aperture in. [mm]	Dimensions ± 0.005 in. [± 0.13 mm]	Thickness ± 0.020 in. [±0.51 mm]	Part Number
Half Wave			
0.4	Ø1.00	0.25	STM-NHM-050-λ
[10.2]	[Ø25.4]	[6.35]	
0.7	Ø1.00	0.35	STM-NHM-100-λ
[17.8]	[Ø25.4]	[8.9]	
1.2	Ø2.00	0.5	STM-NHM-200-λ
[30.5]	[Ø50.8]	[12.7]	

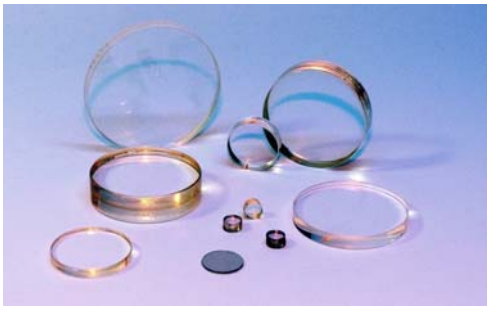
Quarter Wave			
0.4	Ø1.00	0.25	STM-NQM-050-λ
[10.2]	[Ø25.4]	[6.35]	
0.7	Ø1.00	0.35	STM-NQM-100-λ
[17.8]	[Ø25.4]	[8.9]	
1.2	Ø2.00	0.5	STM-NQM-200-λ
[30.5]	[Ø50.8]	[12.7]	
Unmounted			
Clear Aperture in. [mm]	Dimensions +0/-0.010 in. [+0/-0.25 mm]	Thickness ± 0.020 in. [± 0.51 mm]	Part Number
Half wave			
0.4	Ø0.50	0.13	STM-NH-050-λ
[10.2]	[Ø12.70]	[3.3]	
0.8	Ø1.00	0.26	STM-NH-100-λ
[20.3]	[Ø25.4]	[6.3]	
1.6	Ø2.00	0.51	STM-NH-200-λ
[40.6]	[Ø50.8]	[13.0]	
Quarter wave			
0.4	Ø0.50	0.13	STM-NQ-050-λ
[10.2]	[Ø12.70]	[3.3]	
0.8	Ø1.00	0.26	STM-NQ-100-λ
[20.3]	[Ø25.4]	[6.3]	
1.6	Ø2.00	0.51	STM-NQ-200-λ
[40.6]	[Ø50.8]	[13.0]	





Dual-Wavelength Retarder

Dual wavelength retarders can provide the same retardance at two wavelengths that are separated in wavelength by more than the span covered by an achromatic retarder. They can also provide different specified retardances at two different wavelengths. Traditionally these retarders have been made using crystal quartz and are multiorder retarders at both wavelengths. Our dual wavelength retarders use polymers instead. They are usually much lower order and consequently have a slower change in retardance with angle of incidence as shown in the graph. On average the order is about 20% of that for a comparable quartz dual wavelength retarder. Call for a quote on a custom coating on these normally uncoated retarders. The retardance tolerance is ±0.01waves at both wavelengths. Many custom combinations not listed in the catalog are available. Please call for a quote on your custom requirement. Standard unmounted sizes are 0.50 inches and 1.00 inches.



Features:

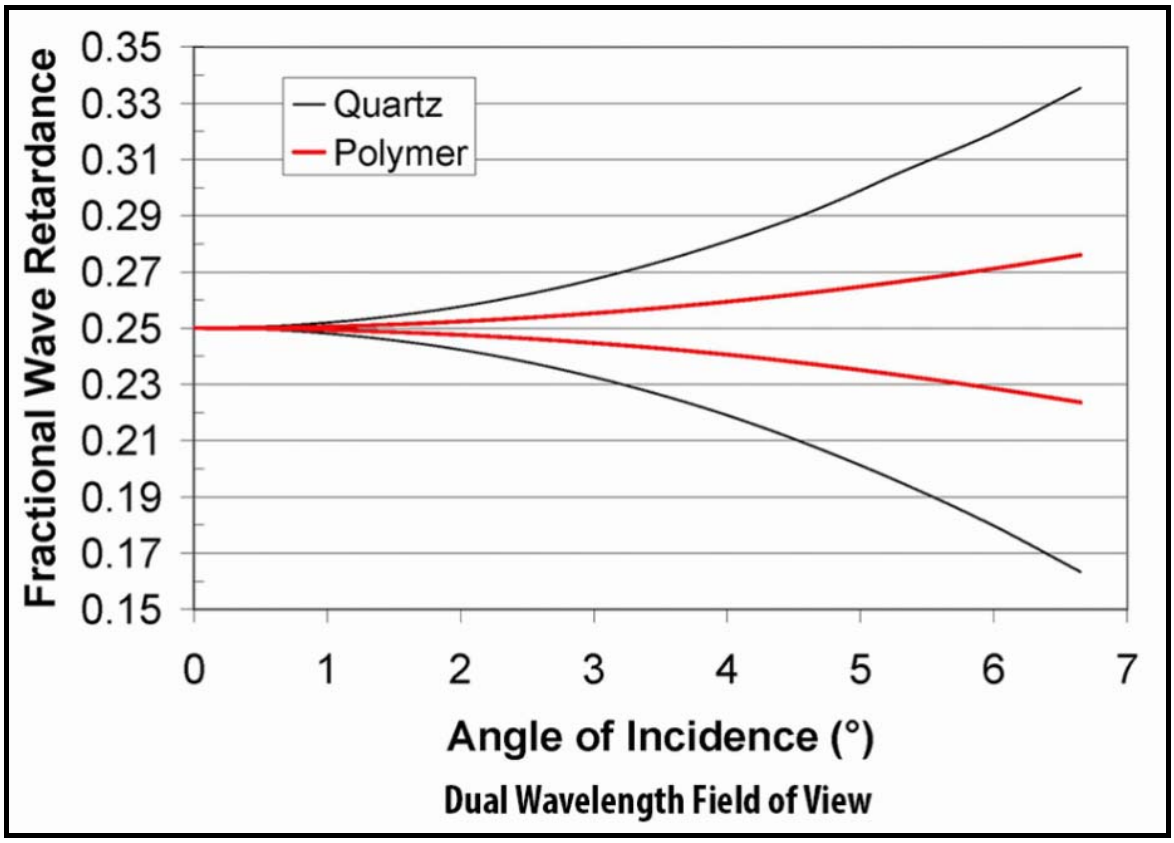
- Low order
- Wide angular field
- Broad wavelength coverage

Technical specifications:

Retarder Material	Birefringent Polymer
Substrate Material	N-BK7
Retardance Accuracy	≤ λ/100 at both wavelengths
Transmitted Wavefront Distortion	≤ λ/4
Beam Deviation	≤ 1 arc-min
Reflectance (per surface)	~ 4% at normal incidence

Storage Temperature	design dependent
Operating Temperature	design dependent

Thickness in. [mm]	Dimensions in. [mm]	Part Number
0.14 [3.6]	0.50 [Ø12.7]	STM-D R1 R2-d-λ1/λ2
0.27 [6.9]	1.00 [Ø25.4]	STM-D R1 R2-d-λ1/λ2



Liquid Crystal Variable Retarder

To prevent ionic buildup, which can damage the liquid crystal layer, liquid crystal devices should be electrically driven with an AC waveform with little to no DC component. We require a 2 kHz square wave of adjustable amplitude for controlling our Liquid Crystal Variable Retarders (LCVRs). Our Basic Controller and Four Channel Interface ensure these drive requirements are met. A temperature sensing and control option can be added to our LCVRs for accurate control of the operating temperature. A temperature sensor is attached directly to the LCVR substrate, outside its clear aperture and a heater is attached to the LCVR housing. This provides active heating and passive cooling of the liquid crystal device.

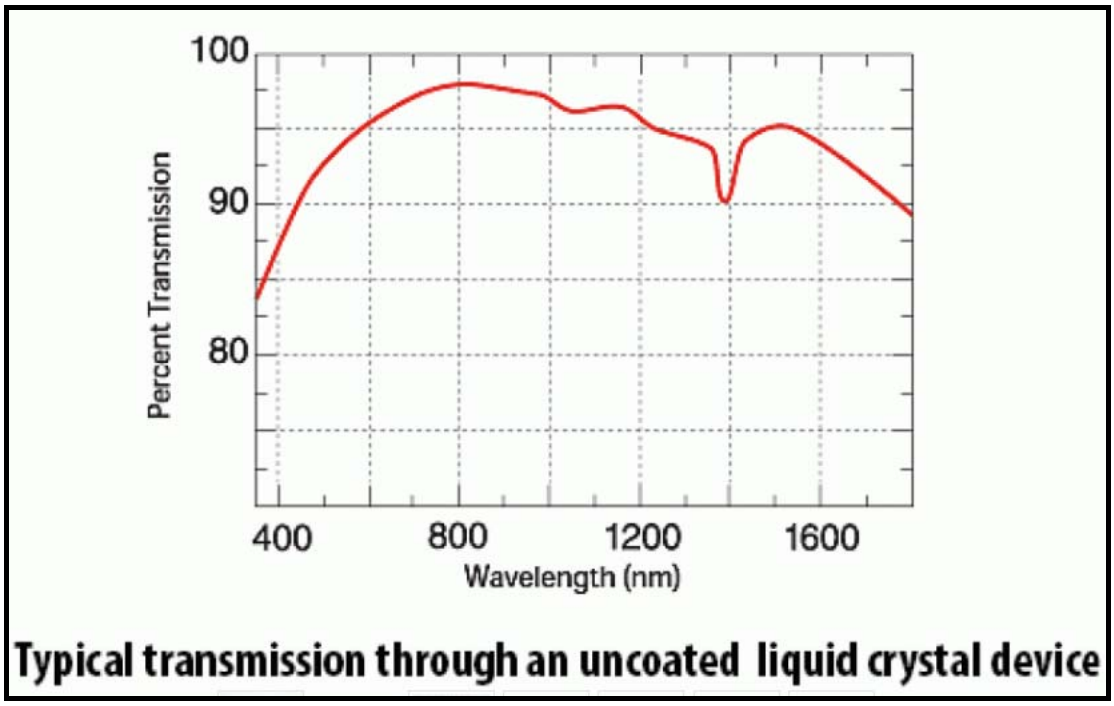
Features:

- Computer control capability
- Temperature control options
- Usable from 450 to 1800 nm
- Precision non-mechanical retardation control

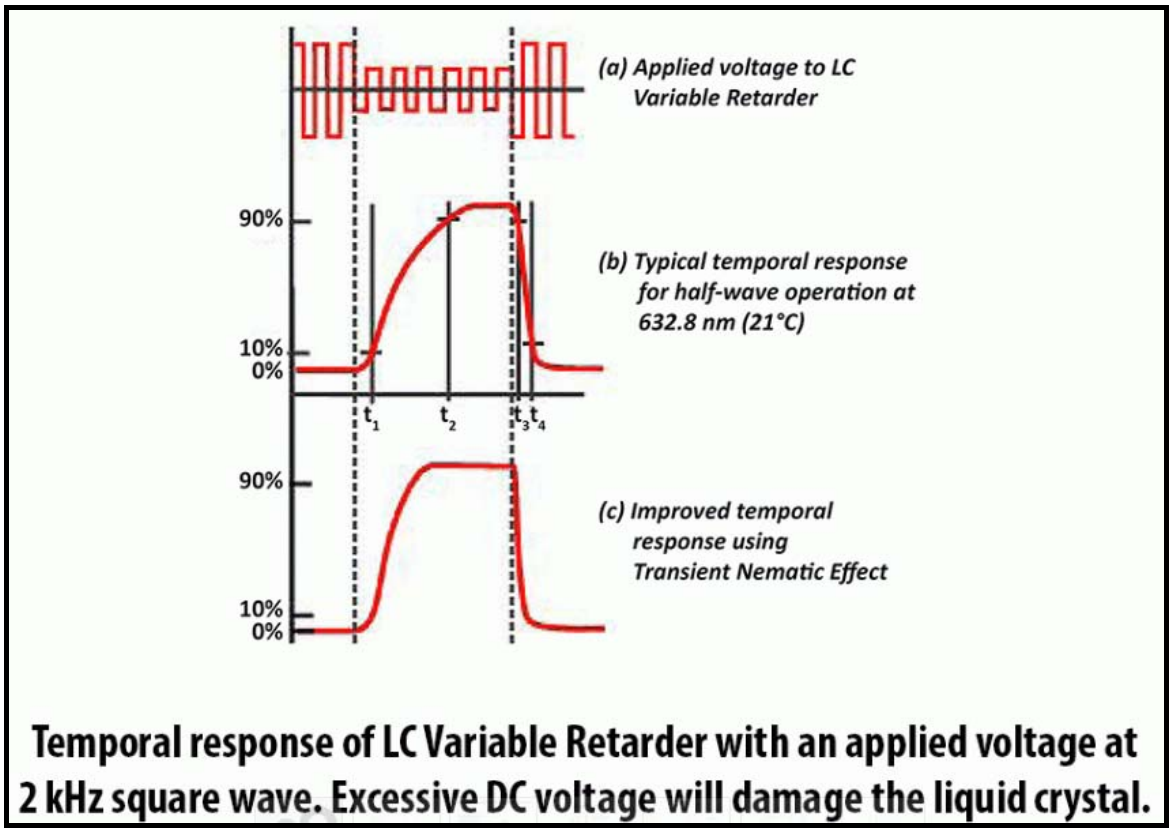
Technical specifications:

Retarder Material	Nematic liquid crystal
Substrate Material	Optical quality synthetic fused silica
Wavelength Range	450-1800 nm (specify)
Retardance Range	
Without compensator	~30 nm to λ/2
With compensator	0 to λ/2
Transmitted Wavefront Distortion	≤ λ/4
Surface Quality (scratch-dig)	40-20
Beam Deviation	≤ 2 arc min
Reflectance (per surface)	≤ 0.5% at normal incidence
Temperature	0˚C to +50˚C
Laser Damage Threshold	500 W/cm2, CW; 300 mJ/cm2, 10 ns, visible

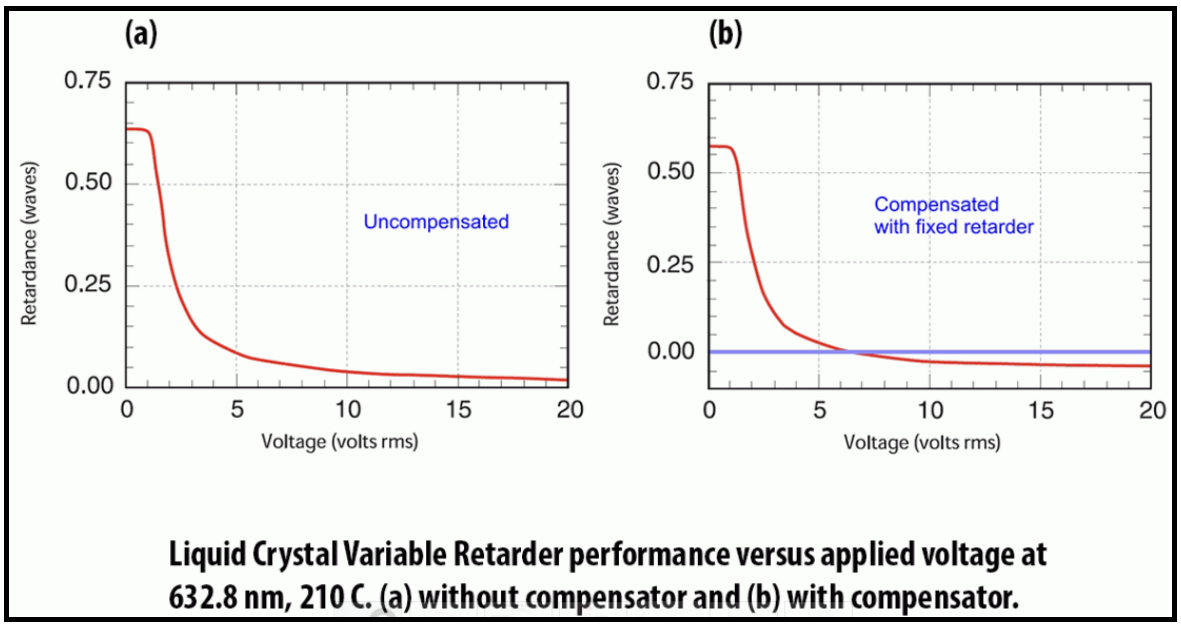
Clear Aperture in. [mm]	Diameter ± 0.005 in. [± 0.13 mm]	Thickness in. [mm]	Part Number
Without Attached Compensator (30 nm to λ/2)			
0.37	Ø1.00	1.23	STM-LVR-100
[9.4]	[Ø25.4]	[31.2]	
0.7	Ø2.00	0.75	STM-LVR-200
[17.8]	[Ø50.8]	[19.1]	
1.6	Ø3.00	1	STM-LVR-300
[40.6]	[Ø76.2]	[25.4]	
With Attached Compensator (0 nm to λ/2)			
0.37	Ø1.00	1.23	STM-LRC-100
[9.4]	[Ø25.4]	[31.2]	
0.7	Ø2.00	0.75	STM-LRC-200
[17.8]	[Ø50.8]	[19.1]	
1.6	Ø3.00	1	STM-LRC-300
[40.6]	[Ø76.2]	[25.4]	



Typical transmission through an uncoated liquid crystal device



Temporal response of LC Variable Retarder with an applied voltage at 2 kHz square wave. Excessive DC voltage will damage the liquid crystal.



Liquid Crystal Variable Retarder performance versus applied voltage at 632.8 nm, 210 C. (a) without compensator and (b) with compensator.

Wide Field Retarder

Sintec Optronics now offers Wide Field Retarders, the latest innovation in near zero-order polymer retarder technology. At their design wavelength, Wide Field Retarders provide a consistent retardance value over a wide acceptance angle, out to 30° or more. Standard quarter- and half-wave designs are available for common wavelengths in the visible to near infrared region. The graphs show the Wide Field Retarder performance as a function of incidence angle for the both half-wave and quarter-wave designs. Multilayer broadband antireflection (BBAR) coatings are included as standard. Note that BBAR coating performance varies with incidence angle; these coatings perform best at (or near) normal

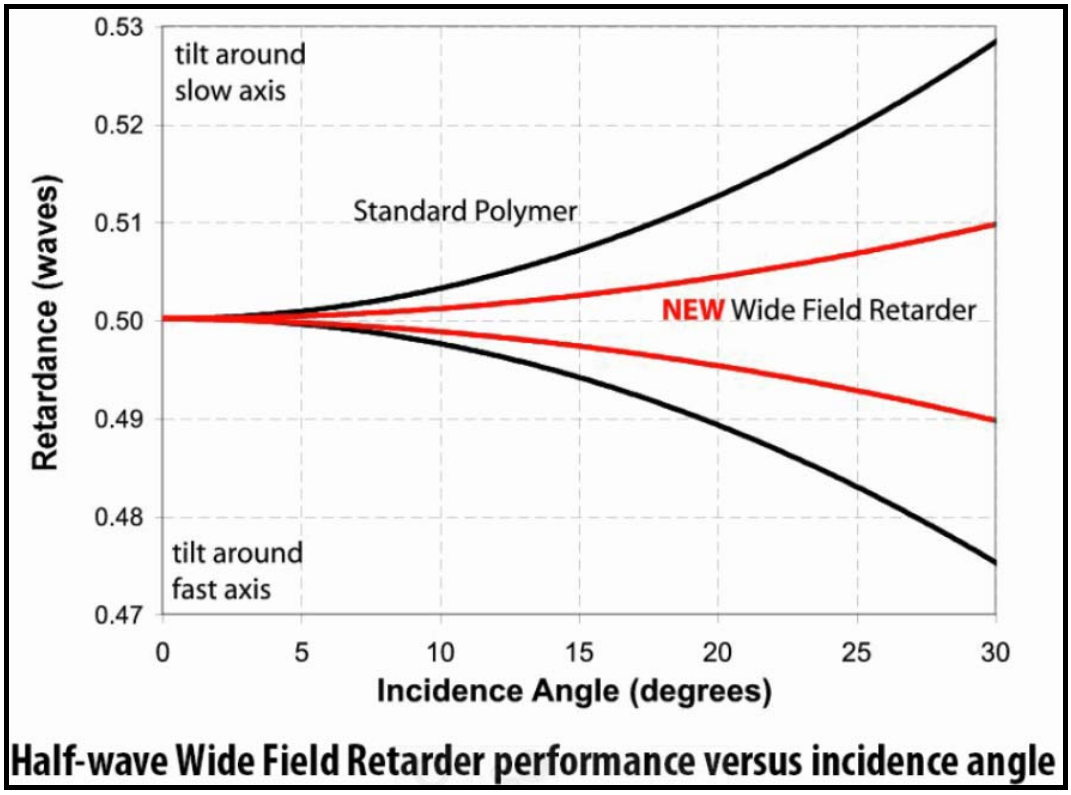
incidence. As with all Sintec Optronics retarders, the fast axis is conveniently marked. Custom retardance values are available for wavelengths from 400-1800 nm. Please call for application assistance or to request a custom quotation.

Features:

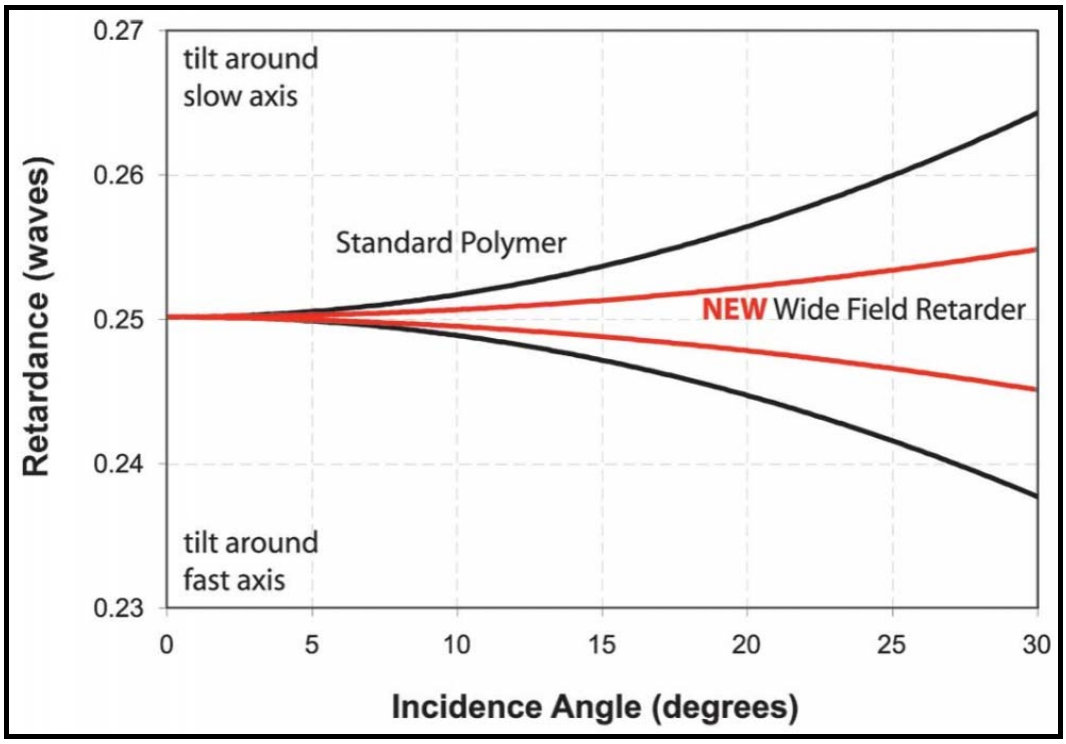
- Unmatched off-axis performance
- Standard and custom wavelength retarders
- Mounted and unmounted versions available
- Off-axis performance ideal for uncollimated light applications

Technical specifications:

Retarder Material	Birefringent Polymer
Substrate Material	N-BK7
Standard Wavelengths	532, 632.8, 670, 780, 850, 1064, and 1550 nm
Custom Wavelengths	400-1800nm (specify)
Retardance	λ/2 and λ/4
Retardance Accuracy	≤ λ/250 at normal incidence at the center of the part
Retardance Change (at 30˚tilt)	
Half-wave	≤ λ/100
Quarter-wave	≤ λ/200
Transmitted Wavefront Distortion	≤ λ/2
Surface Quality (scratch-dig)	60-40
Beam Deviation	≤ 1 arc-min
Reflectance (per surface)	
At normal incidence	≤ 0.5%
At 30˚ incidence	≤ 1.0%
Operating Temperature	0˚C to 40˚C



Half-wave Wide Field Retarder performance versus incidence angle



Polymer Film Retarder

Sintec Optronics is pleased to present our Bare Polymer Retarder film. Our proprietary polymer film provides high retardance accuracy in a cost effective product which can be provided in almost any configuration and quantity. The temperature dependence of the nominal retardance is approximately 0.01%/°C, which provides a very stable and versatile polarization solution. Manufactured in-house for wavelengths between 400 and 1800nm, this retarder is ideal for applications requiring a high precision, thin and cost effective solution. We are also able to tune the retardance to your Angle of Incidence to optimize performance. AR coatings are available on a special order basis. Standard shapes and retardance values are available when quick turn-around is needed. We can also accommodate requests for custom shapes, sizes (up to 4 inches) and retardance values.

Features:

- Very thin profile
- Thermally stable
- High volume scalable
- AR coatings available
- Custom retardance available

Technical specifications:

Substrate Material	Polymer Film
Thickness	0.005 inch (127 µm), nominal
Wavelength Range	400-1800 nm
Retardance Ranges	Single Layer: 20-1600 nm
	Double Layer: 1600-3000 nm
Reflectance	~4% per surface
Retardance Variation	≤ 2%/in.
Retardance Accuracy	± λ/300
Acceptance Angle	± 6˚

Transmitted Wavefront Distortion	≤ 2λ (P-V @ 633)
	[≤ λ/2 (RMS @ 633)]
Surface Quality	80-50 scratch-dig
Beam Deviation	≤ 30 arc-sec
Operating Temperature	-40˚C to +60˚ C

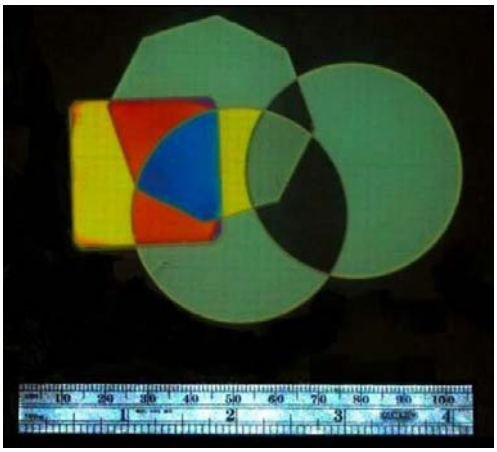
Round			
Clear Aperture (in.)	Thickness (in.)	Dimensions (in.)	Part Number
0.45	0.01	Ø0.50	λ/4 Wave: STM-BQ-050-λ
			λ/2 Wave: STM-BH-050-λ
0.9	0.01	Ø1.00	λ/4 Wave: STM-BQ-100-λ
			λ/2 Wave: STM-BH-100-λ
1.35	0.01	Ø1.50	λ/4 Wave: STM-BQ-150-λ
			λ/2 Wave: STM-BH-150-λ
1.8	0.01	Ø2.00	λ/4 Wave: STM-BQ-200-λ
			λ/2 Wave: STM-BH-200-λ
Square			
0.45 x 0.45	0.01	0.50 x 0.50	λ/4 Wave: STM-BQ-050x050-λ
			λ/2 Wave: STM-BH-050x050-λ
0.90 x 0.90	0.01	1.00 x 1.00	λ/4 Wave: STM-BQ-100x100-λ
			λ/2 Wave: STM-BH-100x100-λ
1.35 x 1.35	0.01	1.50 x 1.50	λ/4 Wave: STM-BQ-150x150-λ
			λ/2 Wave: STM-BH-150x150-λ
1.80 x 1.80	0.01	2.00 x 2.00	λ/4 Wave: STM-BQ-200x200-λ
			λ/2 Wave: STM-BH-200x200-λ

Raptor Applied Polymer Retarder

Retarder Applied Polymer (RAPtor) parts are manufactured using a proprietary high birefringent polymer. These retarders are true zero order with a typical film thickness less than 10 microns. The material can be added to customer provided windows and even mildly curved substrates to produce truly custom solutions. These retarders were originally designed for use in astronomy but have applications wherever a true zero order waveplate would be used. Sintec Optronics can apply these retarders to substrates from 10 mm to 100 mm diameter (and even larger on a custom basis).

Features:

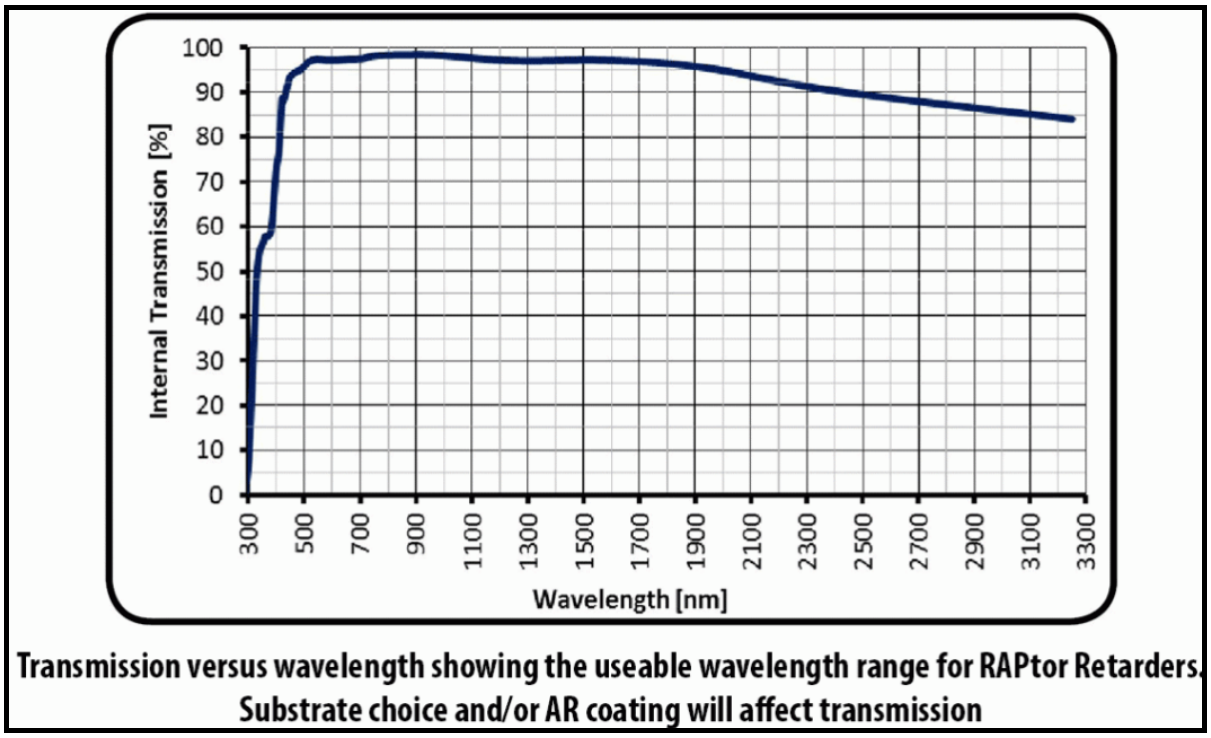
- Extremely thin and large diameter
- Curved surfaces
- High temperature resistance
- Custom sizes, shapes, wavelengths and retardances available



Technical specifications:

Retarder Material	High Birefringence Polymer
Retarder Thickness	< 10 μm**
Substrate Material	1.1 mm Fused Silica
Wavelength Range/Retardance	400 - 1064 nm (λ/2)
	400 - 1550 nm (λ/4)
Retardance Accuracy	< ± λ/100
Retardance Uniformity	< λ/100 [<5 nm]
Clear Aperture	80%
Reflectivity	≤ 0.5%
Transmitted Wavefront Distortion	≤ λ/2 (P-V @ 633 nm)
	[≤ λ/8 (RMS @ 633 nm)]
Beam Deviation	≤ 5 arc sec
Surface Quality	80-50 scratch-dig
Operating Temperature	-20 °C to 80 °C
Storage Temperature	-40 °C to 80 °C
Custom Design	
Wavelength Range	350-3300 nm
Retardance Accuracy	< ± λ/200
Dimensions	up to 150 mm diameter
Fast Axis Datum/Orientation	Customer specified
Substrate Material/Geometry/Thickness	Customer specified

Clear Aperture in. [mm]	Diameter in. [mm]	Part Number
Ø0.9 in. [22.9 mm]	Ø1.00 in. [25.4 mm]	STM-PQ-100-λ , STM-PPH-100-λ
Ø1.8 in. [45.7 mm]	Ø2.00 in. [50.8 mm]	STM-PPQ-200-λ , STM-PPH-200-λ



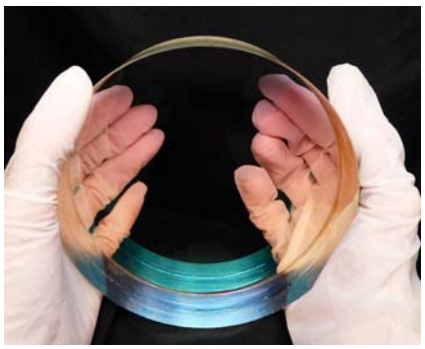
Transmission versus wavelength showing the useable wavelength range for RAPtor Retarders. Substrate choice and/or AR coating will affect transmission

Large Aperture Retarder

For many astronomical, aerospace, and defense projects, large aperture retarders are required. Sintec Optronics has over thirty-five years of retarder manufacturing expertise and is able to manufacture from a wide variety of materials to facilitate high or low power applications. Waveplates up to 150 mm diameter are available. Some materials allow retarders to be used over different wavelengths from the ultraviolet, through the visible and into the near infrared. Sintec Optronics uses proprietary methods to ensure the best spatial uniformity of its polymer and crystalline retarders. These retarders have a spatial uniformity of better than two percent across the clear aperture and with the correct substrates, can have a wavefront distortion that is on par with Meadowlark Optics' Precision Retarders.

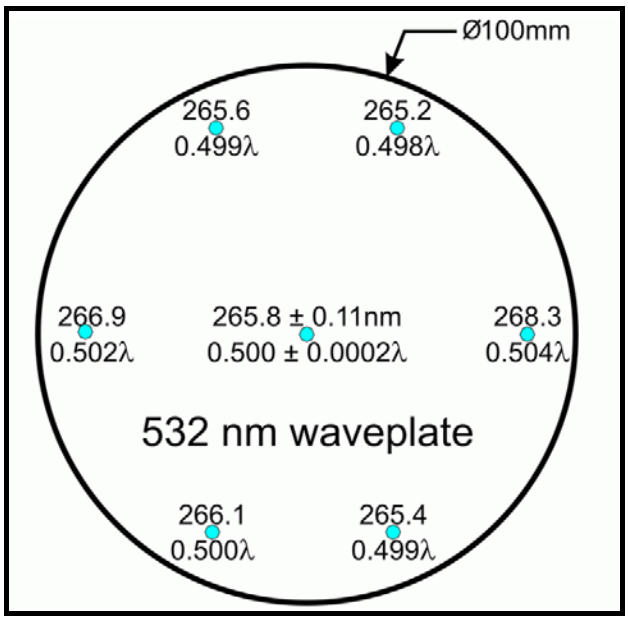
Features:

- Outer diameter up to 6 inches
- Clear aperture > 90%
- Custom size, retardance and wavelength range available
- Spatial uniformity of less than 2% across clear aperture
- Various materials available: (polymer, quartz, sapphire, magnesium fluoride and liquid crystal)



Technical specifications:

Retarder (Bifringent) Material Options	Polymer
	Crystalline Quartz
	Magnesium Fluoride
	Sapphire
	Liquid Crystal†
Wavelength	300-2500 nm (specify)
Retardances	0 to 100s of λ
Retardance Accuracy	
Center	≤ λ/100 to ≤ λ/350
Spatial Uniformity	≤ λ/10 to ≤ λ/100
Transmitted Wavefront Distortion	≤ λ to ≤ λ/5 (P-V @ 633)
	[λ/4 to λ/20 (RMS @ 633)]
Surface Quality	40-20 scratch-dig to 80-50 scratch-dig
Outside Dimensions	up to 150 mm



Bi-Crystalline Achromatic Retarder

Sintec Optronics is pleased to offer a selection of quarter- and half-wave achromatic retarders that span the UV, visible, near IR and IR portions of the spectrum. Two multi-order crystalline retarders, one made of crystalline quartz and the other magnesium fluoride, are combined in a subtractive mode to give an effective zero-order waveplate. By a careful choice of waveplate thicknesses, retardance dispersion is balanced to give a nearly constant retardance (in waves) over a broad range of wavelengths. The useable wavelength range is defined to give a retardance value within λ/100 of the nominal value. Custom designs with larger achromatic ranges or deeper UV wavelengths are available on request. Bi-Crystalline Achromats are similar in achromatic performance to our polymer achromats in the visible, but they excel in the IR. They have higher power handling capability than our polymer achromats and can with stand higher storage temperatures. Their field of view is narrow compared to polymer achromats. Typically, they cannot be expected to meet their retardance accuracy for rays whose incidence angles exceed 1.5°. If you must have the performance of a Bi-Crystalline Achromat and a large field of view, call us. We have a proprietary design that can be your polarization solution.

Features:

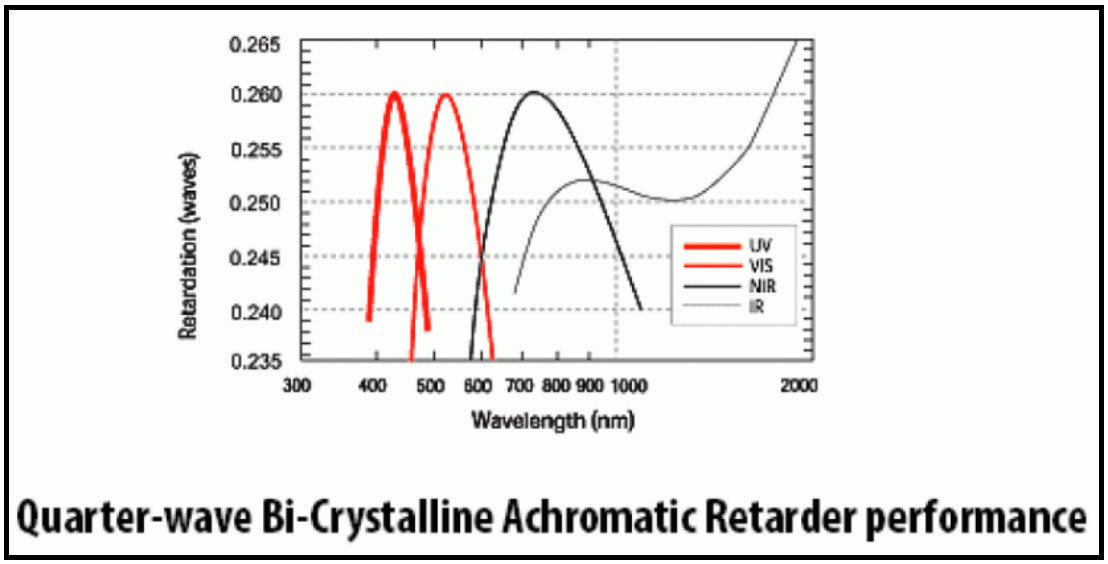
- High Damage Threshold
- Volume Pricing
- Superior IR performance

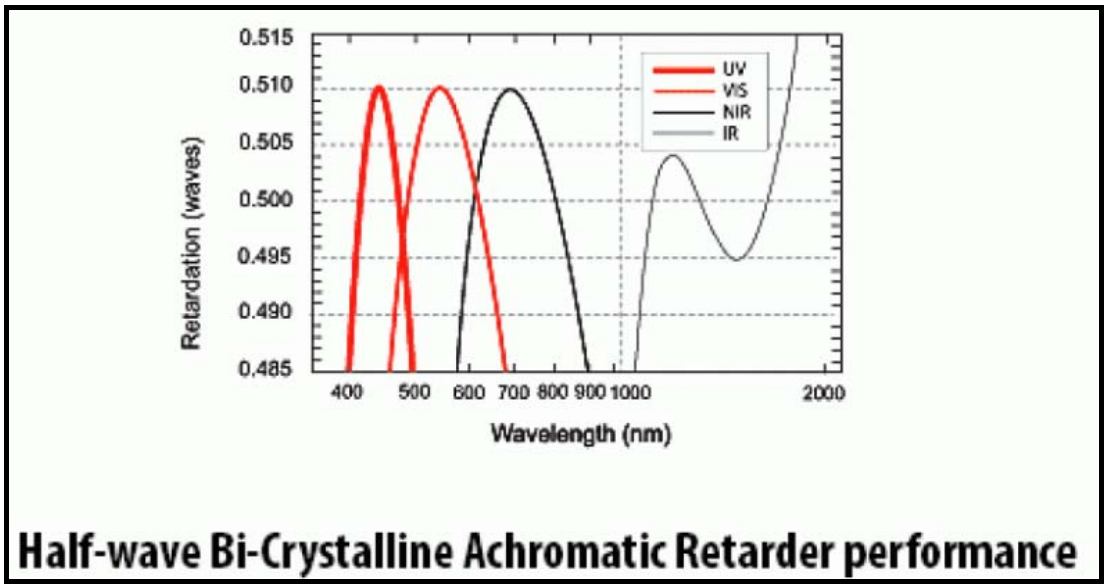
Technical specifications:

Retarder Material	Quartz & Magnesium Fluoride
Retardance Accuracy	λ/4 or λ/2
Temp. Coefficient of Retardance	λ/500 per ˚C
Standard Wavelengths - Quarter Wave	
Ultraviolet	395-465 nm
Visible	475-590 nm
Near Infrared	600-900 nm
Infrared	690-2050 nm
Standard Wavelengths - Half Wave	
Ultraviolet	412-475 nm
Visible	500-650 nm
Near Infrared	600-840 nm
Infrared	1190-1660 nm
Transmitted Wavefront Distortion	≤ λ/4
Surface Quality (scratch-dig)	40-20
Beam Deviation	≤ 1 arc-min
Reflectance (per surface)	≤ 0.5% at normal incidence
Storage Temperature	-40˚C to +75˚C
Threshold	2 J/cm2, 10 ns, 1064 nm

Mounted		
Clear Aperture in. [mm]	Diameter in. [mm]	Part Number
Half Wave		
0.4	Ø1.00	STM-CHM-050
[10.2]	[Ø25.4]	
Quarter Wave		
0.4	Ø1.00	STM-CQM-050

[10.2]	[Ø25.4]	
Unmounted		
Clear Aperture in. [mm]	Diameter in. [mm]	Part Number
Half Wave		
0.4	Ø0.50	STM-CH-050
[10.2]	[Ø12.7]	
Quarter Wave		
0.4	Ø0.50	STM-CQ-050
[10.2]	[Ø12.7]	





Liquid Crystal Devices

Achromatic Ferroelectric Liquid Crystal Devices

Sintec Optronics' Ferroelectric Liquid Crystal (FLC) devices offer a significant performance advantage in optical shutter and rotator applications demanding the fastest optical response times available. FLC devices are designed for applications requiring active timing control of beam transmittance. Key features of our FLC devices include high-speed binary operation, high purity linear polarized output, and maximum extinction ratio performance. Since these devices are solid state – undesirable mechanical motion, associated noise, and vibration problems are eliminated. Our FLC devices require a DC-balanced AC drive signal, typically resulting in a 50% duty cycle operation. Our optional FC 5010 Controller is ideal for driving the devices for optimal performance (sold separately).

FLC Controller (FCS010)
The FCS010 is a two-channel liquid crystal controller specifically designed to drive our ferroelectric liquid crystal shutters and rotators. The FCS010 has two short-circuit protected output channels driven 180 degrees out of phase. The pre-configured controller waveforms are optimized for FLC devices. We can tailor the waveform to your specific needs based on application and purchased FLC device. The drive waveform is output through SMA connectors. The controller is 100% RoHS compliant and is powered by a separate 12V international power supply.

Features:

- Mounted and unmounted design options
- Extremely fast switching speeds
- Silent, vibration-free
- Low-voltage operation
- OEM sizes and shapes
- No mechanical motion
- Stand alone controller available
- Optimized waveforms for driving FLC devices

Technical specifications:

Achromatic FLC Rotator:

Retarder Material	Ferroelectric liquid crystal

Substrate Material	Fused silica
Wavelength Range	405-850 nm, custom ranges up to 2 microns
Transmitted Wavelength Distortion	λ/2 (P-V @ 633), [λ/10 (RMS @ 633)]
Surface Quality	60-40 scratch dig
Beam Deviation	≤ 5 arc min
Outside Diameter (mounted)	2.00 ± 0.005 in. please inquire about custom sizes
Clear Aperture	0.70 in.
Response Time (10-90% & 90-10%)	≤ 100 micro-sec at room temp, wavelength dependent
Operating Temperature	20°C to 30°C
Storage Temperature	0°C to 60°C
Driver Requirements	± 5 to 30 Volts, 50% duty cycle

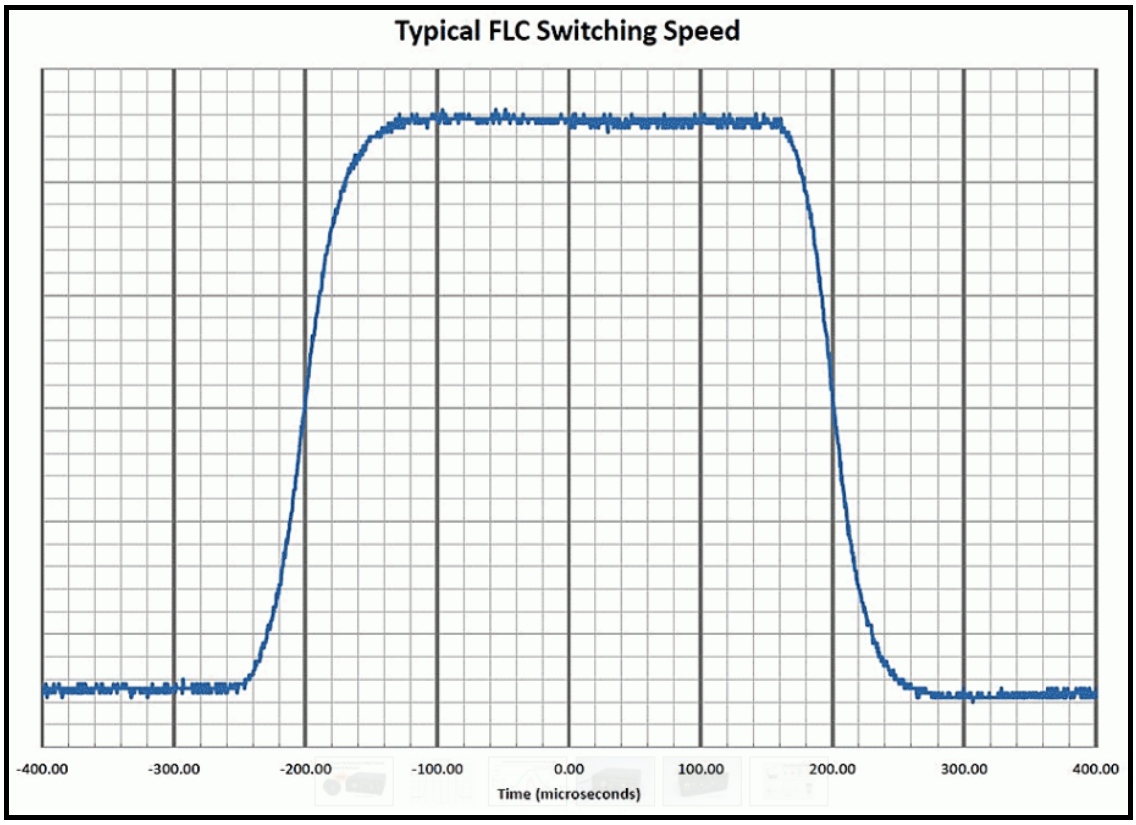
Achromatic FLC Shutter:

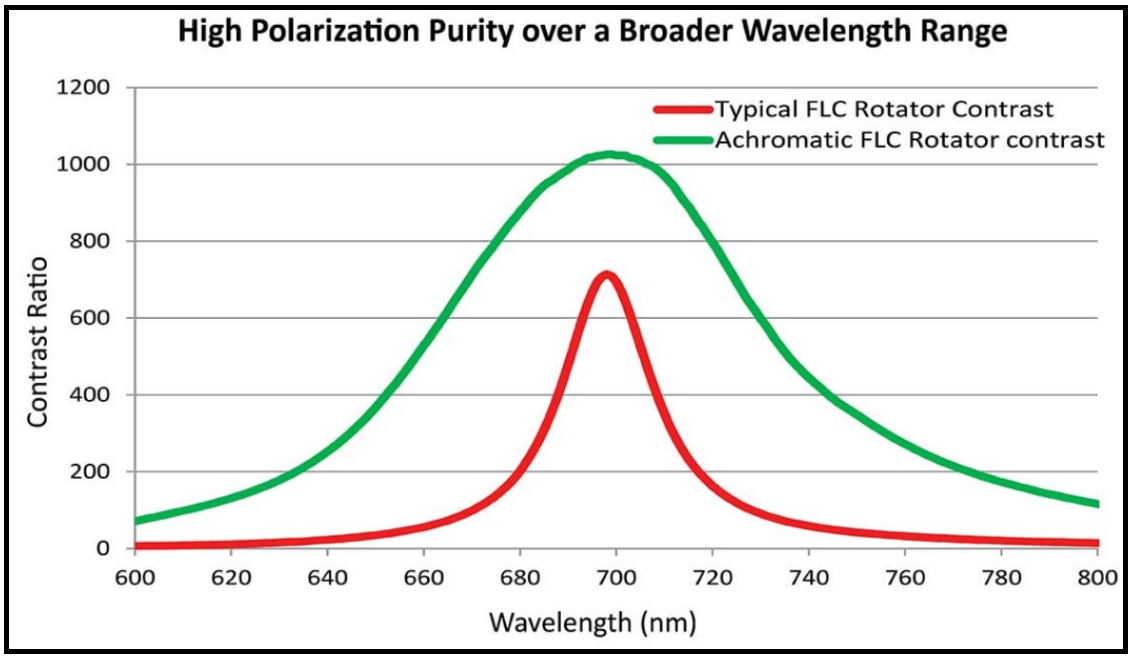
Polarizer Material	Dichroic Polymer
Transmission	≥ 30% (typical - unpolarized light)
	≥ 65% (typical - polarized light)
Wavelength Range	450-720 nm, custom ranges up to 2 microns
Transmitted Wavefront Distortion	λ/2 (P-V @ 633), [λ/8 (RMS @ 633)]
Contrast Ratio	≥ 200:1

Achromatic FLC Controller:

Dimensions	5.3 in. W x 5.3 in. L x 2.0 in. H, (13.5 cm W x 13.5 cm L x 5.1 cm H)
Number of LC Channels	Two, running identical programs 180, degrees out of phase
Output Waveform	Bipolar ± 15V peak voltage, ± 10V holding voltage
Amplitude Resolution	16-bit; 1 mV voltage resolution
Internal Drive	1 to 10,000 Hz, 50% duty cycle, frequency controlled by front-panel, 10-turn knob

Product Description	Diameter (in.)	Clear Aperture (in.)	Thickness (in.)	Part Number
Rotator	2.00 [50.8 mm]	0.70 [17.78 mm]	1.38 [19.05 mm]	STM-FPA-200-λ
Shutter	1.00 [25.4 mm]	0.37 [9.4 mm]	1.42 [36.07 mm]	STM-FCS-100-λ
	2.00 [50.8 mm]	0.70 [17.78 mm]	1.13 [28.7 mm]	STM-FCS-200-λ
Controller	N/A	N/A	N/A	STM-FC010





OEM Liquid Crystal Variable Retarder

Sintec Optronics is pleased to announce a small, mounted liquid crystal family of products intended for space constrained or OEM applications. By removing the temperature control circuitry, the overall dimensions of the housing can be significantly reduced. For even tighter mechanical constraints, unmounted cells are also available with flying leads or custom connectors.

Features:

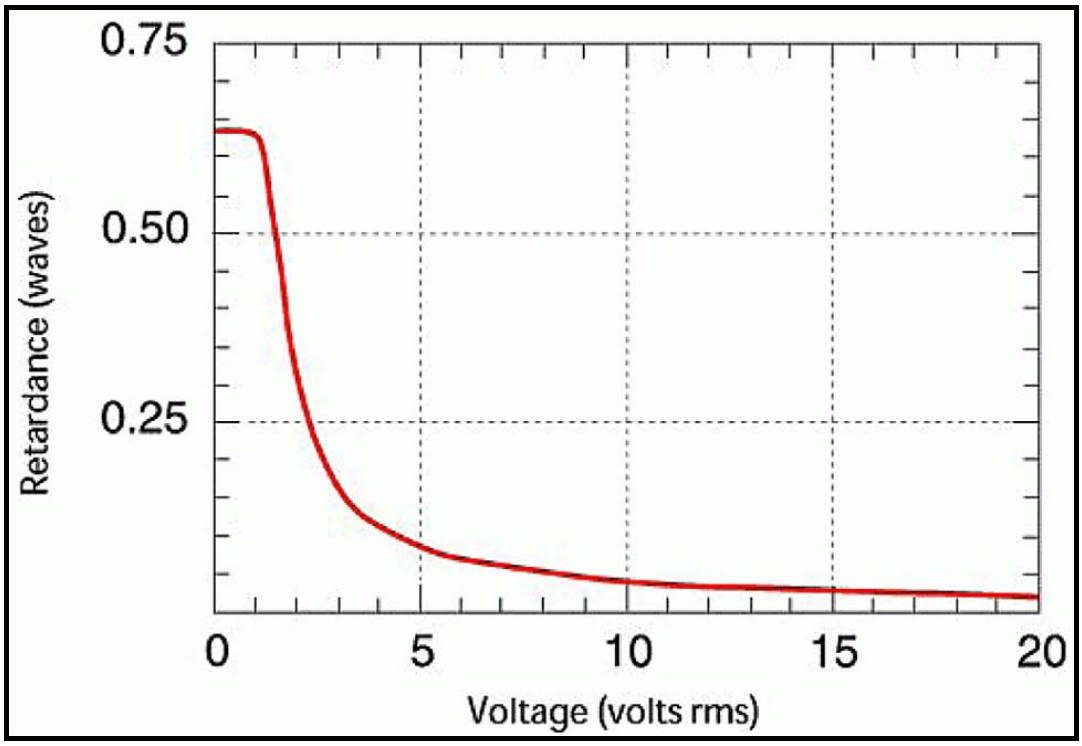
- Precision control at lower cost
- Scalable quantities

- Thin housing
- Large clear aperture
- Usable from 450 to 1800 nm

Technical specifications:

Retarder Material	Nematic liquid crystal
Substrate Material	Optical quality synthetic fused silica
Wavelength Range	450 - 1800 nm (specify)
Retardance Range	~30 nm to λ/2, custom ranges are available
Transmitted Wavefront Distortion	λ/2 (P-V @ 633), [λ/8 (RMS @ 633)]
Surface Quality	80 - 50 scratch-dig
Beam Deviation	3 arc min
Reflectance (per surface)	0.5% at normal incidence
Diameter Tolerance	± 0.005 in.
Temperature Range	0°C to 50°C
Laser Damage Threshold	500 W/cm2, CW; 300 mJ/cm2, 10 ns, visible

Clear Aperture in. [mm]	Thickness in. [mm]	Diameter in. [mm]	Part Number
0.49 [12.5]	0.25 [6.35]	Ø1.00 [Ø25.4]	STM-LVT-100



MWIR Variable Retarder

Liquid crystal technology for polarization control now extends into the mid IR. Sintec Optronics standard line of polarization controllers can be used for these new variable retarders. They can be custom configured for use as variable attenuators and as polarization rotators.

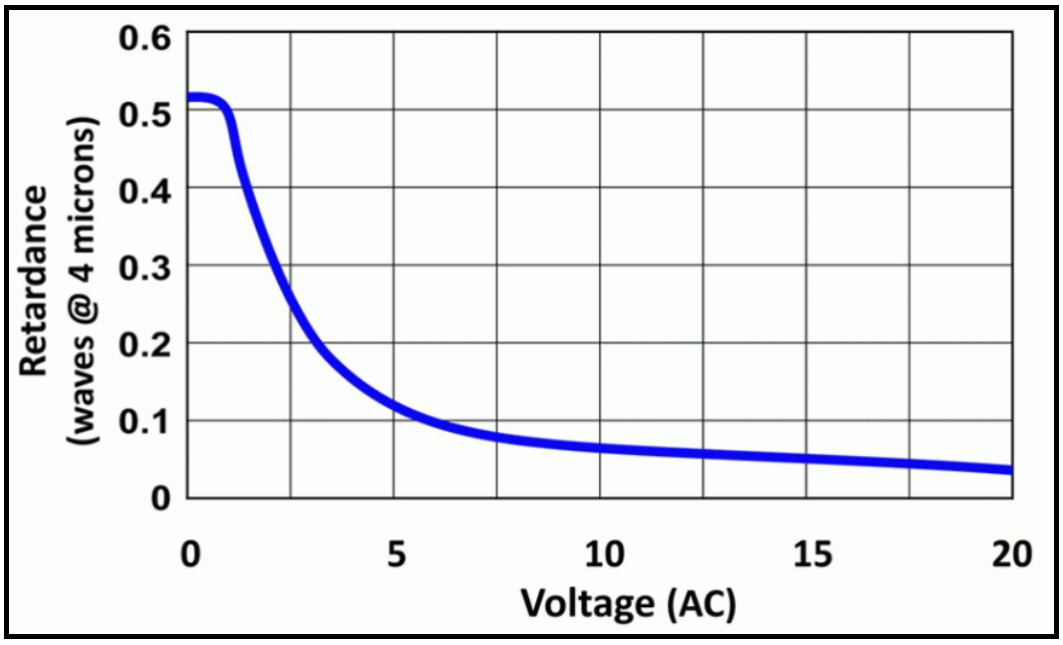
Features:

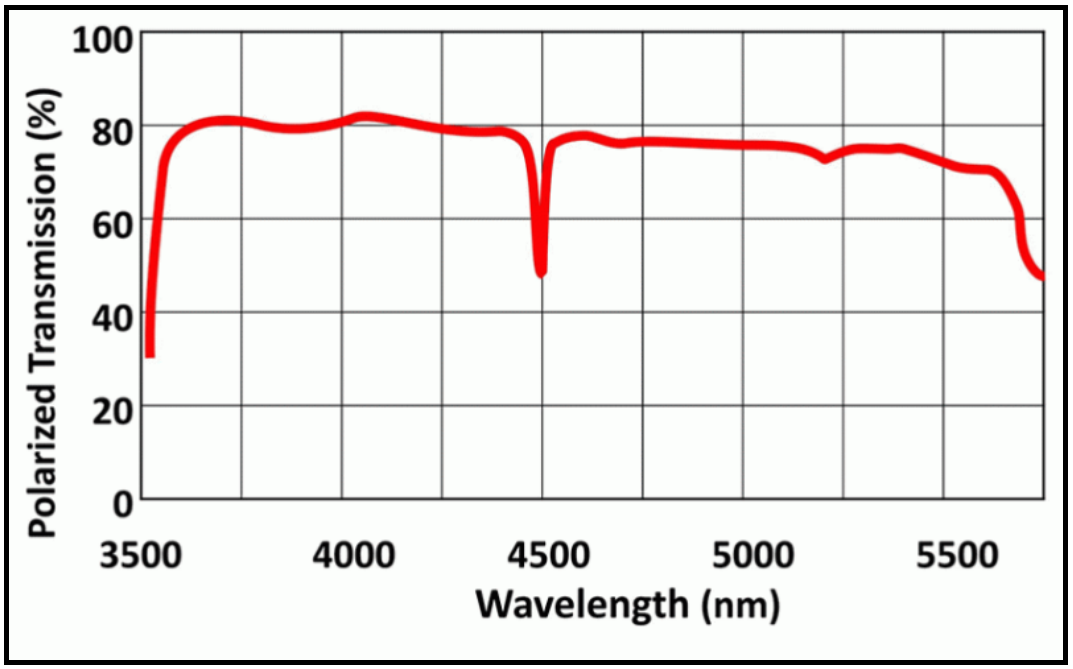
- 3600 to 5500 nm transmission
- Non-mechanical polarization control
- Computer controllable
- Useful for variable attenuation

Technical specifications:

Retarder Material	Nematic liquid crystal
Substrate Material	Anti-reflection coated germanium
Wavelength Range	3.6 µm to 5.7 µm
Maximum Retardance	1/2 λ at 4 µm*
Minimum Retardance	0.06 λ at 4 µm at 10 V
Reflectance	≤ 5% per external surface
Operating Temperature Range	0˚C to +50˚C
Response Times	< 500 msec

Clear Aperture in. [mm]	Diameter ± 0.005 in. [± 0.13 mm]	Thickness in. [mm]	Part Number
0.7 [17.8]	Ø2.00 [Ø50.8]	0.75 [19.1]	STM-LVR-200-λ





Sintec Optronics

UV Liquid Crystal Variable Retarder

Liquid crystal technology for polarization control now extends into the ultraviolet. While standard LC materials are susceptible to UV light damage below 450 nm, Sintec Optronics has designed a new UV-resistant LCVR material capable of operating at lower wavelengths (as low as 350 nm). These parts can be custom configured for use as variable attenuators or polarization rotators and are compatible with our standard line of liquid crystal controllers.

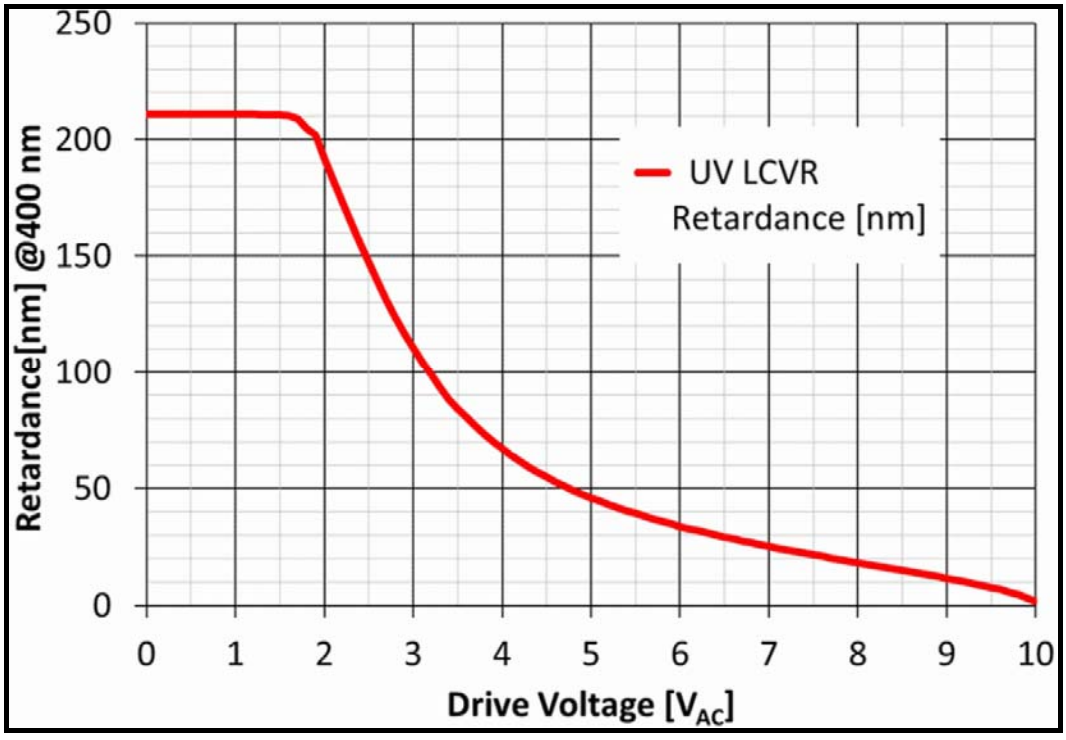
Features:

- Phase of Amplitude modulation of UV spectrum
- Analog modulation
- Non-mechanical polarization control
- Low absorption
- High UV tolerance LC

Technical specifications:

Retarder Material	Nematic liquid crystal
Substrate Material	UV Grade Fused Silica
Wavelength Range	350-450 nm (specify)
Maximum Retardance*	1/2 λ at 400 nm
Minimum Retardance	0.06 λ at 400 nm (at 10 V)
Transmitted Wavefront Distortion	λ/4 (P-V @ 633), [λ/16 (RMS @ 633)]
Surface Quality	40-20 scratch-dig
Beam Deviation	2 arc min
Reflectance*	AR coatings are available
Diameter Tolerance	± 0.010 in.
Temperature Range	0˚C to +50˚C (Operating)

Clear Aperture in. [mm]	Thickness in. [mm]	Diameter in. [mm]	Part Number
0.37 [9.4]	1.23 [31.2]	Ø1.00 [Ø25.4]	STM-LVR-100-UV
0.7 [17.78]	0.75 [19.05]	Ø2.00 [Ø50.8]	STM-LVR-200-UV



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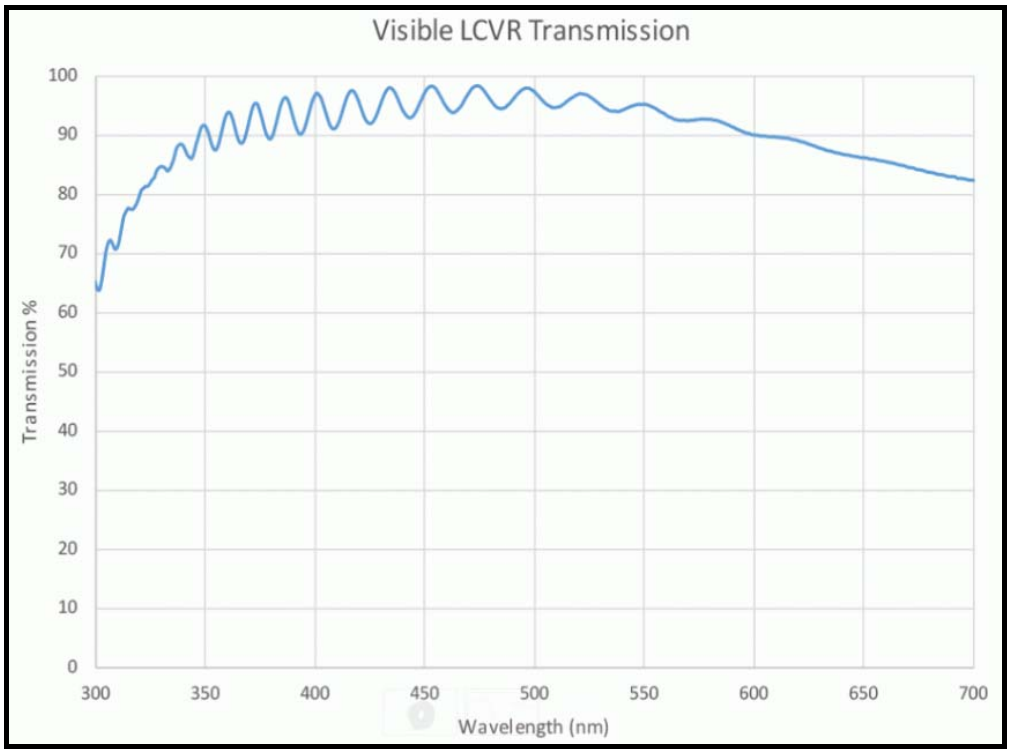


Liquid Crystal Variable Attenuator

Sintec Optronics' Liquid Crystal Variable Attenuator (LCVA) offers real-time, continuous control of light intensity. Our attenuator consists of an LC Variable Retarder (with attached compensator) operating between crossed linear polarizers. With crossed polarizers, light transmission is maximized by applying the correct voltage to achieve half-wave retardance from the LC cell as shown in figure 4-11. Half-wave operation rotates the incoming polarization direction by 90°, so that light is passed by the second polarizer. Minimum transmission is obtained with the retarder operating at zero (or a whole number of) waves. Transmission decreases as the applied AC voltage amplitude increases (half- to zero-waves retardance). The relationship between transmittance T and retardance (in degrees) for crossed polarizer configuration is given by: $T(\Theta) = 1/2\ [1 - \cos(\Theta)]\ Tmax$ where Tmax is the maximum transmittance when retardance is exactly one-half wave (or 180°). Figure 4-12 shows transmittance as a function of applied voltage. Maximum transmission is dependent upon properties of the LC Variable Retarder as well as the polarizers used in your system. Figure 4-13 shows the transmission of an LC Variable Attenuator optimized for use at 550 nm with crossed polarizers. An unpolarized light source is used for illumination. Extinction ratio is defined as the maximum transmission (LC cell at half-wave) divided by the minimum transmission (LC cell at zero waves). Values exceeding 1000:1 (see figure 4-14) can be obtained for a single wavelength by optimizing the applied voltage levels for minimum and maximum transmission. We guarantee a minimum extinction ratio of 500:1 at your specified wavelength. A Liquid Crystal Variable Attenuator can be configured with high efficiency calcite or beamsplitting polarizers to maximize light transmittance and increase damage threshold. With a linearly polarized input beam and a calcite polarizer, transmittance values exceed 90% at most wavelengths. Very high extinction ratios, in excess of 5000:1, can be achieved with custom double attenuators. In this design, two Liquid Crystal Variable Retarders are combined with three polarizers.

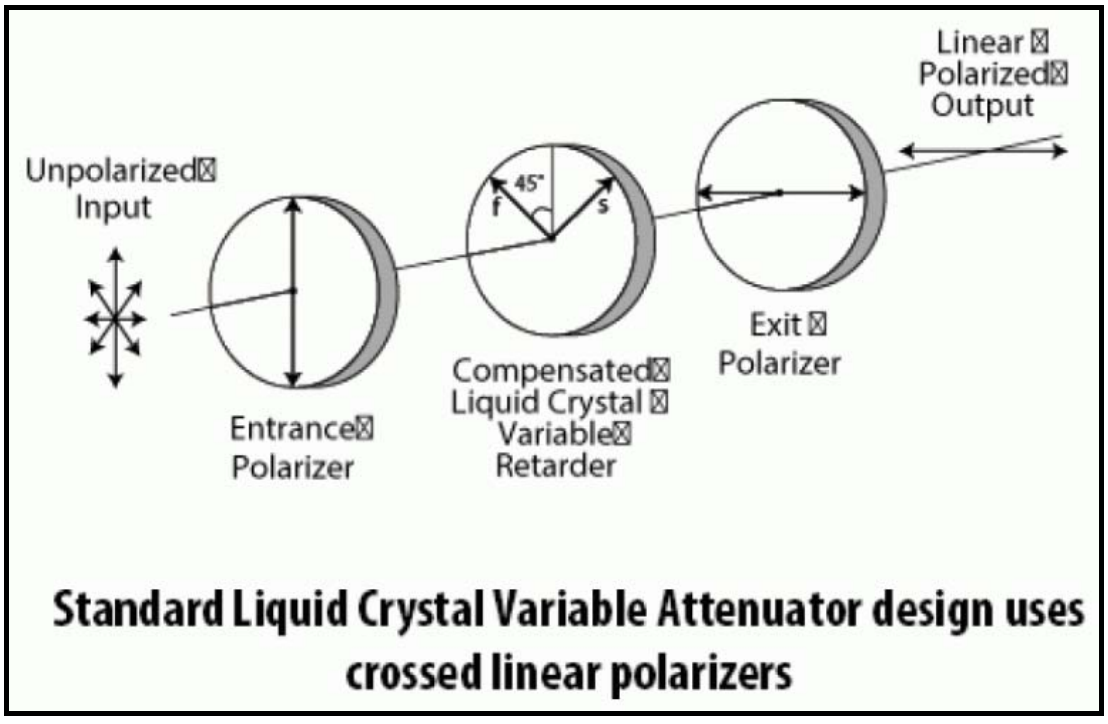
Features:

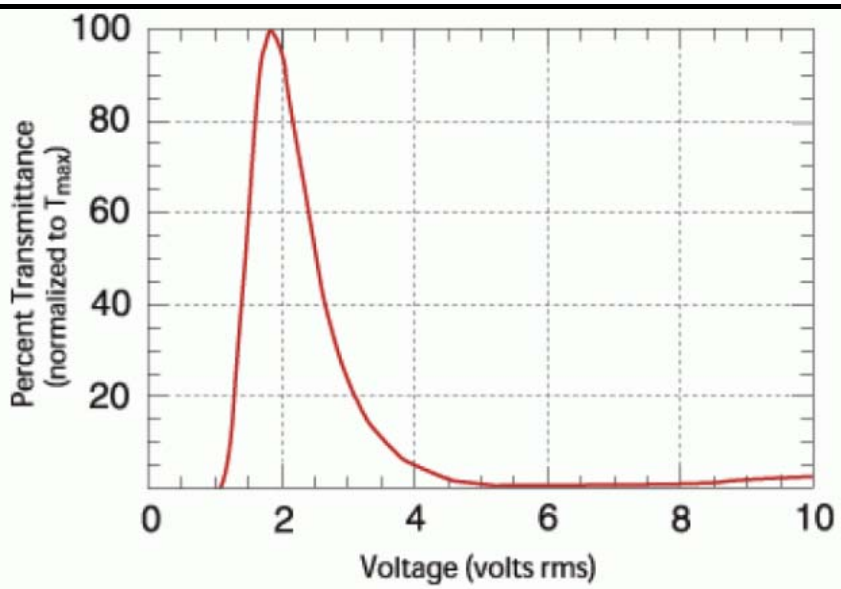
- High contrast ratio
- Computer control capabilities
- Continuous control of light intensity

Technical specifications:

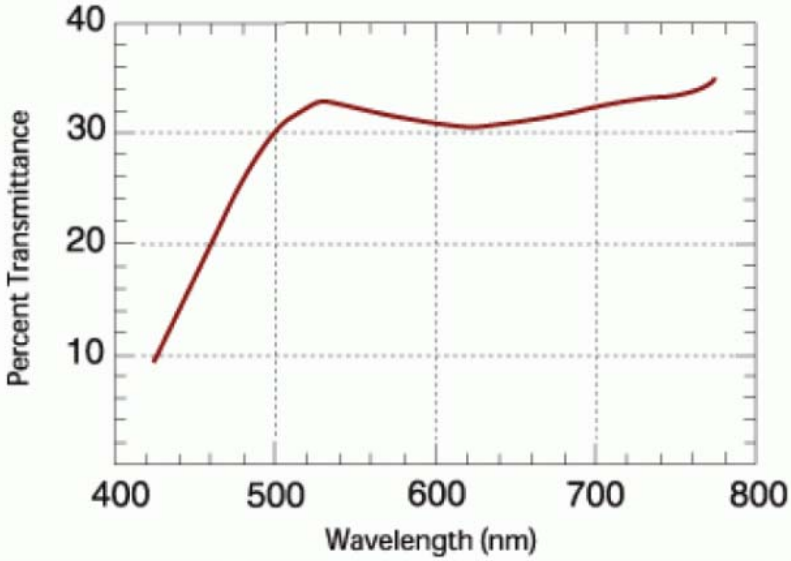
Retarder Material	Nematic liquid crystal with Birefringent polymer
Polarizer Material	Dichroic polymer
Substrate Material	Optical quality synthetic fused silica
Wavelength Range	
Visible	450-700 nm
Near Infrared 1	650-950 nm
Near Infrared 2	900-1250 nm
Near Infrared 3	1200-1700 nm
Contrast Ratio	500:1 at single wavelength
Transmitted Wavefront Distortion	≤ λ/4 (each component)
Surface Quality (scratch-dig)	40-20
Beam Deviation	≤ 2 arc min
Reflectance (per surface)	≤ 0.5% at normal incidence
Operating Temperature	0˚C to 50˚C
Laser Damage Threshold	1 W/cm2, CW (dichroic polarizers)

Clear Aperture in. [mm]	Diameter ± 0.005 in. [± 0.13 mm]	Thickness in. [mm]	Part Number
0.37	Ø1.00	1.23	STM-LVA-100-λ
[9.4]	[Ø25.4]	[31.2]	
0.7	Ø2.00	0.75	STM-LVA-200-λ
[17.8]	[Ø50.8]	[19.1]	
1.6	Ø3.00	1	STM-LVA-300-λ
[40.6]	[Ø76.2]	[25.4]	

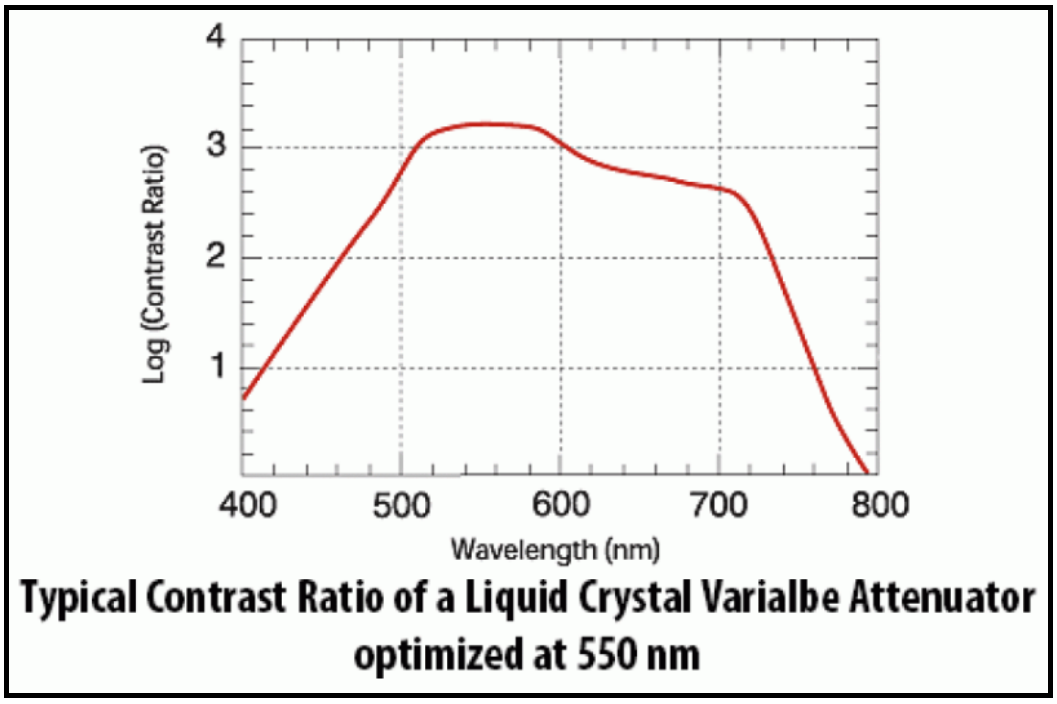




Normalized transmittance of Liquid Crystal Variable Attenuator with crossed linear polarizers at a single wavelength



Unpolarized Transmittance as a function of wavelength for LC Variable Attenuator, optimized for 550 nm, with polarizers and unpolarized input



Typical Contrast Ratio of a Liquid Crystal Varialbe Attenuator optimized at 550 nm

Liquid Crystal Polarization Rotator

Our Liquid Crystal Polarization Rotator (LPR) continuously rotates the polarization orientation of a monochromatic, linearly polarized input beam. Our LPR consists of a compensated Liquid Crystal Variable Retarder combined with a zero-order polymer quarter-wave retarder. The fast axis of the liquid crystal variable retarder is oriented at 45° to the slow axis of the quarter-wave retarder and the linearly polarized input must be parallel to the quarter-wave retarder slow axis. Polarization rotation is achieved by electrically controlling the retardance of the Liquid Crystal Variable Retarder, eliminating any mechanical motion. A quarter-wave retarder converts elliptical polarization formed by the Liquid Crystal Variable Retarder to linear polarization. The rotation angle is equal to one-half the retardance change from the Liquid Crystal Variable Retarder. Response time of the LPR depends upon the desired amount of rotation. Small rotations have a longer response time because of a smaller change in the electric field strength. Polarization purity is defined as the ratio of the rotated linear component to the orthogonal component and, on average, polarization purity (or extinction ratio) is better than 150:1. We provide test data including the required voltages corresponding to polarization orientations, in 10° increments, from approximately -40° to approximately 140° rotation. These measurements are taken at ambient temperature for your specified wavelength. Standard Liquid Crystal Polarization Rotators are supplied without an input polarizer. Input polarization direction must be precisely aligned for optimum performance.

Features:

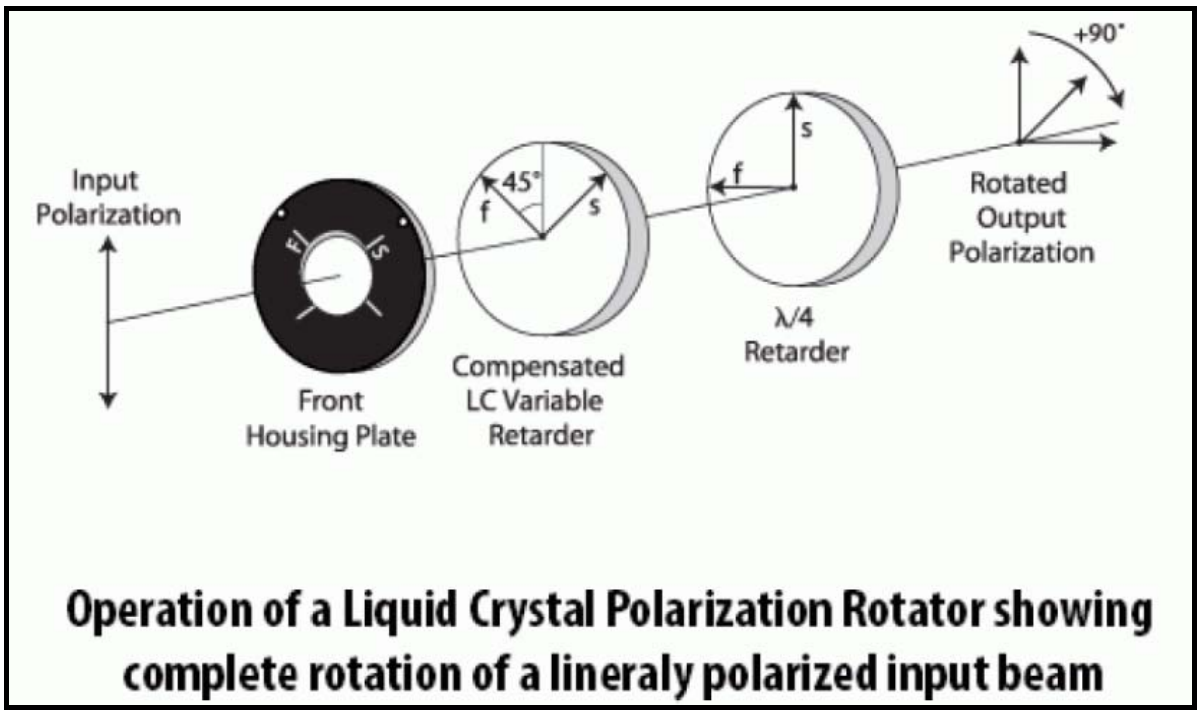
- High power capability
- High polarization purity
- Computer control capability
- 180 degree polarization rotation
- Continuous rotation of linearly polarized light

Technical specifications:

Retarder Material	Nematic liquid crystal with Birefringent polymer
Substrate Material	Optical quality synthetic fused silica
Wavelength	450 -1800 nm (specify)
Polarization Rotation	180˚
Polarization Purity	150:1 average

Transmittance	> 92% with polarized input
Transmitted Wavefront Distortion	n ≤ λ/4
Surface Quality (scratch-dig)	40-20
Beam Deviation	≤ 2 arc-min
Reflectance (per surface)	≤ 0.5% at normal incidence
Operating Temperature	0˚C to +50˚C
Laser Damage Threshold	500 W/cm2, CW; 300 mJ/cm2, 10 ns, visible

Clear Aperture in. [mm]	Diameter ± 0.005 in. [± 0.13 mm]	Thickness in. [mm]	Part Number
0.37	Ø1.00	1.23	STM-LPR-100-λ
[9.4]	[Ø25.4]	[31.2]	
0.7	Ø2.00	0.75	STM-LPR-200-λ
[17.8]	[Ø50.8]	[19.1]	
1.6	Ø3.00	1	STM-LPR-300-λ
[40.6]	[Ø76.2]	[25.4]	



Operation of a Liquid Crystal Polarization Rotator showing complete rotation of a lineraly polarized input beam

High Contrast Optical Shutter

Our liquid crystal shutter uses twisted nematic liquid crystals to provide a vibration-free mechanical shutter alternative. The twisted nematic liquid crystal switches between a state that rotates the input polarization by 90° with no voltage applied and a state that makes no change in the input polarization with 8 to 10 volts applied. The applied voltage is a 2 kHz AC square-wave. The shutter is supplied with integral dichroic visible polarizers to provide an average extinction ratio of better than 1,000:1. Custom shutters with larger aperture sizes and with wavelength coverage to 2.1 microns are available on a custom basis.

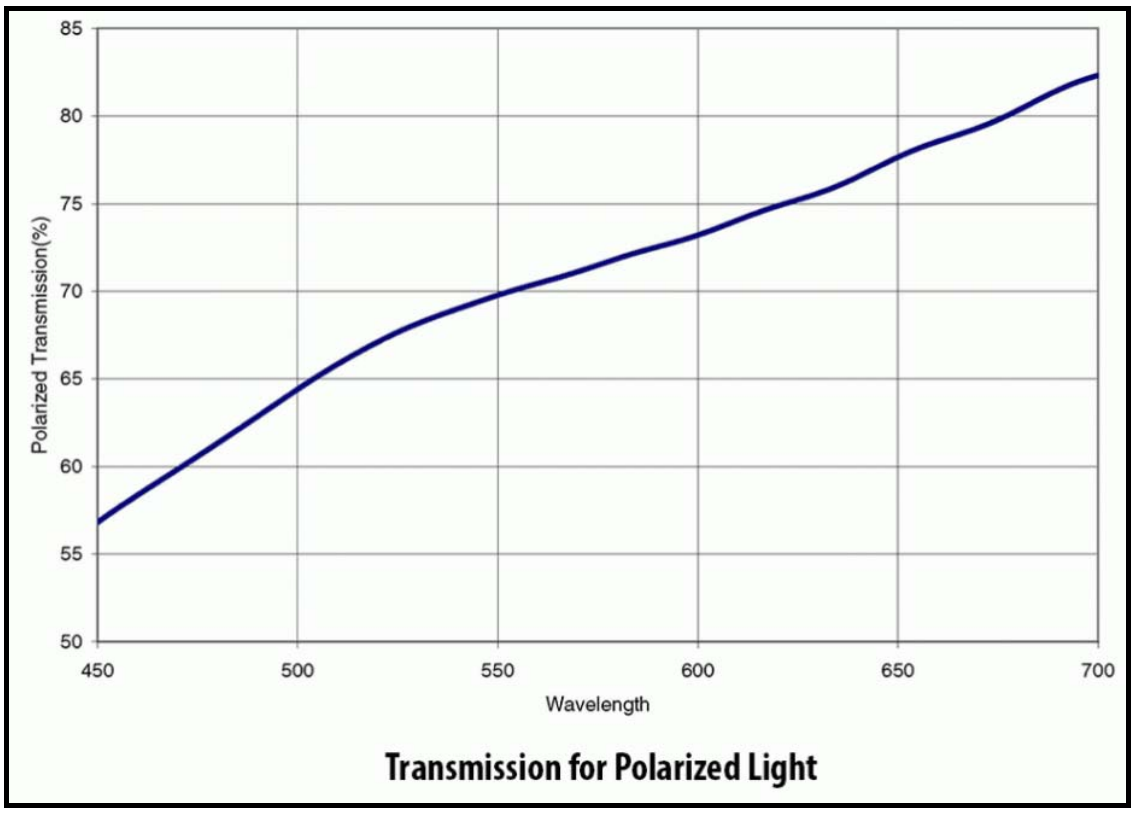
Features:

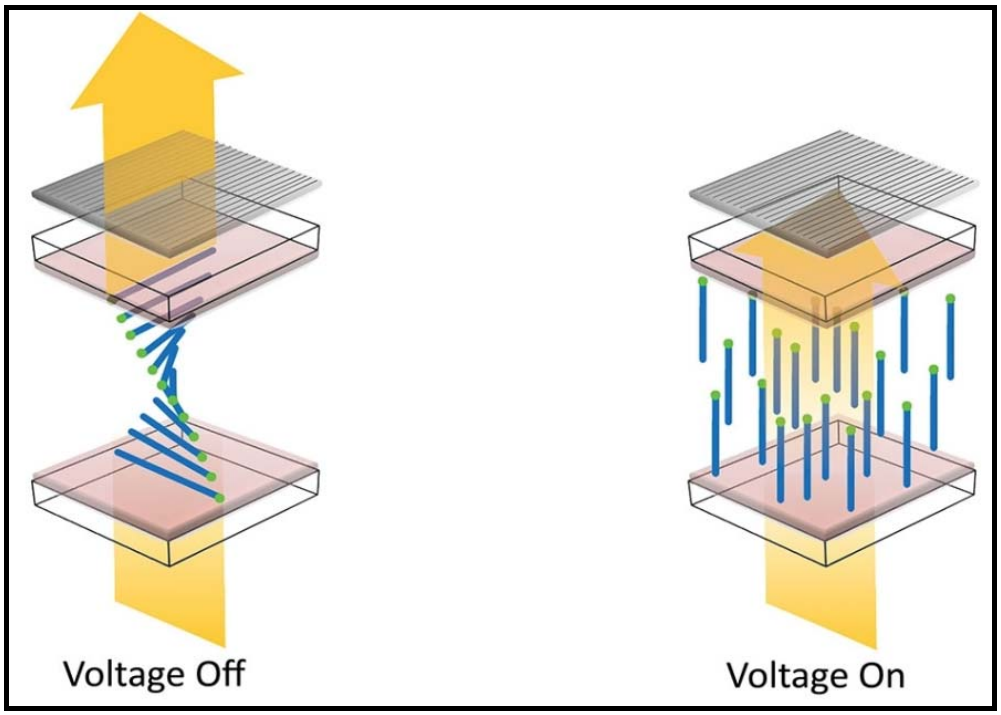
- High contrast
- No mechanical motion
- Computer control capacity
- No vibration

Technical specifications:

Liquid Crystal Configuration	Twisted nematic
Substrate Material	Optical quality synthetic fused silica
Polarizer Material	Dichroic polymer
Wavelength Range	450-1800 nm
Contrast Ratio (average)	1,000:1
Acceptance Angle	25˚ incidence angle with some reduction above 10˚
Switching Time (10% to 90% at room temperature)	
Closed to open:	5 milliseconds
Open to closed:	0.4 milliseconds
Transmitted Wavefront Distortion	≤ λ/2
Surface Quality (scratch-dig)	60-40
Beam Deviation	≤ 5 arc min
Reflectance (per surface)	≤ 0.5% at normal incidence
Laser Damage Threshold	1 W/cm2, CW
Glass Thickness	0.48-0.52 in.
Polarization Direction	Vertical on input face, horizontal on output face
Storage Temperature	-20˚C to +80˚C
Operating Temperature	0˚C to +50˚C

Clear Aperture in. [mm]	Diameter ± 0.005 in. [± 0.13 mm]	Thickness in. [mm]	Part Number
0.37	Ø1.00	1.23	STM-LCS-100
[9.4]	[Ø25.4]	[31.2]	
0.7	Ø2.00	0.75	STM-LCS-200
[17.8]	[Ø50.8]	[19.1]	
1.6	Ø3.00	1	STM-LCS-300
[40.6]	[Ø76.2]	[25.4]	





Binary Liquid Crystal Rotator

An Optical Rotator is a two-state device used to rapidly switch between two orthogonal sites of linear polarization. One state has output linear polarization parallel to an input linear polarization state. This occurs when voltage is applied to the rotator. The other state has output polarization orthogonal to the input polarization and occurs when no voltage is applied. Sintec Optronics manufactures and sells liquid crystal based Optical Rotators for applications requiring active timing control of beam transmittance by using them in combination with high quality polarizers. Key features of our Optical Rotators include high-speed binary operation, high purity linear polarized output, and maximum extinction ratio performance. Since these devices are solid state – undesirable mechanical motion, associated noise, and vibration problems are eliminated. Binary LC Rotators deliver optimum extinction ratio performance, often greater than 10,000:1 across the visible wavelength range, when used with high quality polarizers. Even higher extinction performance is achieved over narrower bandwidths or for single laser line applications. Up to 100% duty cycle operation is standard. This Rotator has a broad operating temperature range, designed to meet applications requiring low cost components with negligible impact on performance.

Features:

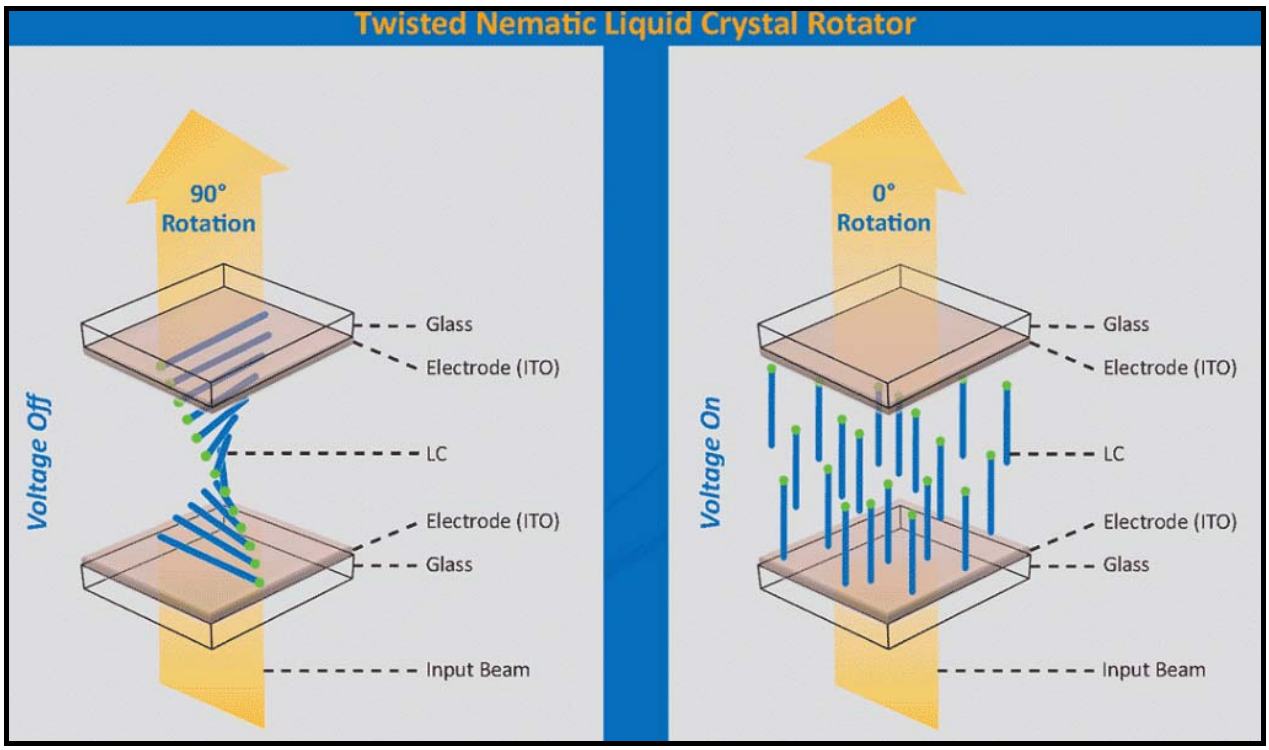
- High polarization purity
- Silent, vibration-free
- Low-voltage operation
- Broad thermal range
- Faster switching speeds than LCVRs

Technical specifications:

Retarder Material	Twisted Nematic liquid crystal
Substrate Material	Optical quality synthetic fused silica
Wavelength Range	400 - 1800 nm
Transmitted Wavefront Distortion	λ/4 (P-V @ 633 nm), [λ/16 (RMS @ 633 nm)]
Response Time (VIS)	≤ 5 ms
Surface Quality	40-20 scratch-dig
Beam Deviation	2 arc min

Reflectance (per surface)	0.5% at normal incidence
Diameter Tolerance	± 0.010 in.
Operating Temperature Range	10°C to 60°C (Operating); -40°C to 90°C (Storage)
Laser Damage Threshold	500 W/cm2, CW; 300 mJ/cm2, 10 ns, visible

Diameter (in.)	Clear Aperture (in.)	Thickness (in.)	Part Number
1.00 [25.4 mm]	0.37 [9.4 mm]	1.23 [31.24 mm]	STM-LTN-100-λ
2.00 [50.8 mm]	0.70 [17.8 mm]	0.75 [19.05 mm]	STM-LTN-200-λ
We offer Binary LC Rotators to cover four spectral regions:			
VIS: 450 – 700 nm			
IR 1: 650 – 950 nm			
IR 2: 900 – 1250 nm			
IR 3: 1200 – 1700 nm			



High Speed Liquid Crystal Variable Retarder

Sintec Optronics newest liquid crystal (LC) product, the high speed LC variable retarder (HS LCVR) has a 10X speed improvement over our award winning standard LCVR. The sub-millisecond speeds are achieved without the 50/50 duty cycle drive scheme required by our ferroelectric liquid crystal components, but are nearly as fast. The new LCVR uses nematic liquid crystal materials to electrically control polarization and provide tunable retardation by changing the effective birefringence of the material with applied voltage, thus altering the input polarized light to any chosen elliptical, linear or circular polarization. Our precision HS LCVR requires unique fabrication and assembly steps. We construct these retarders using optically flat fused silica windows coated with our transparent conductive Indium Tin Oxide (ITO). Our ITO coating is specially designed for maximum transmission from 400 – 700 nm. Liquid Crystal Variable Retarder response time depends on several parameters, including layer thickness, viscosity, temperature, variations in drive voltage and surface treatment. Liquid crystal response time is proportional to the square of the layer thickness and therefore, the square of the total retardance.

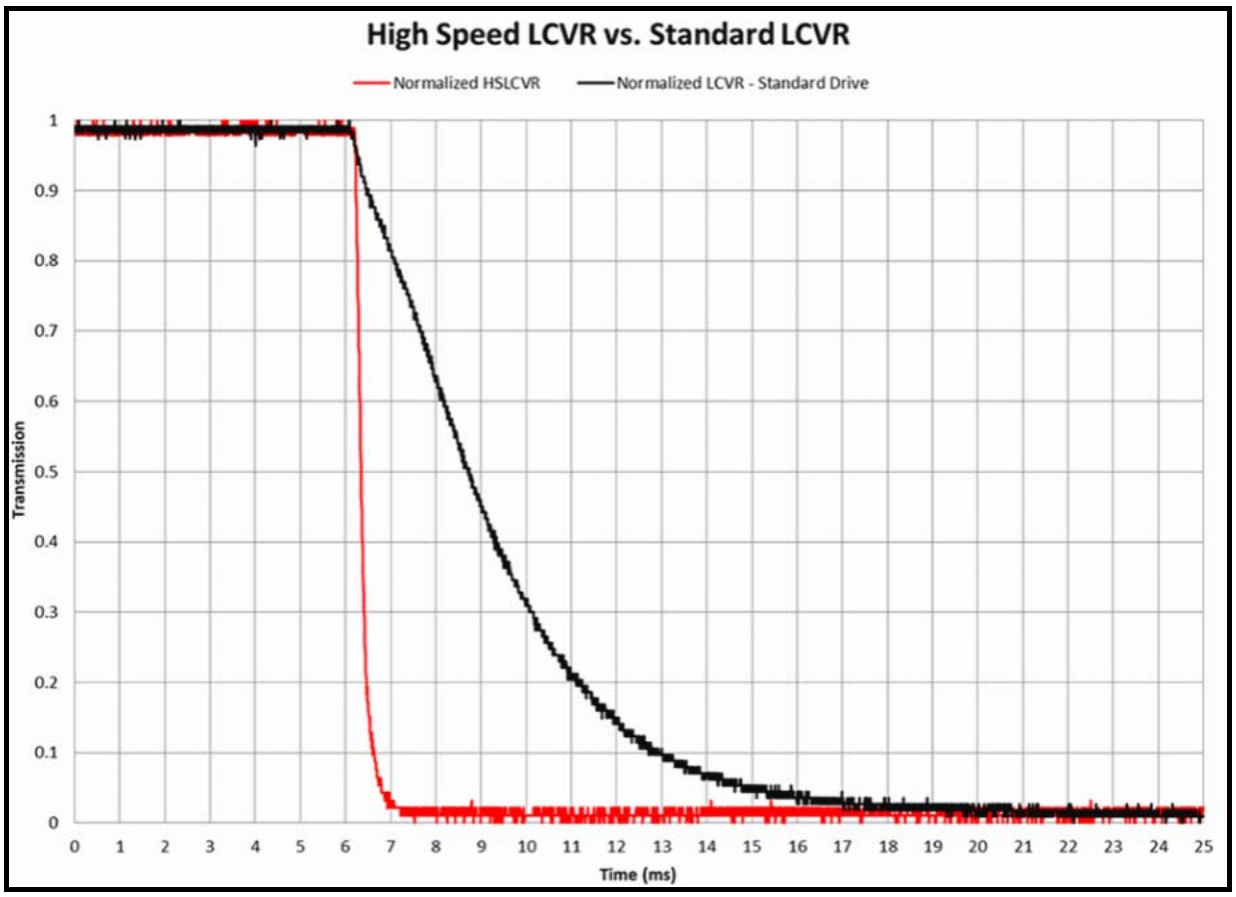
Features:

- Sub-millisecond speeds
- Standard LC Drive Schemes
- Includes heated housing
- Precision non-mechanical retardation control

Technical specifications:

Retarder Material	Nematic liquid crystal
Substrate Material	Optical quality synthetic fused silica
Wavelength Range	450 - 700 nm
Typical LC Rise Time (10 – 90%)	50 µs @ 532 nm
Typical LC Fall Time (90 – 10%)	500 µs @ 532 nm
Retardance	0 to λ/2
Transmitted Wavefront Distortion (at 632.8 nm)	≤ λ/4
Surface Quality	40-20 scratch-dig
Beam Deviation	≤ 2 arc min
Reflectance (per surface)	≤ 0.5% at normal incidence
Temperature Range	50°C
Recommended Safe Operating Limit	500 W/cm 2, CW; 300 mJ/cm2, 10 ns, visible

Diameter, D (in.)	Clear Aperture, CA (in.)	Thickness, t (in.)	Part Number
2	0.8	0.75	STM-HSLRC-200



Analog Liquid Crystal Controller

Sintec Optronics is excited to announce the release of the Model B1010, our new Analog Liquid Crystal Controller. This liquid crystal (LC) driver is designed to integrate with any single (standard) Meadowlark Optics LC device currently offered as well as any nematic Liquid Crystal device compatible with the specifications listed. Independent voltage settings allow easy and repeatable selection of two retardance values. Often, it is desirable to modulate between the two states. For example, switching between quarter-wave and three quarterwave retardance changes linearly polarized light between left and right circular. A manual toggle allows easy switching between two states. Banana jacks between the knobs allow for continuous voltage monitoring without interfering with LC device connections. Each Sintec Optronics Liquid Crystal Variable Retarder is supplied with a plot of its actual retardance versus voltage. Using your Model B1010 Controller and this retardance plot ensures accurate retardance to voltage correlation.

Features:

- Convenient, stand-alone bench top operation
- Versatile-compatible with all standard Sintec Optronics LC devices and other nematics
- Out-of-the-box functionality. Sets up in minutes
- Optional battery supply for short term use
- Banana jacks allow for easy multimeter attachment

Technical specifications:

Output Voltage	0 to 20 VAC, RMS, maximum
Fundamental Drive Waveform	2 kHz AC square wave
External Modulation (input)	none
Output Bias	± 10 mV DC
Power Requirements	12 VDC 200 mA or 9V battery external power supply included 100-240 VAC 50-60 Hz, 0.3 A International Plugs
Battery Life	1 hour (intended for convenience, not as a primary power source)
External Dimensions (W x D x H)	3.3 x 6.0 x 2.2 in.
Weight	< 1 lb.
CE Compliance	Compliant

Item	Part Number
Analog Liquid Crystal Controller	STM-B1010
B1010 Package	
B1010 Controller Unit	
Power Supply	
SMA-BNC Adapter	
Internal Plug Set	
9 Volt Battery	
User Manual	

Two Channel High Voltage Interface

Our two Channel High Voltage Digital Interface is designed for independent high precision computer control of up to two Sintec Optronics Swift LC liquid crystal devices at one time. The D3060HV Package includes all the functionality of the D3050 plus the high voltage circuitry necessary for Swift LC devices. Also included is capability for temperature monitoring and control on one channel. The Advanced

Package allows the amplitude of the 13 kHz square wave output to be driven either by an external signal supplied to a front panel connector or specific CellDRIVE generated waveforms including sinusoidal, square, triangle, sawtooth and transient nematic effect waveforms. Additional functions include the capability to output a sync pulse on a front panel connector at desired points in the CellDRIVE generated waveforms and the ability to save/restore all CellDRIVE settings to/from a file.

Features:

- USB or RS232 interface
- C++ code examples (all required libraries included)
- Compact and simple to use
- Microsoft® HyperTerminal configuration file included
- Independent control of voltage levels on two channels to 10 mV resolution
- Includes National Instruments LabVIEW™ Virtual Instrument drivers to interface with custom software

Technical specifications:

Fundamental Drive Waveform	13 kHz ac square wave
Modulation Amplitude	0-100 V rms
Modulation Resolution	10 mV (1.55 mV using LabVIEW™ subroutines)
DC Offset	< 50 mV
Communications Interface	USB or RS232
LC Cell to Controller Connections	LEMO™ RF cable, 2 m length
Power Requirements	100-240 V ac; 47-63 Hz; 2.5 A
Safety Feature	Keyed Interlock Switch
Modulation Waveforms	External modulation input (0-5 V)
	Sinusoidal
	Triangle
	Square
	Sawtooth
	Transient nematic effect
Temperature Control	Active heating/passive cooling to within ± 1˚C of nominal set point
Sync Output	TTL, 1 µs pulse, user specified phase
Minimum System Requirements	
USB or RS232 COM Port	
Use of LavVIEW Instrument Library requires LabVIEW version 2010 or higher	

Item	Part Number
High Voltage Controller	STM-D3060HV
High Voltage Cable	Swift LC Cable

Liquid Crystal Digital Interface Controller

The new D5020 Liquid Crystal Digital Interface is the next generation in the evolution of Sintec Optronics Liquid Crystal Controllers. The Digital Controller is designed for user functionality and productivity. The D5020 provides a “set and go” function that allows the controller to run autonomously without a computer. Controlling multiple Liquid Crystal cells has never been easier. CellDRIVE 5000 software provides a separate sync output for each channel as well as temperature sensing and control on both channels. The 2kHz square wave output can be amplitude modulated with sinusoidal, square, triangle, sawtooth and transient nematic effect waveforms.

Features:

- Two channels of voltage and temperature sensing & control (TSC)
- USB powered (unless using TSC)
- Waveforms generated internally
- Independent SMB I/O Connectors for each channel
- Multiple external control options
- Includes USB and LabVIEW™ code example

Technical specifications:

Fundamental Drive Waveform	2 kHz AC square wave
Modulation Amplitude	0-10 V rms (20 V rms available)
Modulation Resolution	1 mV (0.155 mV using LabVIEW™ subroutines)
DC Offset	< 5 mV
Communications Interface	USB
LC Cell to Controller Connections	SMA-SMB, 2 m cable length
CE Compliance	Compliant
Modulation Waveforms	External modulation input (0-5 V)
	Sinusoidal
	Triangle
	Square
	Sawtooth
	Transient nematic effect
Temperature Control (2 channels)	Active heating/passive cooling to within ± 1˚C of nominal set point
Sync Output	TTL, user specified phase
Minimum System Requirements	
Windows™ Vista, 7 or 8	
Requires LabVIEW™ version 2010 or higher for use with LabVIEW™	
instrument library	

Item	Part Number
LC Digital Interface	STM-D5020
LC Digital Interface (20V rms)	STM-D5020-20V
SMA to SMB Cables	STM-SMA-SMB
Sync Cables (SMB to BNC)	STM-SMB-BNC

LC Temperature Controller

The Sintec Optronics TC3051 is a single channel, microprocessor based temperature controller specifically designed to work with Meadowlark Optics' liquid crystal devices equipped with the Temperature Sensing and Control (TSC) option. The TC3051 requires minimal setup: connect the included power supply, connect the temperature control cable to both the TC3051 and the liquid crystal device and turn the power on.

Features:

- Stand alone
- LED display
- 1 channel temperature control

Technical specifications:

Power Requirements	100 – 240V ac, 47 – 63 Hz, 500 mA
Fuse	Internal (not user serviceable)
Environment	0° C to +50° C (Operating); -55°C to +100°C (Storage)
External Dimensions (W x D x H)	5.08 x 5.25 x 1.50 in. (12.90 x 13.33 x 3.81 cm)
Weight	lb. (0.45 kg)
Temperature Readout Resolution	1°C
Temperature Readout Range	0°C to 99°C
Setpoint Resolution	1°C
Setpoint Range	20°C to 60°C

Temperature Controller	STM-TC3051

Ferroelectric Liquid Crystal Controller

The FCS010 is a two-channel liquid crystal controller specifically designed to drive our ferroelectric liquid crystal shutters and rotators. It has two short-circuit protected output channels driven 180 degrees out of phase. The pre-configured controller waveforms are optimized for FLC devices. We can tailor the waveform to your specific needs based on application and purchased FLC device. The drive waveform is output through SMA connectors. This controller is 100% RoHS compliant and is powered by a separate 12V international power supply.

Features:

- Automatically DC balances
- External modulation
- 10V output
- Gate input
- Drive I/O
- Frequency range 1Hz - 10kHz

Technical specifications:

Dimensions	5.3 in. W x 5.3 in. L x 2.0 in. H , (13.5 cm W x 13.5 cm L x 5.1 cm H)
Number of LC Channels	Two, running identical programs 180 degrees out of phase
Output Waveform	Bipolar ± 15V peak voltage, ± 10V holding voltage
Amplitude Resolution	16-bit; 1 mV voltage resolution
Internal Drive	1 to 10,000 Hz, 50% duty cycle, frequency controlled by front-panel 10-turn knob

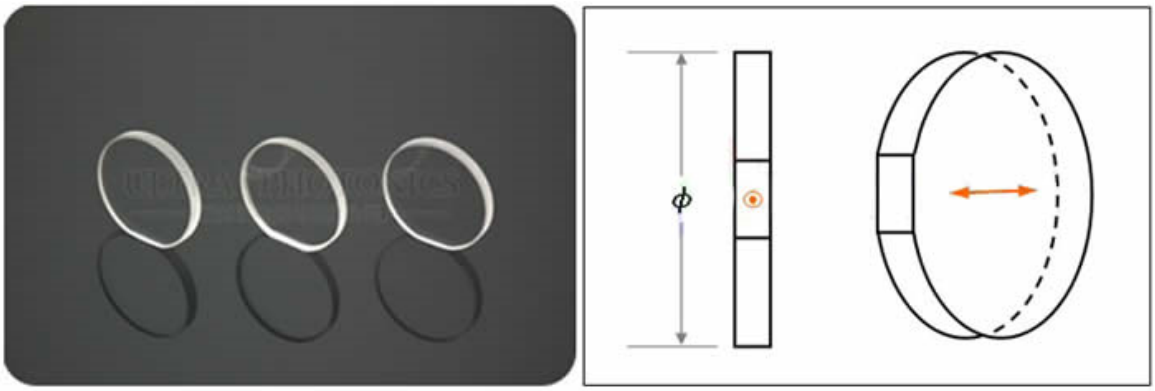
Ferroelectric Liquid Crystal Controller	STM-FCS010

Waveplates

Waveplate		Part #	(λ/100 Bandwidth) λ/2 @532 nm	Acceptance Angle	Damage Threshold
Low order Waveplate		ST-WPL	0.55nm (T=0.5060 mm)	Med.	1GW/cm^2
Zero Order	Cemented	ST-WPC	19.22nm (ΔT=0.0145 mm)	Low	~ 10MW/cm^2
	Optically Contracted	ST-WPO	19.22nm (ΔT=0.0145 mm)	Low	~200 MW/cm^2
	Air Spaced	ST-WPA	19.22nm (ΔT=0.0145 mm)	Low	~500 MW/cm^2
True Zero Order Waveplate	Cemented	ST-WPF	19.22nm (T=0.0145 mm)	High	~ 10MW/cm^2
	Single Plate	ST-WPS	19.22nm (T=0.0145 mm）	High	> 1GW/cm^2
Achromatic Waveplate		ST-WPB	250 nm	Low	10MW/cm^2
Dual Wavelength Waveplate		ST-WPD	Very Small	Low	

1. Low Order Waveplates

Low (multiple) order waveplate is designed to give a retardance of several full waves, plus the desired fraction. This result in a single, physically robust component with desired performance. However, even small changed in wavelength or temperature will result in significant changes in the desired fractional retardance. They are less expensive and find use in many applications where the increased sensitivities are not an important.



Material	Quartz
Wavelength Range	200～2300 nm,
Dimension Tolerance	+/-0.1mm
Surface Quality	20 / 10
Parallelism	<1 arc Sec
Retardation Tolerance	< λ/300
Clear Aperture	>90%
Damage Threshold	>500 MW/cm2
Coating	AR coating

Mount	Black Anodized Aluminium

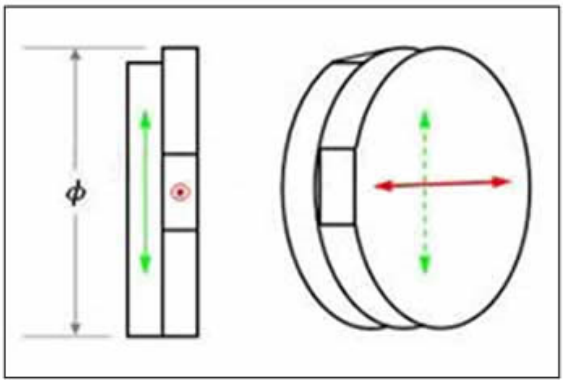
Standard Wavelength:
355nm, 532nm, 632.8nnm, 780nm, 808nm, 850nnm, 980nm, 1064nm, 1310nm, 1480nm, 1550nm

Ordering Information

Quarter Waveplates P/N#	Half Waveplates P/N#	Diameter (∮ mm)
ST-WPL410	ST-WPL210	10
ST-WPL412	ST-WPL212	12.7
ST-WPL415	ST-WPL215	15
ST-WPL420	ST-WPL220	20
ST-WPL425	ST-WPL225	25
ST-WPL430	ST-WPL230	30

2. Zero Order Waveplates

The zero order waveplate is designed to give a retardance of zero full waves, plus the desired fraction. Zero order waveplate shows better performance than multiple order waveplates. It has broad bandwidth and a lower sensitivity to temperature and wavelength changes. It should be considered for more critical applications.



Material	Quartz
Wavelength Range	200～2300 nm,
Dimension Tolerance	+/-0.1mm
Surface Quality	20 / 10
Parallelism	<1 arc Sec
Retardation Tolerance	< λ/500
Clear Aperture	>90%
Damage Threshold	>500 MW/cm2
Coating	AR coating
Mount	Black Anodized Aluminium

Standard Wavelength：
355nm, 532nm, 632.8nnm, 780nm, 808nm, 850nnm, 980nm, 1064nm, 1310nm, 1480nm, 1550nm

2.1 Zero Order Waveplates-Optically Contacted

This type of zero order waveplate is constructed of two low order waveplate with their axes crossed. Thus, the effect of the first plate is cancelled by the second, except for the residual difference between them.

- Optically contacted
- AR coated, R<0.2%
- High damage threshold
- Better temperature band width
- Wide wavelength bandwidth

Quarter Waveplates P/N #	Half Waveplates P/N #	Diameter (∮ mm)
ST-WPO410	ST-WPO210	10
ST-WPO412	ST-WPO212	12.7
ST-WPO415	ST-WPO215	15
ST-WPO420	ST-WPO220	20
ST-WPO425	ST-WPO225	25
ST-WPO430	ST-WPO230	30

2.2 Zero Order Waveplates - Cemented by Epoxy

This type of zero order waveplate is constructed of two low order waveplate with their axes crossed. Thus, the effect of the first plate is cancelled by the second, except for the residual difference between them.

- Cemented by epoxy
- AR coated, R<0.2%
- Better temperature band width
- Wide wavelength bandwidth

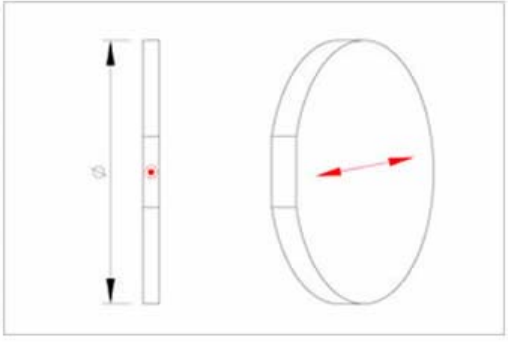
Quarter Waveplates P/N #	Half Waveplates P/N #	Diameter (∮ mm)
ST-WPC410	ST-WPC210	10
ST-WPC412	ST-WPC212	12.7
ST-WPC415	ST-WPC215	15
ST-WPC420	ST-WPC220	20
ST-WPC425	ST-WPC225	25
ST-WPC430	ST-WPC230	30

2.3 Zero Order Waveplate - Air Spaced

- Air spaced
- Double retardation plates
- AR coated, R<0.2%
- High damage threshold
- Better temperature band width
- Wide wavelength bandwidth

Quarter Waveplates P/N #	Half Waveplates P/N #	Diameter (∮ mm)
ST-WPA410	ST-WPA210	10
ST-WPA412	ST-WPA212	12.7
ST-WPA415	ST-WPA215	15
ST-WPA420	ST-WPA220	20
ST-WPA425	ST-WPA225	25
ST-WPA430	ST-WPA230	30

3. True Zero Order Waveplates



Material	Quartz
Wavelength Range	200～2300 nm,
Dimension Tolerance	+/-0.1mm
Surface Quality	20 / 1 0
Parallelism	<1 arc Sec
Retardation Tolerance	< λ/300
Clear Aperture	>90%
Damage Threshold	>500 MW/cm2
Coating	AR coating
Mount	Black Anodized Aluminium

3.1 True Zero Order Waveplate-Single Plate

This type of zero order waveplate is designed for high damage threshold applications (more than 1GW/cm2). As the plate is very thin, it's easy to break during operation.

- Wide angle acceptance
- Better temperature bandwidth
- Wide wavelength bandwidth
- High damage threshold
- AR coated, R<0.2%
- Single plate

Standard Wavelength：
1/2：1310nm, 1480nm, 1550nm
1/4：980nm, 1064nm，1310nm, 1480nm, 1550nm

Quarter Waveplates P/N #	HalfWaveplate P/N #	Diameter (∮ mm)
ST-WPS410	ST-WPS210	10
ST-WPS412	ST-WPS212	12.7
ST-WPS415	ST-WPS215	15
ST-WPS420	ST-WPS220	20
ST-WPS425	ST-WPS225	25
ST-WPS430	ST-WPS230	30

3.2 True Zero Order Waveplate – Cemented

This type of zero order waveplate is constructed of a true zero order waveplate and a BK7 substrate. As the waveplate is very thin and easy to be damaged, the Bk7 plate's function is to strengthen the waveplate.

- Standard thickness:1.1±0.2mm
- Cemented by epoxy
- Wide angle acceptance
- Better temperature bandwidth
- Wide wavelength bandwidth
- AR coated, R<0.2%

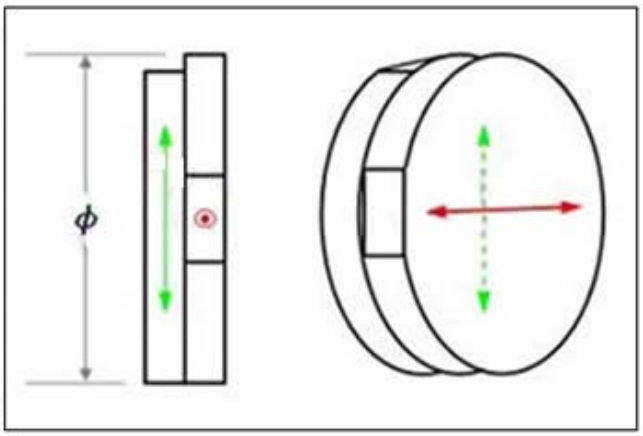
Standard wavelength:
532nm, 632.8nm, 780nm, 808nm，980nm, 1064nm，1310nm, 1480nm, 1550nm

Quarter Waveplates P/N #	HalfWaveplate P/N #	Diameter (∮ mm)
ST-WPF410	ST-WPF210	10
ST-WPF412	ST-WPF212	12.7
ST-WPF415	ST-WPF215	15
ST-WPF420	ST-WPF220	20
ST-WPF425	ST-WPF225	25

ST-WPF430	ST-WPF230	30

4. Achromatic Waveplate

Achromatic waveplate is made from two different substrate materials such as crystal quartz and magnesium fluoride. For the single material waveplates the working wavelength is very limited because of the dispersion of the material. While two different kinds of material are used achromatic waveplate, the dispersions of the birefringence are also different. Hence such waveplate is not sensitive to the wavelength change.



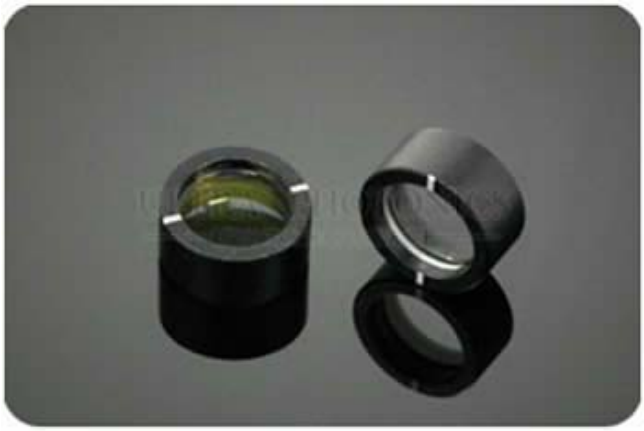
Material	Quzrtz+MgF2
Wavefront Distortion	350~2100 nm,
Dimension Tolerance	+/-0.1mm
Surface Quality	20 / 10
Parallelism	<1 arc Sec
Retardation Tolerance	< λ/100
Clear Aperture	>90%
Damage Threshold	>500 MW/cm2
Coating	AR Coating
Mount	Black Anodized Aluminium

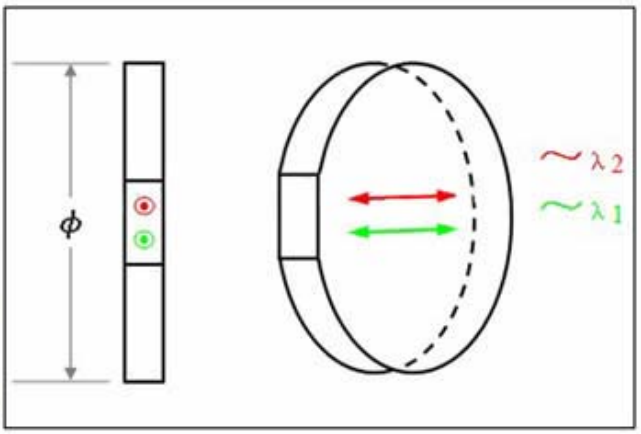
Standard Wavelength：
460-650nm, 550-750nm, 650-1000nm, 900-2100nm

Quarter Waveplates P/N#	Half Waveplates P/N#	Diameter (ϕ mm)
ST-WPB410	ST-WPB210	10
ST-WPB412	ST-WPB212	12.7
ST-WPB415	ST-WPB215	15
ST-WPB420	ST-WPB220	20
ST-WPB425	ST-WPB225	25
ST-WPB430	ST-WPB230	30

5. Dual Wavelength Waveplate

Dual wavelength waveplate is a multiple waveplate that provides a specific retardance at two different wavelengths, it's particularly useful when used in conjunction with other polarization sensitive components to separate coaxial laser beams of different wavelength.





Material	Quartz
Wavefront Distortion	350~2100 nm,
Dimension Tolerance	+/-0.1mm
Surface Quality	20 / 10
Parallelism	<1 arc Sec
Retardation Tolerance	< λ/100
Clear Aperture	>90%
Damage Threshold	>500 MW/cm2
Coating	AR Coating
Mount	Black Anodized Aluminium

Quarter Waveplates P/N#	Half Waveplates P/N#	Diameter (∮ mm)
ST-WPD410	ST-WPD210	10
ST-WPD412	ST-WPD212	12.7
ST-WPD415	ST-WPD215	15
ST-WPD420	ST-WPD220	20
ST-WPD425	ST-WPD225	25
ST-WPD430	ST-WPD230	30

6. Polarization Rotator

Due to the rotation activity of natural quartz crystal, it also can be used as polarization rotators so that the plane of input linearly polarized beam will be rotated at special angle which is determined by the thickness of quartz crystal.

- Made of quartz, 200-2500nm
- Up to 50.8mm diameter
- Custom rotation angle available
- RoHS Compliant

Material	Crystal Quartz 200-2500nm

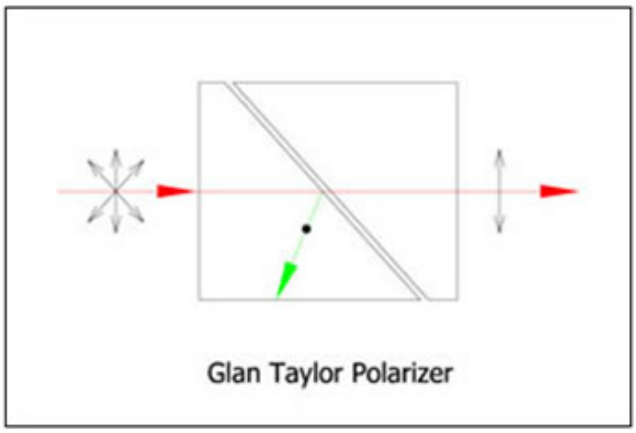
Dimension Tolerance	±0.2mm
Rotation Accuracy	<5 arc minutes
Parallelism	<10 arc seconds
Wavefront Distortion	λ/4@632.8nm
Surface Quality	20/10 scratch and dig
Rotation	clockwise and counter-clockwise
Coating	AR coating available, R<0.25%@central wavelength

Polarizer

Type	Material	Characters
Glan-Taylor	Calcite(350～2300nm) α-BBO(190～3500nm) YVO4 (500～4000nm)	Air spaced, nearly Brewster cut, not suitable for high power laser
Glan-laser	Calcite(350～2300nm) α-BBO (190～3500nm) YVO4 (500～4000nm)	Air spaced, nearly Brewster cut, with windows, suitable for high power laser
Glan-Thompson	Calcite(350～2300nm) α-BBO(190～3500nm)	Glue contacted, wide accept angle, not suitable for high power laser
Brewster Polarizers	Calcite(350～2300nm) YVO4 (500～4000nm)	High transmisson：Tp>98% High damage threshold
Glan-Thompson PBS	Calcite(350～2300nm) α-BBO(190～3500nm)	used to separate o and e light 45 degree
Wollaston	Calcite(350～2300nm) Crystal Quartz (200～300nm) YVO4 (500～4000nm)	Glue contacted or Optical contacted, separate o and e light
Rochon Polarizers	Crystal Quartz (200～2300nm) α-BBO(190～500nm) YVO4 (500～4000nm)	Glue contacted or Optical contacted, separate o and e light(only o light walks off)
Polarization Beam Splitter	K9 (350～2000nm) ZF2(400～2000nm)	used to separate o and e light with right angle

1. Glan Taylor Polarizer

Glan Taylor polarizer is made of two birefringent prisms that are assembled with an air space. The polarizer with no side escape windows is suitable for low to medium power application where the side rejected beams are not required.



- Air-spaced
- Close to Brewster's angle cutting
- High polarization purity
- Short length
- Wide wavelength range
- Suitable for low to medium power application

Material	a-BBO, Calcite or YVO4
Wavelength Range	BBO:200~3500 nm, Calcite:350~2300 nm, YVO4: 500~4000 nm

Extinction Ratio	Calcite:<5x10-5 ; a-BBO:<5x10-6 ; YVO 4 :<5x10-6
Surface Quality	20 / 10
Parallelism	<1 arc Min
Beam Deviation	< 3 arc minutes
Wavefront Distortion	λ /4@633nm
Damage Threshold	>200 MW/cm^2
Coating	Single MgF2
Mount	Black Anodized Aluminium

1.1 a-BBO Glan Taylor Polarizer

Part No.	Wavelength Range(nm)	Extinction Ratio	Angular Field	C.A. φa (mm)	O.D. φd (mm)	L (mm)
ST-PGT1206	200-270nm	<5x10^{-6}	>6.0°	6.0	15.0	15.0
ST-PGT1208				8.0	25.4	17.0
ST-PGT1210				10.0	25.4	19.0
ST-PGT1212				12.7	25.4	21.0
ST-PGT1215				15.0	30.0	23.0
ST-PGT1306	300-700nm	<5x10^{-6}	>6.0°	6.0	15.0	15.0
ST-PGT1308				8.0	25.4	17.0
ST-PGT1310				10.0	25.4	19.0
ST-PGT1312				12.0	25.4	21.0
ST-PGT1315				15.0	30.0	23.0
ST-PGT1320				20.0	38.0	29.0
ST-PGT1706	700-3000nm	<5x10^{-6}	>6.0°	6.0	15.0	15.0
ST-PGT1708				8.0	25.4	17.0
ST-PGT1710				10.0	25.4	19.0
ST-PGT1712				12.0	25.4	21.0
ST-PGT1715				15.0	30.0	23.0
ST-PGT1720				20.0	38.0	29.0

1.2 Calcite Glan Taylor Polarizer

Part No.	Wavelength Range	Extinction Ratio	Angular Field	C.A. φa (mm)	O.D. φd (mm)	L (mm)
ST-PGT2006	350～ 2300nm	<5x10^{-6}	＞7.7°	6.0	15.0	15.0
ST-PGT2008				8.0	25.4	17.0
ST-PGT2010				10.0	25.4	19.0
ST-PGT2012				12.7	25.4	21.0
ST-PGT2015				15.0	30.0	23.0
ST-PGT2020				20.0	38.0	29.0

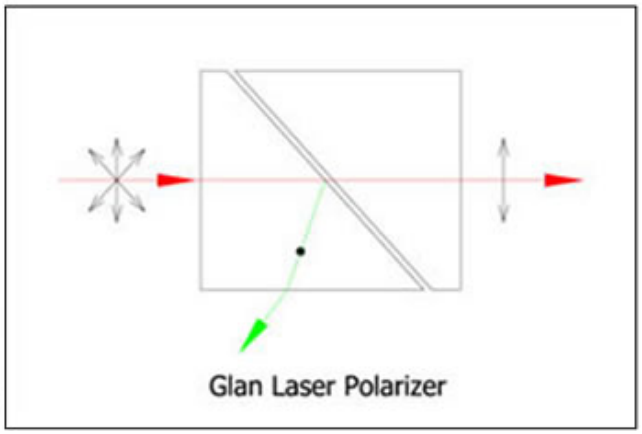
1.3 YVO4 Glan Taylor Polarize

Part No.	Wavelength Range	Extinction Ratio	Angular Field	C.A. φa (mm)	O.D. φd (mm)	L (mm)
ST-PGT3006	500-4000nm	<5x10^{-6}	>6.5°	6.0	15.0	12.0
ST-PGT3008				8.0	25.4	12.0

ST-PGT3010				10.0	25.4	17.0
ST-PGT3012				12.7	25.4	19.0
ST-PGT3015				15.0	30.0	20.0
ST-PGT3020				20.0	38.0	25.0

2. Glan Laser Polarizer

Glan laser prism polarizer is made of two same birefringent material prisms that are assembled with an air space. The polarizer is a modification of the Glan Taylor type and is designed to have less reflection loss at the prism junction. The polarizer with two escape windows allow the rejected beam to escape out of the polarizer, which makes it more desirable for high energy lasers. The surface quality of these faces is relatively poor as compared to that of entrance and exit faces. No scratch dig surface quality specifications are assigned to these faces.



- Air-spaced
- Close to Brewster's angle cutting
- High polarization purity
- Short length
- Wide wavelength range
- Suitable for medium power application

Material	a-BBO, Calcite or YVO4
Wavelength Range	BBO:200~3500 nm, Calcite:350~2300 nm, YVO4: 500~4000 nm
Extinction Ratio	Calcite:<5x10-5; a-BBO: <5x10-6; YVO4: <5x10-6
Surface Quality	20 / 10
Parallelism	<1 arc min
Beam Deviation	< 3 arc minutes
Wavefront Distortion	λ /4@633nm
Damage Threshold	>500 MW/cm^2
Coating	Single MgF2
Mount	Black anodized aluminium

2.1 a-BBO Glan Laser Polarizer

Part No.	Wavelength Range	Extinction Ratio	Angular Field	C.A. φa (mm)	O.D. φd (mm)	L (mm)
ST-PGL1206	200-300nm	<5x10^{-6}	>6.0°	6.0	15.0	29.0
ST-PGL1208				8.0	25.4	31.0
ST-PGL1210				10.0	25.4	31.0
ST-PGL1212				12.7	25.4	38.6
ST-PGL1215				15.0	30.0	48.9

ST-PGL1306	300-700nm	<5x10^{-6}	>6.0°	6.0	15.0	25.0
ST-PGL1308				8.0	25.4	25.0
ST-PGL1310				10.0	25.4	26.0
ST-PGL1312				12.0	25.4	27.0
ST-PGL1315				15.0	30.0	33.4
ST-PGL1320				20.0	38.0	43.6
ST-PGL1706	700-3000nm	<5x10^{-6}	>6.0°	6.0	15.0	23.0
ST-PGL1708				8.0	25.4	24.7
ST-PGL1710				10.0	25.4	25.9
ST-PGL1712				12.0	25.4	27.0
ST-PGL1715				15.0	30.0	33.4
ST-PGL1720				20.0	38.0	43.6

2.2 Calcite Glan Laser Polarizer

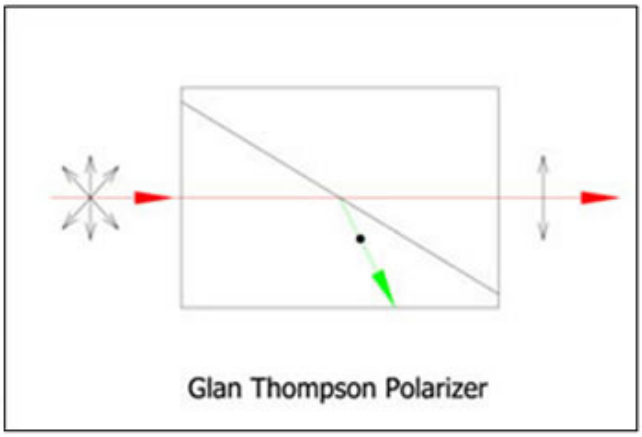
Part No.	Wavelength Range	Extinction Ratio	Angular Field	C.A. φa (mm)	O.D. φd (mm)	L (mm)
ST-PGL2006	350～2300nm	<5x10^{-5}	＞7.7°	6.0	15.0	21.0
ST-PGL2008				8.0	25.4	24.5
ST-PGL2010				10.0	25.4	26.2
ST-PGL2012				12.7	25.4	27.5
ST-PGL2015				15.0	30.0	33.3
ST-PGL2020				20.0	38.0	42.3

3. YVO4 Glan Laser Polarizer

Part No.	Wavelength Range	Extinction Ratio	Angular Field	C.A. φa (mm)	O.D. φd (mm)	L (mm)
ST-PGL3006	500-4000nm	<5x10^{-6}	>6.5°	6.0	15.0	18.0
ST-PGL3008				8.0	25.4	20.0
ST-PGL3010				10.0	25.4	23.0
ST-PGL3012				12.7	25.4	25.0
ST-PGL3015				15.0	30.0	26.0
ST-PGL3020				20.0	38.0	29.0

3. Glan Thompson Polarizer

Glan Thompson polarizer beamsplitter cube is made of two calcite prisms cemented together. It has been arranged to permit the output of the s-polarized beam at 45° from the straight through p-polarized beam. They provide high polarization purity and high transmission in the two emerging beams. These are useful if it is required to utilize both linear polarization states. They are mounted in a rectangular metal cell and surrounded with an absorbing compound.



- Widest field angle
- Cemented, suitable for low power application
- High polarization purity

Material	a-BBO, Calcite
Wavelength Range	a-BBO: 200~3500nm, Calcite: 350~2300nm
Extinction Ratio	a-BBO: $<5x10^{-6}$, Calcite: $<5x10^{-5}$
Surface Quality	20 / 10
Parellelism	<1 arc min
Beam Deviation	< 3 arc minutes
Wavefront Distortion	λ /4@633nm
Wavefront Distortion	>200 MW/cm^2
Coating	Single MgF2
Mount	Black anodized aluminium

3.2 Calcite Glan Thompson Polarizer (350-2300nm)

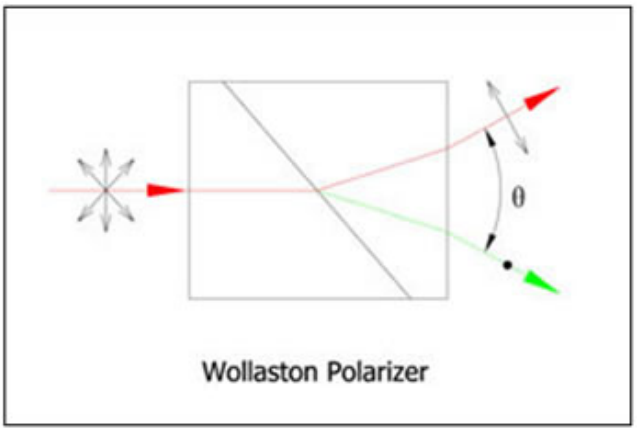
Part No.	L/CA	Extinction Ratio	Angular Field	C.A. φa (mm)	O.D. φd (mm)	L (mm)
ST-PGM2106	2.5	$<5x10^{-6}$	＞14～16°	6.0	15.0	22.0
ST-PGM2108				8.0	25.4	28.0
ST-PGM2110				10.0	25.4	33.0
ST-PGM2112				12.7	25.4	39.0
ST-PGM2115				15.0	30.0	45.5
ST-PGM2206	3.0	$<5x10^{-6}$	＞25～28°	6.0	15.0	26.0
ST-PGM2208				8.0	25.4	32.0
ST-PGM2210				10.0	25.4	38.0
ST-PGM2212				12.7	25.4	46.0
ST-PGM2215				15.0	30.0	53.0

3.3 a-BBO Glan Thompson Polarizer (200-1100nm)

Part No.	L/CA	Extinction Ratio	Angular Field	C.A. φa (mm)	O.D. φd (mm)	L (mm)
ST-PGM1006	1.6	$<5x10^{-6}$	>15°	6.0	15.0	22.0
ST-PGM1008				8.0	25.4	28.0
ST-PGM1010				10.0	25.4	33.0
ST-PGM1012				12.7	25.4	39.0
ST-PGM1015				15.0	30.0	45.5

4. Wollaston Polarizers

Wollaston polarizer is made of two birefringent material prisms that are cemented together. The deviations of the ordinary and extraordinary beams are nearly symmetrical about the input beam axis, so that the Wollaston polarizing beam splitter has approximately twice the deviation of the Rochon. The separation angle exhibits chromatic dispersion, as shown in the blow. Any separation angle can be designed upon the requirement.



Material	a-BBO, Calcite, YVO4, Quartz
Wavelength Range	a-BBO: 190~3500nm, Calcite: 350~2300 nm, YVO4: 500~4000nm, Quartz: 200~2300 nm
Extinction Ratio	a-BBO:<5x10-6 Calcite: <5x10-5, YVO4: <5x10-6, Quartz: <5x10-4
Surface Quality	20 / 10
Parallelism	<1 arc min
Beam Deviation	< 3 arc minutes
Wavefront Distortion	λ /4@633nm
Damage Threshold	>500 MW/cm^2
Coating	Single MgF2
Mount	Black anodized aluminium

4.1 αa-BBO Wollaston Polarizer

Part No.	Wavelength Range	Extinction Ratio	Separation Angle	C.A.φa (mm)	O.D.φd (mm)	L (mm)
ST-PWS1006	190～3500nm	<5x10^{-6}	16° @800nm	6.0	15.0	15.0
ST-PWS1008				8.0	25.4	17.0
ST-PWS1010				10.0	25.4	19.0
ST-PWS1015				15.0	30.0	23.0

4.2 Calcite Wollaston Polarizer

Part No.	Wavelength Range	Extinction Ratio	Separation Angle	C.A.φa (mm)	O.D.φd (mm)	L (mm)
ST-PWS2006	350～2300nm	<5x10^{-5}	19° @980nm	6.0	15.0	15.0
ST-PWS2008				8.0	25.4	17.0
ST-PWS2010				10.0	25.4	19.0
ST-PWS2015				15.0	30.0	23.0
ST-PWS2020				20.0	38.0	29.0

4.3 YVO4 Wollaston Polarizer

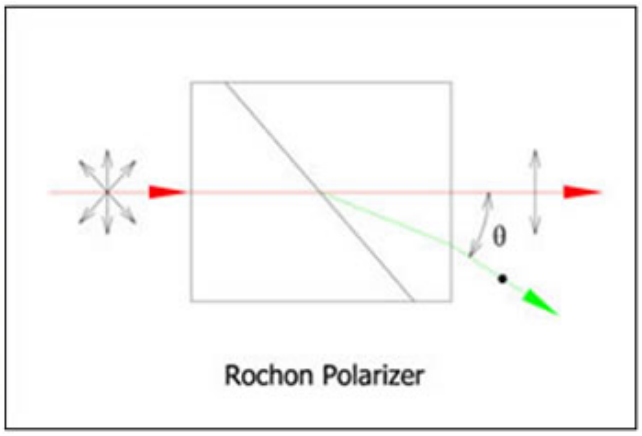
Part No.	Wavelength Range	Extinction Ratio	Separation Angle	C.A.φa (mm)	O.D.φd (mm)	L (mm)
ST-PWS3006	400～4000nm	<5x10^{-6}	20° @1550nm	6.0	15.0	15.0
ST-PWS3008				8.0	25.4	17.0
ST-PWS3010				10.0	25.4	19.0
ST-PWS3015				15.0	30.0	23.0
ST-PWS3020				20.0	38.0	29.0

4.4 Quartz Wollaston Polarizer

Part No.	Wavelength Range	Extinction Ratio	Separation Angle	C.A.φa (mm)	O.D.φd (mm)	L (mm)
ST-PWS4006	200～2300nm	<5x10^{-4}	2° @1064nm	6.0	15.0	20.0
ST-PWS4008				8.0	25.4	24.0
ST-PWS4010				10.0	25.4	28.0
ST-PWS4015				15.0	30.0	38.0
ST-PWS4020				20.0	38.0	48.0

5. Rochon Polarizers

Rochon polarizer is one of the earliest designs, which is made of two birefringent material prisms cemented together. Both ordinary and extraordinary beams propagate collinearly down the optic axis in the first prism under the ordinary refractive index. Upon entering the second prism the ordinary beam experiences the same refractive index and continues undeviated. The extra-ordinary beam, however, now has a lower refractive index and is refracted at the interface. The angle of refraction is further increased at the birefringent material/air exit surface. Any separation angle can be designed for specific wavelength upon the requirement.



Material	a-BBO, Calcite, YVO 4, Quartz
Wavelength Range	a-BBO: 190~3500, Calcite: 350~2300 nm, YVO4: 500~4000 nm, Quartz: 200~2300 nm
Extinction Ratio	a-BBO: <5x10-6, YVO4: <5x10-6, Quartz: <5x10-5, MgF2: <5x10-5
Surface Quality	20 / 10
Parallelism	<1 arc min
Beam Deviation	< 3 arc minutes
Wavefront Distortion	λ /4@633nm
Damage Threshold	>500 MW/cm^2
Coating	Single MgF2
Mount	Black anodized aluminium

5.1 a-BBO Rochon Polarizer

Part No.	Wavelength Range	Extinction Ratio	Separation Angle	C.A. φa (mm)	O.D. φd (mm)	L (mm)
ST-PRH1006	190～2300nm	$<5x10^{-6}$	8° @1064nm	6.0	15.0	15.0
ST-PRH1008				8.0	25.4	17.0
ST-PRH1010				10.0	25.4	19.0
ST-PRH1015				15.0	30.0	23.0
ST-PRH1020				20.0	38.0	29.0

5.2 YVO4 Rochon Polarizer

Part No.	Wavelength Range	Extinction Ratio	Separation Angle	C.A. φa (mm)	O.D. φd (mm)	L (mm)
ST-PRH3006	400～4000nm	$<5x10^{-6}$	10° @1550nm	6.0	15.0	15.0
ST-PRH3008				8.0	25.4	17.0
ST-PRH3010				10.0	25.4	19.0
ST-PRH3015				15.0	30.0	23.0
ST-PRH3020				20.0	38.0	25.0

5.3 Quartz Rochon Polarizer

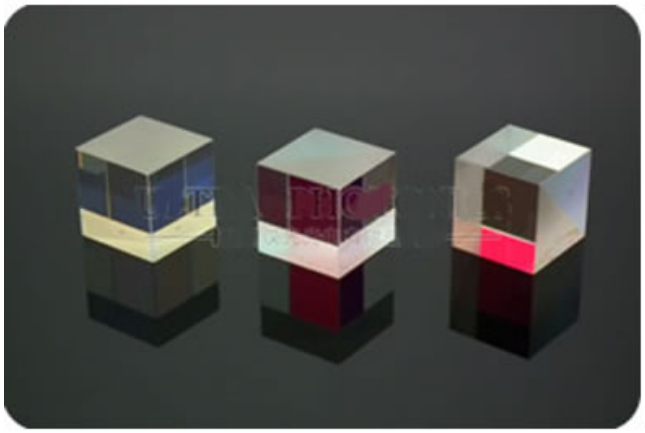
Part No.	Wavelength Range	Extinction Ratio	Separation Angle	C.A. φa (mm)	O.D. φd (mm)	L (mm)
ST-PRH4006	200～2300nm	$<5x10^{-5}$	1° @1064nm	6.0	15.0	20.0
ST-PRH4008				8.0	25.4	24.0
ST-PRH4010				10.0	25.4	28.0
ST-PRH4015				15.0	30.0	38.0
ST-PRH4020				20.0	38.0	48.0

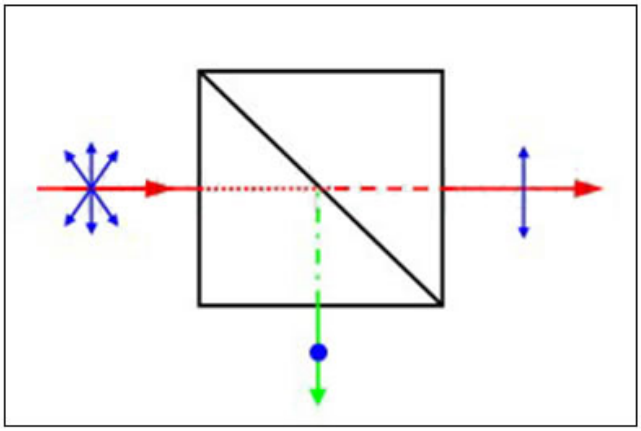
5.4 MgF2 Rochon Polarizer

Part No.	Wavelength Range	Extinction Ratio	Separation Angle	C.A. φa (mm)	O.D. φd (mm)	L (mm)
ST-PRH5006	110～8000nm	$<5x10^{-5}$	1° @980nm	6.0	15.0	14.0
ST-PRH5008				8.0	25.4	18.0
ST-PRH5010				10.0	25.4	18.0
ST-PRH5015				15.0	30.0	38.0
ST-PRH5020				20.0	38.0	48.0

6. Polarizating Beam Splitter

Polarizing cube beamsplitters split randomly polarized beams into two orthogonally and linearly polarized components, that is S-polarized light is reflected at a 90deg angle while P-polarized light is directly transmitted. Each beamsplitter consists of a pair of precision high tolerance right angle prisms cemented together with a dielectric coating on the hypotenuse of one of prisms.





Material	K9 or ZF Glass
Wavelength Range	350~2300nm
Dimension Tolerance	+/-0.2mm
Surface Quality	60 / 40
Beam Deviation	<3 arc sec
Extinction Ratio	>500:1~1000:1 (Narrow band) >300:1~500:1 (Broad band）
Principal Transmittance	Tp>95%, Ts<1%
Principal Reflectance	Rs>99%, Rp<5%
Coating	Polarization beamsplitter coating on hypotenuse face, AR coating on all input and output face
Standard Wavelength	Narrow Band: 532, 632.8, 808, 980, 1064, 1310, 1550 Broadband: 450-650, 650-900, 900-1200, 1200-1550, 1550-1610

Narrowband:

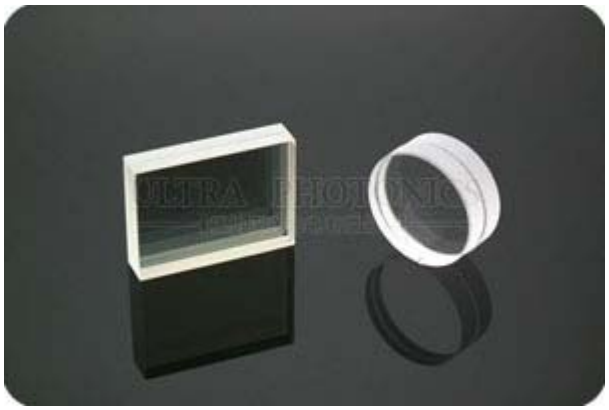
Part No.	Extinction Ratio	Size (mm)
ST-PBS2005	>500:1 (Narrow Band) >300:1 (Broad band)	5X5X5
ST-PBS2010		10X10X10
ST-PBS2015		15X15X15
ST-PBS2020		20X20X20
ST-PBS2025		25X25X25

High Power ST-PBS:

Part No.	Extinction Ratio	Size (mm)
ST-PBS1005	>1000:1 （Narrow Band） >500:1 (Broad band）	5X5X5
ST-PBS1010		10X0X10
ST-PBS1015		15X15X15
ST-PBS1020		20X20X20
ST-PBS1025		25X25X25

7. Depolarizer

Plane polarized beam is not welcomed in some circumstances such as reflecting spectrometer. A depolarizer will change the plane polarization into a mix of polarization states by scrambling up the polarization which is to change plane polarized beam into pseudo-depolarized beam and produce depolarization. Depolarizer is widely used in polarization sensitive instrument.



The usual depolarizer can only be used at narrow band wavelength to avoid the big beam deviation. With our special design, our depolarizer can be used in a wide range of wavelength and keep the beam deviation in a acceptable range.

Usually we can get better result if we orient the input polarization state 45deg to the optical axis of the depolarizer. And also the effectiveness of the depolarizer increases with the size of the beam cross-section

Material	Quartz 200-2500nm
Dimension Tolerance	±0.2mm
Surface Quality	Better than 60/40 scratch and dig
Beam Deviation	<3 arc minutes
Wavefront Distortion	<λ/4@632.8nm
Clear Aperture	>90% central
Coating	Uncoated, AR coating available

Part No.	Wavelength Range(nm)	Diameter(mm)
ST-DOP10212	532-850	12.7

Note: Other sizes and wavelengths are available upon request.