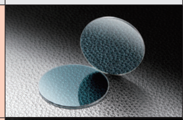
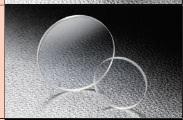
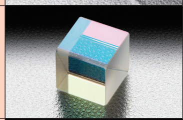
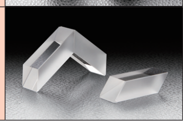
Polarizers | INDEX

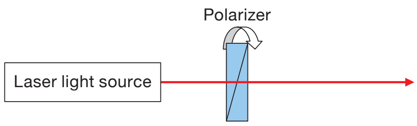
Polarizers Selection Guide

Human eyes have no ability to perceive the polarization of light. Also, the most of the optical detectors do not carry sensitivity of the polarization. For this reason, filters that selectively transmit the light with specific polarization or optics that can change the polarization state become necessary. In this page, a guidance is provided for finding a suitable application for the variety of polarization optics.

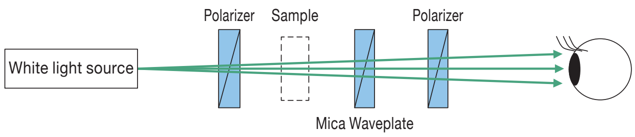
Type of Polarizers	Type of Waveplates	Products	Features	Accuracy	Application
Plastic Sheet Polarizers (USP) Reference B102			Low cost, Lightweight	Inferior	Variable adjustment of laser intensity
	Mica Waveplates (WPM) Reference B090		Substitute use as optical retarder Substitute use as phase sensitive color plate (visually intensify the retardance distribution)	↕	Observation of stress (birefringence) distribution
Polarizing Beamsplitters (PBS) Reference B079			Combine or separate the polarized beam	↕	A simple polarization experimental setup, Polarizing optical systems (Variable attenuator, Polarization interferometer, Optical isolator)
Visible Sheet Polarizers (SPF) Reference B099			Provide stationary linear polarization light in visible region	↕	
	Quartz Waveplates (WPQ) Reference B087		Provide exact optical retardation for each wavelength of laser	↕	
Glan Thompson Prisms (GTPC) Reference B094			Provide linearly polarized light with excellent extinction ratio in visible region	↕	Polarization measurements (Extinction ratio, Optical retardation)
	Fresnel Rhombs Retarders (FRB) Reference B091		Provide stationary optical retardation in a broad wavelength range.	Superior	

A typical applications for polarized light

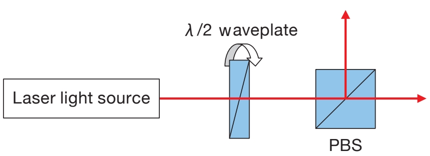
Variable adjustment of laser intensity



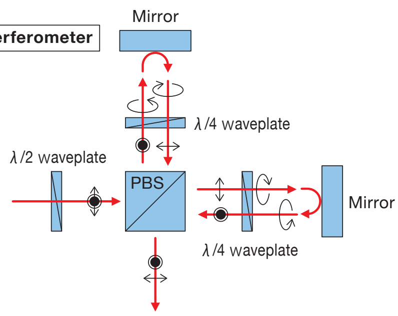
Observation of birefringence distribution using white light



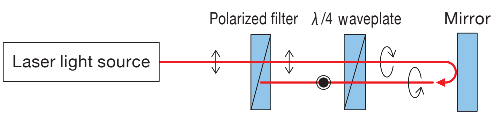
Polarization variable attenuator



Polarization Interferometer



Optical isolator



Polarimetry

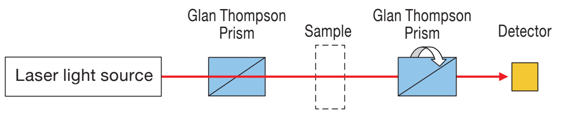
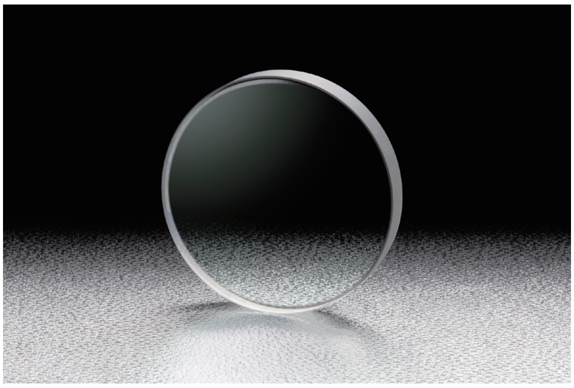


Plate-type Polarizing Beamsplitters | PBS-C

RoHS

Plate-type polarizing beamsplitters are one of plate that is coated with polarizing coating.

- Plate-type polarizing beamsplitters transmit p-polarization and reflect s-polarization as the monochromatic beam entering at Brewster's angle.
- The losses of input beam of these products are minimized because of no absorption of dielectric coating.
- Coating characteristic is not influenced too much by temperature change.



Specifications

Material	BK7, Synthetic fused silica
Surface flatness of substrate	λ/10
Extinction ratio of transmission	Ts : Tp = 1 : 200
Beam Deviation	<5″
Coating	Front surface: Dielectric multi-layer polarization coating Rear surface: No coating
Surface Quality (Scratch–Dig)	10–5
Clear aperture	90% of the diameter

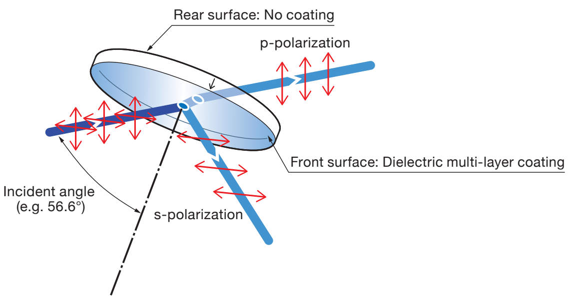
Guide

- ▶Please contact our International Sales Division for customized products. (Customized on size, wavelength,extinction ratio etc.)
- ▶If the surface accuracy is required after coating, please contact our International Sales Divison.

Attention

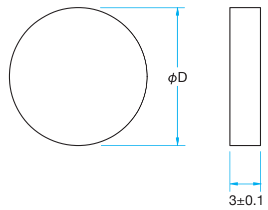
- ▶The surface flatness is the reflected wavefront distortion of the surface before coating.
- ▶Be sure to wear laser safety goggles when checking optical path and adjusting optical axis.
- ▶Rear surface is no coating.

Schematic



Outline Drawing

(in mm)



●Tolerance
Diameter $\phi D^{+0}_{-0.1}$

266nm – 1064nm

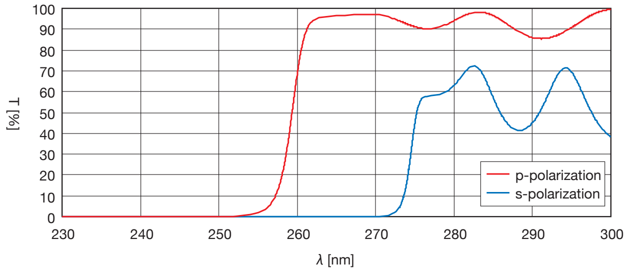
Part Number	Wavelength Range [nm]	Diameter ϕD [mm]	Maximum diameter of transmitted beam [mm]	Material	Incident angle [°]	Transmittance of P polarized light [%]	Reflectance of S polarized light [%]	Laser Damage Threshold* [J/cm^2]
PBS-20C03-10-266	266	ϕ20	ϕ10.0	Synthetic fused silica	56.3	>92	>95	2
PBS-25.4C03-10-266	266	ϕ25.4	ϕ12.7	Synthetic fused silica	56.3	>92	>95	2
PBS-30C03-10-266	266	ϕ30	ϕ15.0	Synthetic fused silica	56.3	>92	>95	2
PBS-20C03-10-355	355	ϕ20	ϕ10.1	Synthetic fused silica	55.9	>94	>95	2
PBS-25.4C03-10-355	355	ϕ25.4	ϕ13.1	Synthetic fused silica	55.9	>94	>95	2
PBS-30C03-10-355	355	ϕ30	ϕ15.7	Synthetic fused silica	55.9	>94	>95	2
PBS-20C03-10-532	532	ϕ20	ϕ9.9	BK7	56.6	>95	>98	5
PBS-25.4C03-10-532	532	ϕ25.4	ϕ12.9	BK7	56.6	>95	>98	5
PBS-30C03-10-532	532	ϕ30	ϕ15.4	BK7	56.6	>95	>98	5
PBS-20C03-10-1064	1064	ϕ20	ϕ10.0	BK7	56.4	>96	>98	7
PBS-25.4C03-10-1064	1064	ϕ25.4	ϕ12.9	BK7	56.4	>96	>98	7
PBS-30C03-10-1064	1064	ϕ30	ϕ15.5	BK7	56.4	>96	>98	7

* Incident angle0°, Laser pulse width 10ns, repetition frequency 20Hz

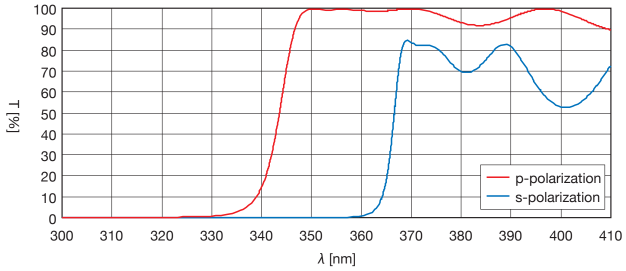
Typical Transmittance Data

T: Transmission

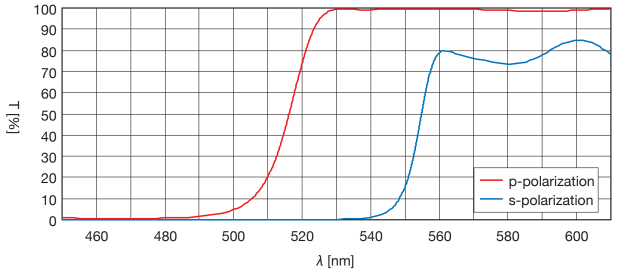
PBS-C-266



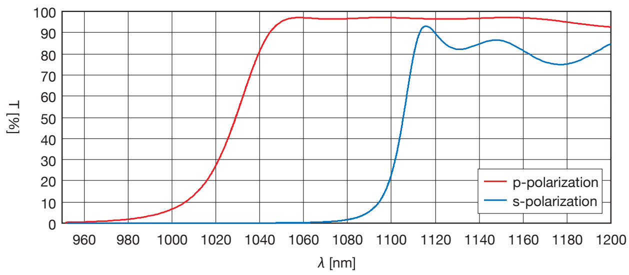
PBS-C-355



PBS-C-532



PBS-C-1064



Compatible Optic Mounts

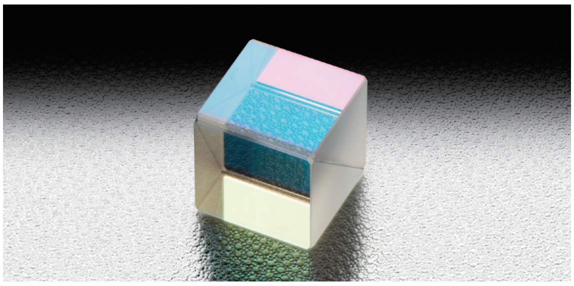
MHG-MP20 / MHG-MP25 / MHG-MP30

High Power Polarizing Beamsplitters | PBSHP

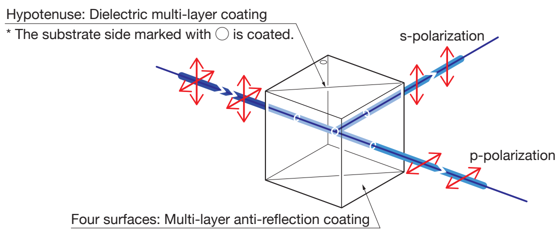
RoHS Catalog Code W3027

High Power Polarizing Beamsplitters have more laser durability compared to our standard Polarizing Beamsplitters (PBS). Polarizing beamsplitters consist of two right angle prisms. One of them is coated with dielectric multi-layer polarizing coating on the hypotenuse surface.

- Polarizing beamsplitters split monochromatic beam entering at zero degrees into p-polarization as transmitted and s-polarization as reflected.
- Four surfaces of the cube are coated with narrowband multi-layer anti-reflection coatings.
- The losses of input beam of these products are minimized because of no absorption of dielectric coating.
- For cube beamsplitters, unlike plate beamsplitters, beam deviations of transmitted beams and ghosts rarely occur.

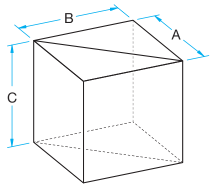


Schematic



Outline Drawing

(in mm)



●Tolerance
Length A·B±0.2
Height C±0.1

Specifications

Material	BK7, Synthetic fused silica
Surface flatness of substrate	λ/4
Angular deviation of transmitted beam	<10′
Coating	Hypotenuse Surface: Dielectric multi-layer polarizing coating Four Surfaces: Narrowband multi-layer anti-reflection coating
Incident angle	0°
transmittance of P polarized light	>97%
Extinction ratio of transmission	Ts : Tp = 1 : 200
Surface Quality (Scratch–Dig)	20–10
Clear aperture	Circle inscribed in a square of 85% of the dimensions

Guide

▶Please contact our International Sales Division for customized products. (Customized on size, wavelength etc.)

▶There is also a high extinction ratio Glan-Thompson prism (GTPB/GTPC). Reference B094

Attention

▶Input beam from the prism on the side indicated by ◯. When the light is incident from the side of the prism without mark, there is a possibility that the characteristics of the transmittance and extinction ratio changes.

▶The surface flatness is the reflected wave front distortion of the surface before coating.

▶Be sure to wear laser safety goggles when checking optical path and adjusting optical axis.

Specifications

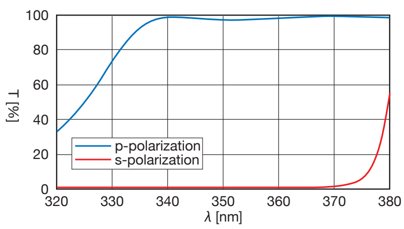
Part Number	Wavelength Range [nm]	A=B=C [mm]	Material	Reflectance of S polarized light [%]	Laser Damage Threshold* [J/cm^2]
PBSHP-10-3550	355	10	Synthetic fused silica	>97	2
PBSHP-12.7-3550	355	12.7	Synthetic fused silica	>97	2
PBSHP-15-3550	355	15	Synthetic fused silica	>97	2
PBSHP-20-3550	355	20	Synthetic fused silica	>97	2
PBSHP-10-5320	532	10	BK7	>97	5
PBSHP-12.7-5320	532	12.7	BK7	>97	5
PBSHP-15-5320	532	15	BK7	>97	5
PBSHP-20-5320	532	20	BK7	>97	5
PBSHP-10-10640	1064	10	BK7	>97	7
PBSHP-12.7-10640	1064	12.7	BK7	>97	7
PBSHP-15-10640	1064	15	BK7	>97	7
PBSHP-20-10640	1064	20	BK7	>97	7

* Incident angle 0°, laser pulse width 10ns, repetition frequency 20Hz

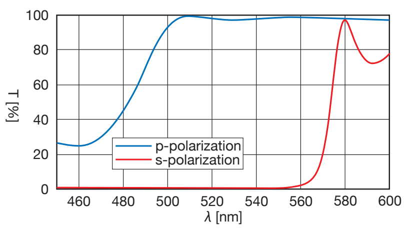
Typical Transmittance Data

T: Transmission

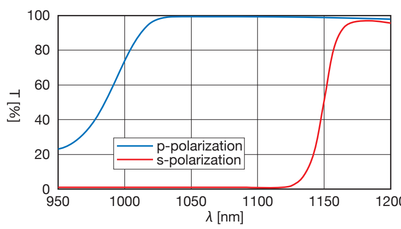
PBSHP-3550



PBSHP-5320



PBSHP-10640



Compatible Optic Mounts

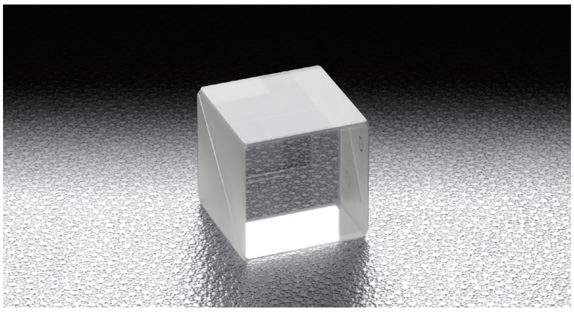
PLH-25, -40 / KDD-25PHRO, -40PHRO / MHG12.7PAD + MHG-MP30-NL / MHG-20PAD + MHG-MP30-NL

Broadband Polarizing Beamsplitters | PBSW

RoHS Catalog Code W3028

Broadband Polarizing Beamsplitters set up a polarizing band widely.
Polarizing beamsplitters consist of two right angle prisms.
One of them is coated with dielectric multi-layer polarizing coating on the hypotenuse surface.

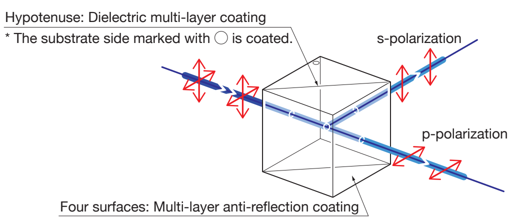
- Polarizing beamsplitters split the light entering at zero degrees into p-polarization as transmitted and s-polarization as reflected.
- Four surfaces of the cube are coated with multi-layer anti-reflection coatings.
- For cube beamsplitters, unlike plate beamsplitters, beam deviations of transmitted beams and ghosts rarely occur.



Specifications

Material	BK7, SK2, SF15, Synthetic fused silica
Surface flatness of substrate	$\lambda/4$
Angular deviation of transmitted beam	<10′
Coating	Hypotenuse Surface: Dielectric multi-layer polarizing coating Four Surfaces: Narrowband multi-layer anti-reflection coating
Incident angle	0°
Laser Damage Threshold	0.3J/cm^2 (Laser pulse with 10ns,repetition frequency 20Hz)
Surface Quality (Scratch–Dig)	20–10
Clear aperture	Circle inscribed in a square of 85% of the dimensions

Schematic



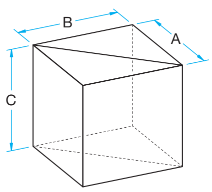
Guide

▶ Please contact our International Sales Division for customized products. (Customized on size, wavelength etc.)
▶ There is also a high extinction ratio Glan-Thompson prism (GTPB/GTPC). Reference B094

Attention

▶ Input beam from the prism on the side indicated by ○. When the light is incident from the side of the prism without mark, there is a possibility that the characteristics of the transmittance and extinction ratio changes.
▶ The surface flatness is the reflected wave front distortion of the surface before coating.
▶ Be sure to wear laser safety goggles when checking optical path and adjusting optical axis.

Outline Drawing (in mm)



● Tolerance
Length A･B±0.2
Height C±0.1

Specifications

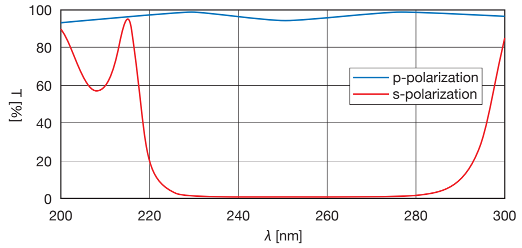
Part Number	Wavelength Range [nm]	A=B=C [mm]	Material	Transmittance of P polarized light [%]	Reflectance of S polarized light [%]	Extinction ratio of transmission* Ts : Tp
PBSW-10-250	235 – 265	10	Synthetic fused silica	>85	>90	1:100
PBSW-12.7-250	235 – 265	12.7	Synthetic fused silica	>85	>90	1:100
PBSW-15-250	235 – 265	15	Synthetic fused silica	>85	>90	1:100
PBSW-20-250	235 – 265	20	Synthetic fused silica	>85	>90	1:100
PBSW-10-350	330 – 370	10	Synthetic fused silica	>85	>95	1:100
PBSW-12.7-350	330 – 370	12.7	Synthetic fused silica	>85	>95	1:100
PBSW-15-350	330 – 370	15	Synthetic fused silica	>85	>95	1:100
PBSW-20-350	330 – 370	20	Synthetic fused silica	>85	>95	1:100
PBSW-10-550	450 – 650	10	BK7	>85	> Average 85	1:200
PBSW-12.7-550	450 – 650	12.7	BK7	>85	> Average 85	1:200
PBSW-15-550	450 – 650	15	BK7	>85	> Average 85	1:200
PBSW-20-550	450 – 650	20	BK7	>85	> Average 85	1:200
PBSW-10-800	750 – 850	10	BK7	>92	>97	1:200
PBSW-12.7-800	750 – 850	12.7	BK7	>92	>97	1:200
PBSW-15-800	750 – 850	15	BK7	>92	>97	1:200
PBSW-20-800	750 – 850	20	BK7	>92	>97	1:200
PBSW-10-3/7	380 – 750	10	SK2	> Average 92	> Average 95	1:500*
PBSW-12.7-3/7	380 – 750	12.7	SK2	> Average 92	> Average 95	1:500*
PBSW-15-3/7	380 – 750	15	SK2	> Average 92	> Average 95	1:500*
PBSW-20-3/7	380 – 750	20	SK2	> Average 92	> Average 95	1:500*
PBSW-10-4/10	450 – 1080	10	SF15	> Average 92	> Average 95	1:500*
PBSW-12.7-4/10	450 – 1080	12.7	SF15	> Average 92	> Average 95	1:500*
PBSW-15-4/10	450 – 1080	15	SF15	> Average 92	> Average 95	1:500*
PBSW-20-4/10	450 – 1080	20	SF15	> Average 92	> Average 95	1:500*
PBSW-10-10/20	1000 – 2000	10	SF15	> Average 94	> Average 95	1:300*
PBSW-12.7-10/20	1000 – 2000	12.7	SF15	> Average 94	> Average 95	1:300*
PBSW-15-10/20	1000 – 2000	15	SF15	> Average 94	> Average 95	1:300*
PBSW-20-10/20	1000 – 2000	20	SF15	> Average 94	> Average 95	1:300*

* It is the average extinction ratio transmission in the wavelength range.

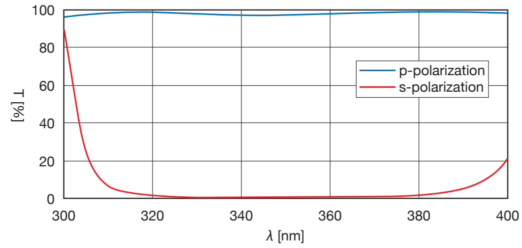
Broadband Polarizing Beamsplitters | PBSW

Typical Transmittance Data T: Transmission

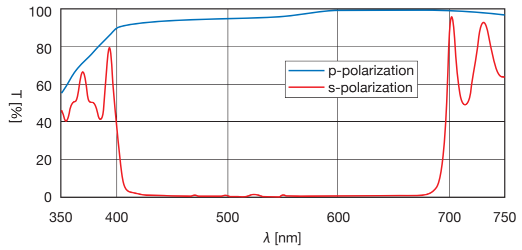
PBSW-250



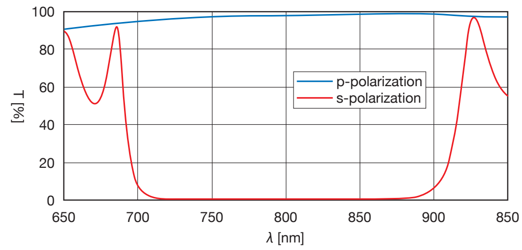
PBSW-350



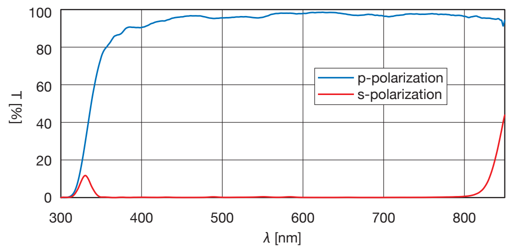
PBSW-550



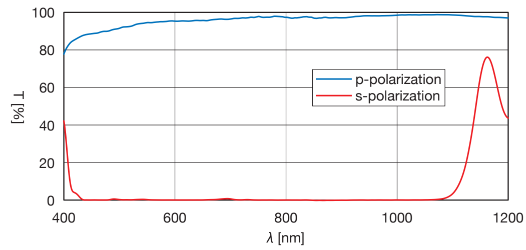
PBSW-800



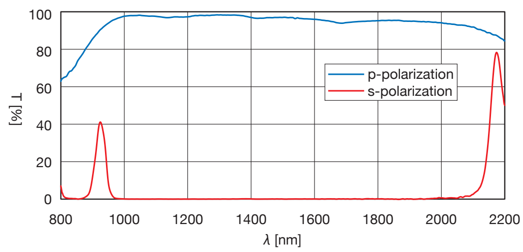
PBSW-3/7



PBSW-4/10



PBSW-10/20

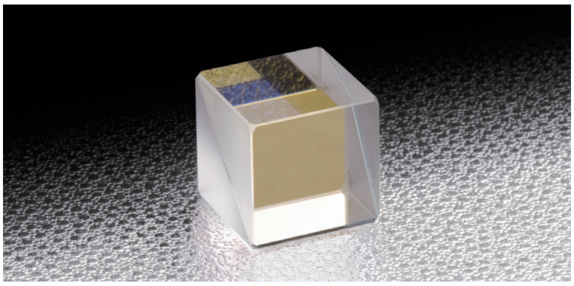


Compatible Optic Mounts

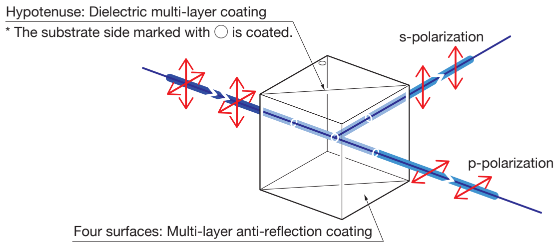
PLH-25, -40 / KDD-25PHRO, -40PHRO / MHG12.7PAD + MHG-MP30-NL / MHG-20PAD + MHG-MP30-NL

Polarizing beamsplitters consist of two right angle prisms.
One of them is coated with dielectric multi-layer polarizing coating on the hypotenuse surface.
Polarizing beamsplitters split monochromatic beam entering at zero degrees into p-polarization as transmitted and s-polarization as reflected.

- Four surfaces of the cube are coated with narrowband multi-layer anti-reflection coatings.
- The losses of input beam of these products are minimized because of no absorption of dielectric coating.
- For cube beamsplitters, unlike plate beamsplitters, beam deviations of transmitted beams and ghosts rarely occur.

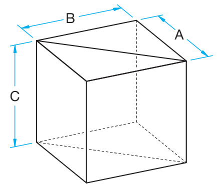


Schematic



Outline Drawing

(in mm)



●Tolerance
Length A･B±0.2
Height C±0.1

Specifications

Material	BK7
Surface flatness of substrate	λ/4
Angular deviation of transmitted beam	<10′
Coating	Hypotenuse Surface: Dielectric multi-layer polarizing coating Four Surfaces: Narrowband multi-layer anti-reflection coating
Incident angle	0°
transmittance of P polarized light	>97% (405nm: >90%)
Extinction ratio of transmission	Ts : Tp = 1 : 1000
Laser Damage Threshold	0.3J/cm^2 (Laser pulse with 10ns,repetition frequency 20Hz)
Surface Quality (Scratch–Dig)	20–10
Clear aperture	Circle inscribed in a square of 85% of the dimensions

Guide

- ▶Please contact our International Sales Division for customized products. (Customized on size, wavelength etc.)
- ▶Plate-type of Polarizing Beamsplitters (PBS-C) is also available upon your request. Reference B074
- ▶There is also a high extinction ratio Glan-Thompson prism (GTPB/GTPC). Reference B094

Attention

- ▶Input beam from the prism on the side indicated by ◯. When the light is incident from the side of the prism without mark, there is a possibility that the characteristics of the transmittance and extinction ratio changes.
- ▶The transmittance curves are based on actual measurements and might be different with manufacturing lots.
- ▶The surface flatness is the reflected wavefront distortion of the surface before coating.
- ▶Be sure to wear laser safety goggles when checking optical path and adjusting optical axis.

405nm – 670nm

Part Number	Wavelength Range [nm]	A=B=C [mm]	Reflectance of S polarized light [%]
PBS-10-4050	405	10	>97
PBS-15-4050	405	15	>97
PBS-20-4050	405	20	>97
PBS-10-4416	441.6	10	>97
PBS-15-4416	441.6	15	>97
PBS-20-4416	441.6	20	>97
PBS-10-4579	457.9	10	>97
PBS-15-4579	457.9	15	>97
PBS-20-4579	457.9	20	>97
PBS-10-4880	488	10	>98
PBS-15-4880	488	15	>98
PBS-20-4880	488	20	>98
PBS-10-5320	532	10	>98
PBS-12.7-5320	532	12.7	>98
PBS-15-5320	532	15	>98
PBS-20-5320	532	20	>98
PBS-5-6328	632.8	5	>98
PBS-10-6328	632.8	10	>98
PBS-12.7-6328	632.8	12.7	>98
PBS-15-6328	632.8	15	>98
PBS-20-6328	632.8	20	>98
PBS-5-6700	670	5	>98
PBS-10-6700	670	10	>98
PBS-12.7-6700	670	12.7	>98
PBS-15-6700	670	15	>98
PBS-20-6700	670	20	>98

780nm – 1550nm

Part Number	Wavelength Range [nm]	A=B=C [mm]	Reflectancee of S polarized light [%]
PBS-5-7800	780	5	>98
PBS-10-7800	780	10	>98
PBS-12.7-7800	780	12.7	>98
PBS-15-7800	780	15	>98
PBS-20-7800	780	20	>98
PBS-5-8300	830	5	>98
PBS-10-8300	830	10	>98
PBS-12.7-8300	830	12.7	>98
PBS-15-8300	830	15	>98
PBS-20-8300	830	20	>98
PBS-10-10640	1064	10	>97
PBS-15-10640	1064	15	>97
PBS-20-10640	1064	20	>97
PBS-5-15500	1550	5	>97
PBS-10-15500	1550	10	>97
PBS-12.7-15500	1550	12.7	>97
PBS-15-15500	1550	15	>97
PBS-20-15500	1550	20	>97

Polarizing Beamsplitters | PBS

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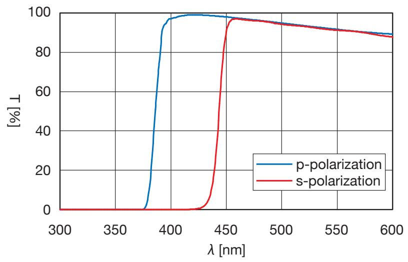
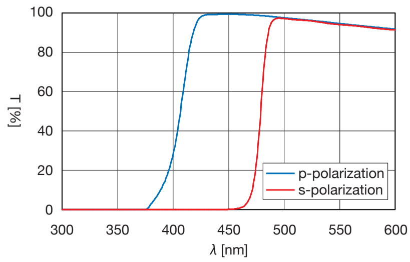
Typical Transmittance Data T: Transmission

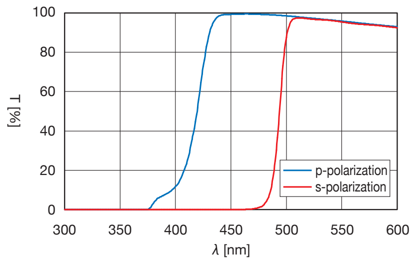
PBS-4050



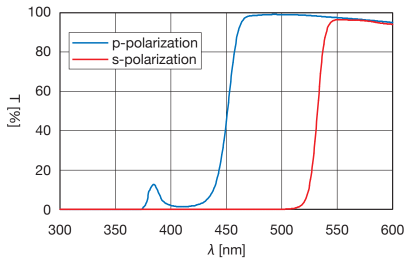
PBS-4416



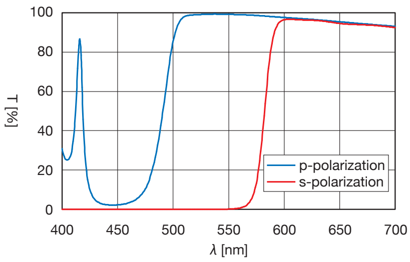
PBS-4579



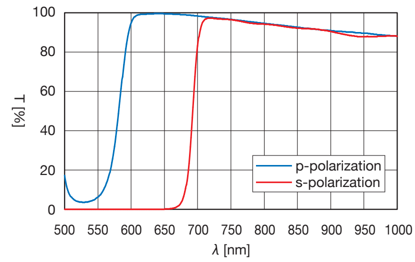
PBS-4880



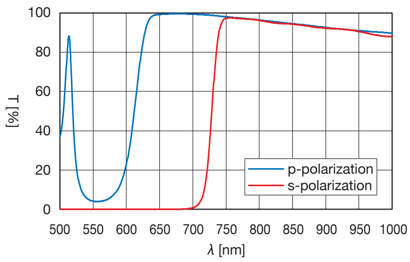
PBS-5320



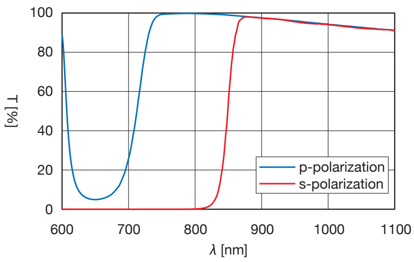
PBS-6328



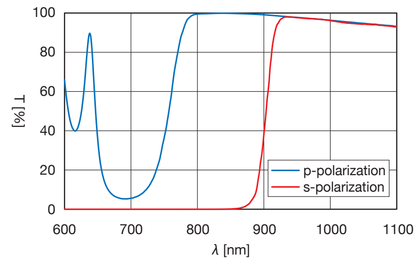
PBS-6700



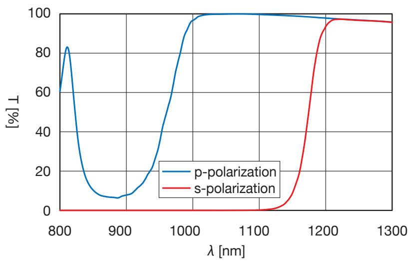
PBS-7800



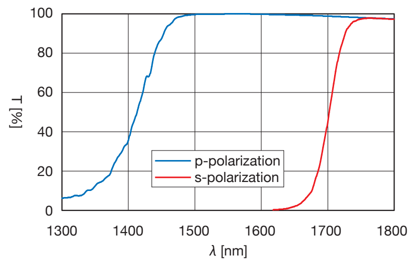
PBS-8300



PBS-10640



PBS-15500



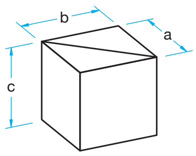
Compatible Optic Mounts

PLH-25, -40 / KDD-25PHRO, -40PHRO / MHG-12.7PAD + MHG-MP30-NL / MHG-20PAD + MHG-MP30-NL

Contact sheet for polarization beamsplitter ■Estimation ■Order

Date

☐ To: Sigma Koki Co., Ltd. **FAX +81-3-5638-6550**

Affiliation (Organization Name)					
Department		Name			
TEL		FAX		E-mail	
Country/Adress					
Name & Designation	(Tentative name is okay)				
Drawing Number		Estimate	☐ Yes: by Date	☐ No	
Desired Delivery Date		Budget	JP Yen		
Quantity	pieces				
Substrates If you do not specify a dimension tolerance is outside the standard tolerance.	Standard product		If you are using a substrate of standard product, please fill in the product number.		
	Custom-made	Material	☐ BK7 ☐ Synthetic fused silica ☐ Other ( )		
			a mm	Surface flatness of substrate	(at λ =632.8nm)
			b mm	Angular deviation of transmitted beam	
			c mm		
Type of Coating	Wavelength Range	λ = nm	Type of Light Source		
	Incident angle	°	Beam Size	mm	
	Dielectric multi-layer	Tp≧ % Ts≦ %	Power or Energy	W	
	AR coat	☐ Multi-layer anti-reflection coating (MLAR) ☐ Other ( )		J pulse width s Repetition frequency Hz	
Other	* There was a more detailed specification, please fill in this field.				

Sigma Koki Co., Ltd.

Application Note

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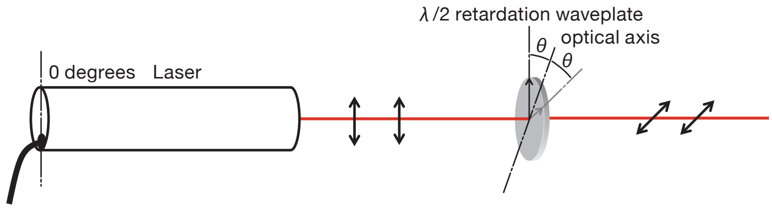
**The waveplate can manipulate the polarization state without a change in light intensity.
Commonly used applications for the waveplate are described in this section.**

Half waveplate (λ/2 retardation waveplate)

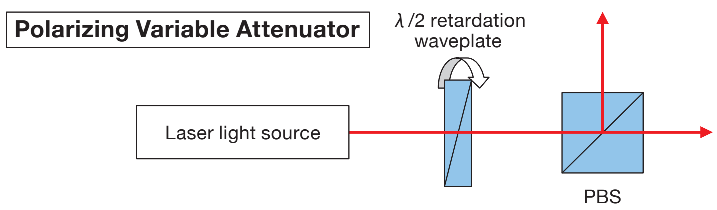
Changing the polarization direction while fixing the laser.

The half waveplate is used to change direction of the linear polarization.
When the crystal axis (fast axis or slow axis) is aligned parallelyl with the polarization direction of the incident beam, the polarization of the exit beam will maintain the same direction.
When the crystal axis of the waveplate is rotated for θ from polarization direction of the incident beam, the polarization of the exit beam rotates for 2θ from polarization direction of the incident beam.
Using this effect, the direction of the linear polarization is arbitrarily rotated with the rotation of the half waveplate.
This method has a merit that the polarization direction is rotatable without change in light intensity.
When the polarization direction of the waveplate is rotated for 90°, the extinction ratio of linear polarization is slightly deteriorated due to the retardation error. For this reason, insertion of a polarizer next to the waveplate is recommended for the precise polarization measurement, which requires high extinction ratio.
If a quartz waveplate with high parallelism is used, the polarization direction can be changed without beam deflection.



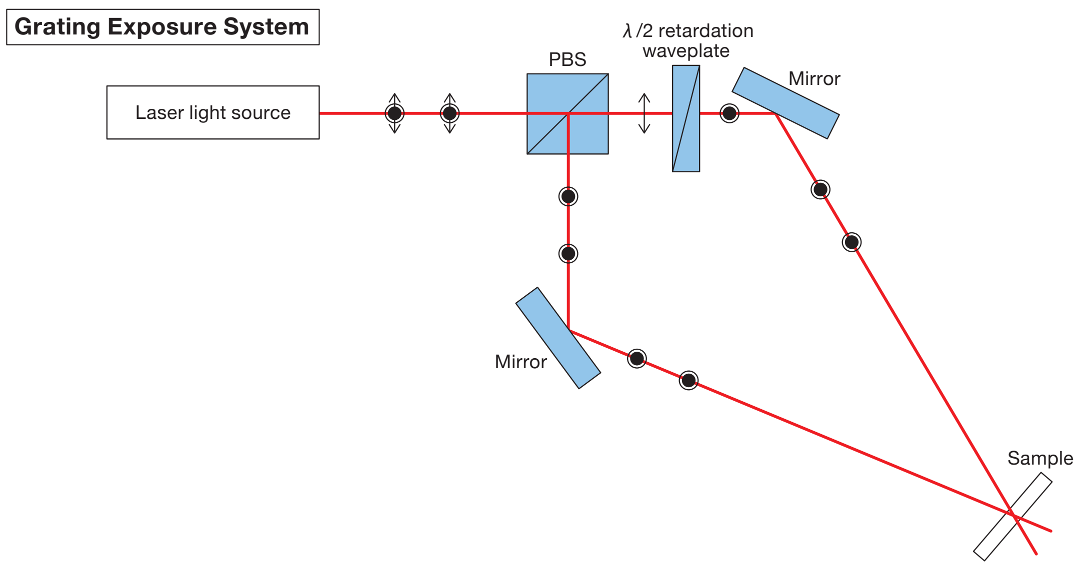
Varying the light intensity

By combining the polarization beam splitter (PBS) and half waveplate, it is possible to vary the light intensity.
The method can be used to adjust the reflectance as well as the transmittance, and also for ratio between transmission and reflection.
This method is highly efficient, which transmittance loss is all converted into the reflectance gain.
One of the features is dynamic range of light intensity adjustment. (97% to 0.3%, depending on the quality of the PBS)



Examples of special optical system

A half waveplate is used when aligning P and S-polarized light which is separated by PBS into same polarization direction.
Below is an example of optical system to expose the grating by two-beam interferometry.
Interference fringes with good contrast can be obtained by aligning the polarization direction.



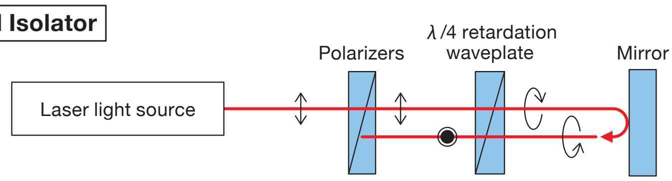
Quarter waveplate (λ/4 retardation waveplate)

It is used to convert linear polarization into circular polarization, but also commonly used for the polarization measurements.

Used to prevent the back reflection

In experiments using a laser, the laser oscillation may be unstable if the back reflection from mirror or optics is returned to the laser.
An optical isolator is used to prevent this returning light.
A typical optical isolators are composed of quarter waveplate and a polarizer.
The light passes through the quarter waveplate two times during the round-trip reflection.
Since the circular polarization does not change its rotational direction in mirror reflection, the retardation of total 180 degrees is obtained from phase difference amount of twice passed through the quarter waveplate.
With the retardation obtained, the polarization direction of the mirror reflection, which passes the quarter waveplate is rotated by 90 degrees with respect to the incident polarization direction. This will make reflected light not able to pass through the polarizer, and block out the back reflection.

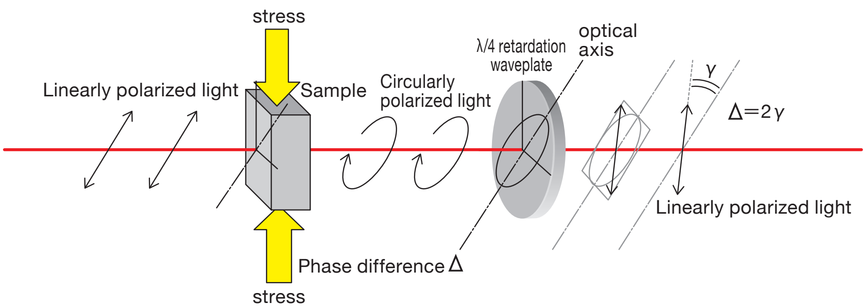
Optical Isolator



Used for polarization measurement (Senarmont method)

Feature of quarter waveplate is that it is possible to convert incident linear polarization into circular polarization, but also into other state of linear polarization or various elliptical polarization.
Conversely, when elliptical axis of incident light is accurately aligned against quarter waveplate optical axis, arbitrary elliptical polarization can be converted into linear polarization.
The azimuth γ of the incident linear polarization is defined by the ellipticity of the elliptical polarization, which corresponds to half of the retardation Δ.
The polarization measurement using this principle is named Senarmont method.
Senarmont method is commonly used when measuring minute stress (birefringence).

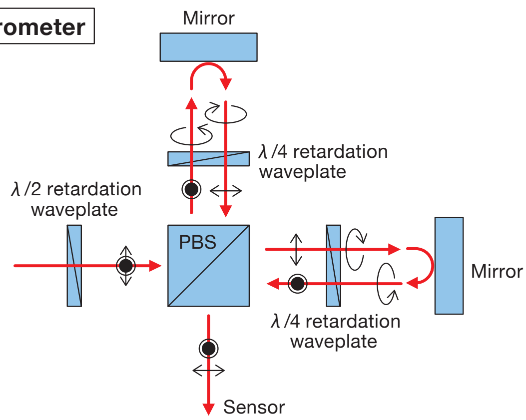
Senarmont Optical System



Examples of special optical system

A Michelson interferometer using a PBS and quarter waveplate is introduced.
Utilizing the polarization, the unnecessary back reflection is reduced and stability of the interference fringes is enhanced.
Incident light is collected on the observation side without a loss, but in order to observe polarization, insertion of the polarizer is demanded with 50% reduction of light intensity.

Polarization interferometer



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Broadband Quartz Waveplates | WPQW

RoHS

Air spaced type two-piece waveplates. Compatible with high-energy lasers (no optical contact occurs). These products utilize birefringence of quartz and give phase difference of λ/4 (π/2, 90°) or λ/2 (π, 180°) to the input beams. λ/4 retarders convert linearly polarization to circularly and circularly polarization to linearly. λ/2 retarders convert the direction of polarization arbitrarily.

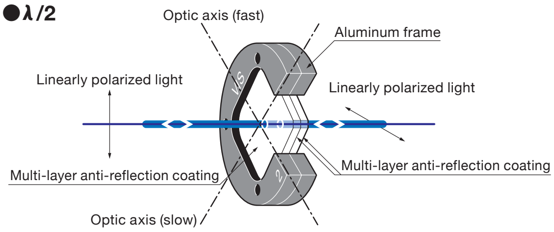
● Air spaced type waveplates are zero-order (first-order) retardation plates (phase plates) which are assembled from pairs of crystalline quartz plates and are mounted on aluminum frames.

Specifications

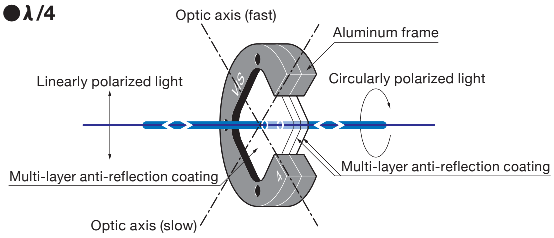
Material	Optical grade crystalline quarts, MgF_2
Material of frame	Aluminum Finishing: Black anodized
Clear aperture	14×14mm
Transmitted wavefront distortion	λ/4 (per one surface)
Angular deviation of beam	<5″
Coating	Both surfaces: Narrowband multi-layer anti-reflection coating (Four surfaces)
Transmittance	> Average 98%
Surface Quality (Scratch–Dig)	20–10

Schematic

●λ/2



●λ/4



Guide

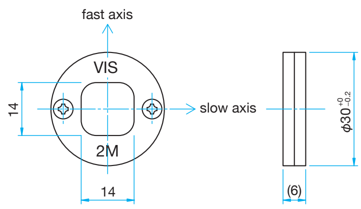
▶Custom-made air spaced type broadband quartz waveplates for other wavelengths are also available. Please feel free to contact us.
▶Standard thickness of Aluminum frame is 6mm (subject to differ without notice).
▶Optical axis is parallel to the edge of 14mm squared plate.

Attention

▶These products can be used for the beams which wavelengths are in +/−1% of rated wavelengths.
▶The surface flatness is the reflected wavefront distortion of the surface before coating.
▶Be sure to wear laser safety goggles when checking optical path and adjusting optical axis.

Outline Drawing

(in mm)



Visible

Part Number	Type	Wavelength Range λ [nm]	Theoretical retardation [nm] λ=400nm	λ=500nm	λ=600nm	λ=700nm	Laser Damage Threshold* [J/cm²]
WPQW-VIS-2M	λ/2	400 – 700	184.6	259.0	300.3	328.9	4
WPQW-VIS-4M	λ/4	400 – 700	92.8	130.0	150.6	164.9	4

650 – 780nm

Part Number	Type	Wavelength Range λ [nm]	Theoretical retardation [nm] λ=650nm	λ=700nm	λ=750nm	λ=800nm	Laser Damage Threshold* [J/cm²]
WPQW-65/78-2M	λ/2	650 – 780	325.3	352.7	376.9	398.8	7
WPQW-65/78-4M	λ/4	650 – 780	162.2	175.9	188.0	198.9	7

700 – 1000nm

Part Number	Type	Wavelength Range λ [nm]	Theoretical retardation [nm] λ=700nm	λ=800nm	λ=900nm	λ=1000nm	Laser Damage Threshold* [J/cm²]
WPQW-NIR-2M	λ/2	700 – 1000	344.8	402.0	450.4	494.4	7
WPQW-NIR-4M	λ/4	700 – 1000	172.4	201.0	225.2	247.2	7

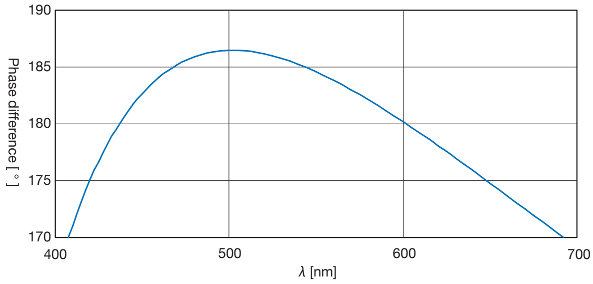
1000 – 1600nm

Part Number	Type	Wavelength Range λ [nm]	Theoretical retardation [nm] λ=1000nm	λ=1200nm	λ=1400nm	λ=1600nm	Laser Damage Threshold* [J/cm²]
WPQW-IR-2M	λ/2	1000 – 1600	510.2	595.4	696.3	814.3	7
WPQW-IR-4M	λ/4	1000 – 1600	255.1	297.7	348.1	407.1	7

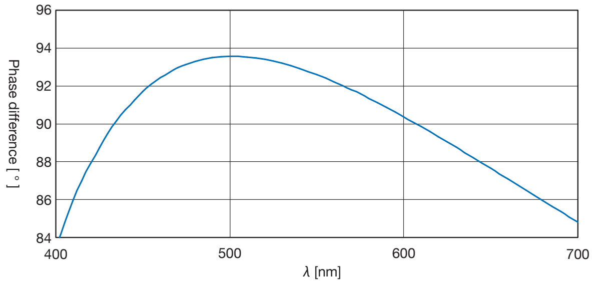
* Laser pulse width 10ns, repetition frequency 20Hz

Typical Angular Field Data

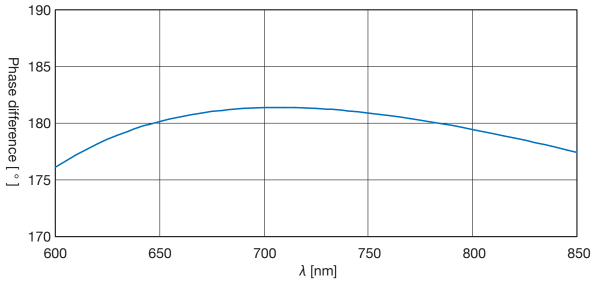
WPQW-VIS-2M



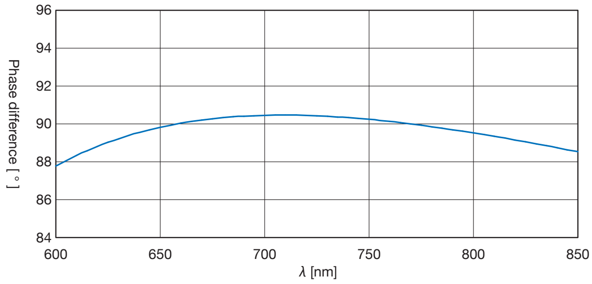
WPQW-VIS-4M



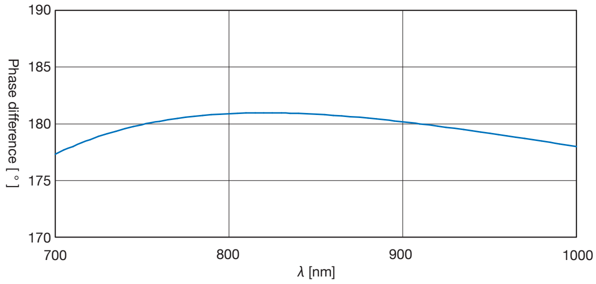
WPQW-65/78-2M



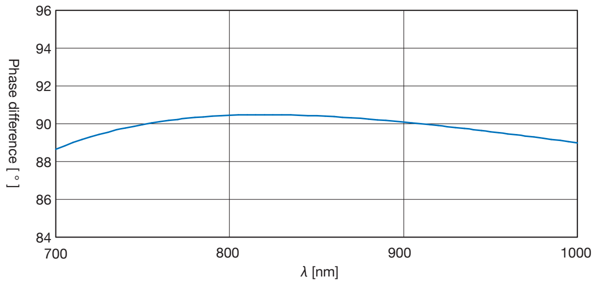
WPQW-65/78-4M



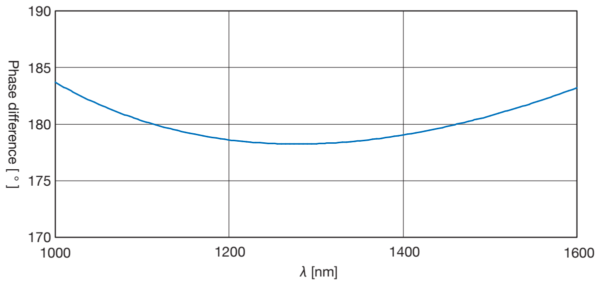
WPQW-NIR-2M



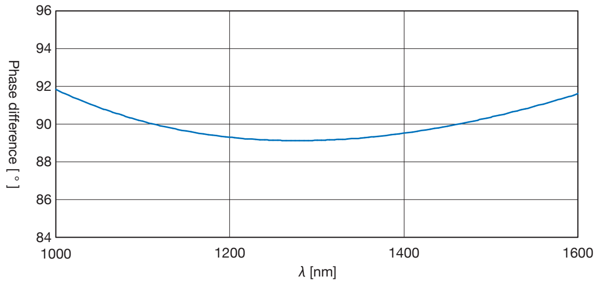
WPQW-NIR-4M



WPQW-IR-2M



WPQW-IR-4M



Compatible Optic Mounts

PH-30-ARS / SPH-30-ARS

Air Gap Type Waveplates | WPQG

RoHS Catalog Code W3031

Air spaced type two-piece waveplates. Compatible with high-energy lasers (no optical contact occurs).

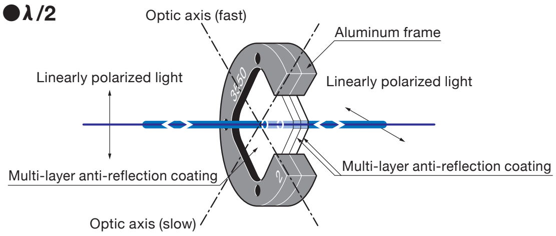
- These products utilize birefringence of quartz and give phase difference of λ/4 (π/2, 90°) or λ/2 (π, 180°) to the input beams. λ/4 retarders convert linearly polarization to circularly and circularly polarization to linearly. λ/2 retarders convert the direction of polarization arbitrarily.
- Air spaced type waveplates are zero-order (first-order) retardation plates (phase plates) which are assembled from pairs of crystalline quartz plates and are mounted on aluminum frames.
- Custom-made air spaced type waveplates for other wavelengths (248nm, 257nm, 308nm etc.) are also available.

Specifications

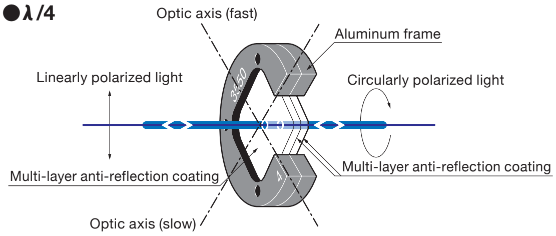
Material	Optical grade crystalline quarts
Material of frame	Aluminum Finishing: Black anodized
Clear aperture	15×15mm
Surface flatness of substrate	λ/10
Angular deviation of beam	<5″
Coating	Both surfaces: Narrowband multi-layer anti-reflection coating (Four surfaces)
Transmittance	>98%
Surface Quality (Scratch–Dig)	20–10

Schematic

● λ/2



● λ/4



Guide

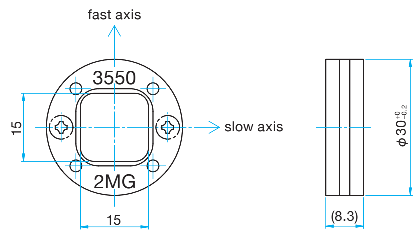
▶ Please contact our International Sales Division for customized products. (Customized on size etc.)

Attention

▶ Unlike multiple-order (higher-order) waveplates that are made from a single quartz plate, the net retardations of zero-order waveplates are almost not affected by temperature change.
▶ Optical axis is parallel to the edge of 15mm squared plate.
▶ These products can be used for the beams which wavelengths are in +/−1% of rated wavelengths.
▶ The surface flatness is the reflected wavefront distortion of the surface before coating.
▶ Be sure to wear laser safety goggles when checking optical path and adjusting optical axis.
▶ Standard thickness of Aluminum frame is 8.3mm (subject to differ without notice).

Outline Drawing

(in mm)



λ/2

Part Number	Wavelength Range [nm]	Theoretical retardation [nm]	Retardation tolerance	Laser Damage Threshold* [J/cm^2]
WPQG-2660-2M	266	133.0	<λ/50	1.4
WPQG-3550-2M	355	177.5	<λ/50	4
WPQG-5320-2M	532	266.0	λ/100 – λ/200	4
WPQG-10640-2M	1064	532.0	λ/200 – λ/500	7

* Laser pulse width 10ns, repetition frequency 20Hz

λ/4

Part Number	Wavelength Range [nm]	Theoretical retardation [nm]	Retardation tolerance	Laser Damage Threshold* [J/cm^2]
WPQG-2660-4M	266	66.5	<λ/50	1.4
WPQG-3550-4M	355	88.8	<λ/50	4
WPQG-5320-4M	532	133.0	λ/100 – λ/200	4
WPQG-10640-4M	1064	266.0	λ/200 – λ/500	7

* Laser pulse width 10ns, repetition frequency 20Hz

Quartz Waveplates | WPQ

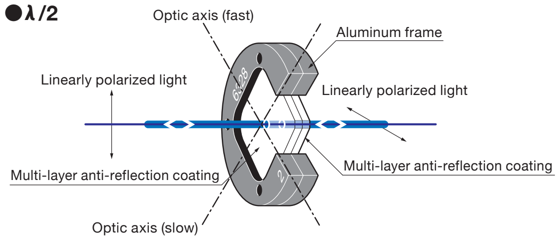
RoHS

Quartz waveplates are zero-order retardation plates (phase plates) which are assembled from pairs of optically contacted crystalline quartz plates and are mounted on aluminum frames.
Unlike multiple-order (higher-order) waveplates that are made from a single quartz plate, the net retardations of zero-order waveplates are almost not affected by temperature change.

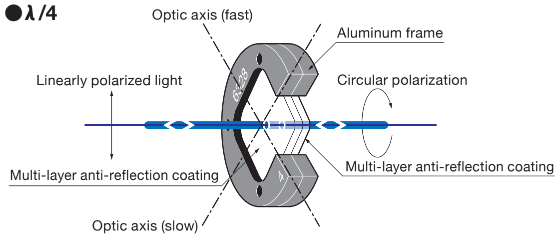
- These products utilize birefringence of quartz and give phase difference of $\lambda/4$ (π/2, 90°) or $\lambda/2$ (π, 180°) to the input beams. $\lambda/4$ retarders convert linearly polarization to circularly and circularly polarization to linearly. $\lambda/2$ retarders convert the direction of polarization in 90 degrees.
- Usually linearly polarized beams are input to the waveplates in a leaning of 45 degrees against its optic axis.

Schematic

●λ/2



●λ/4



Specifications

Material	Optical grade crystalline quarts
Material of frame	Aluminum Finishing: Black anodized
Clear aperture	15×15mm
Surface flatness of substrate	$\lambda/10$
Angular deviation of beam	<5″
Coating	Both surfaces: Narrowband multi-layer anti-reflection coating
Transmittance	>98.5%
Laser Damage Threshold	1J/cm^2 (Laser pulse width 10ns, repetition frequency 20Hz)
Surface Quality (Scratch–Dig)	20–10

Guide

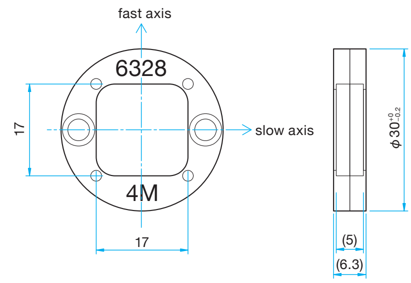
▶Please contact our International Sales Division for customized products. (Customized on size etc.)

Attention

▶These products can be used for the beams which wavelengths are in +/–1% of rated wavelengths.
▶The surface flatness is the reflected wavefront distortion of the surface before coating.
▶Be sure to wear laser safety goggles when checking optical path and adjusting optical axis.

Outline Drawing

(in mm)



Compatible Optic Mounts

PH-30-ARS / SPH-30-ARS

Quartz Waveplates | WPQ

Catalog Code W3032

λ/2

Part Number	Wavelength Range [nm]	Theoretical retardation [nm]	Retardation tolerance
WPQ-2660-2M	266	133.0	<λ/50
WPQ-3250-2M	325	162.5	<λ/50
WPQ-3550-2M	355	177.5	<λ/50
WPQ-4050-2M	405	202.5	λ/100 – λ/200
WPQ-4100-2M	410	205.0	λ/100 – λ/200
WPQ-4416-2M	441.6	220.8	λ/100 – λ/200
WPQ-4579-2M	457.9	229.0	λ/100 – λ/200
WPQ-4880-2M	488	244.0	λ/100 – λ/200
WPQ-5145-2M	514.5	257.3	λ/100 – λ/200
WPQ-5320-2M	532	266.0	λ/100 – λ/200
WPQ-6328-2M	632.8	316.4	λ/100 – λ/200
WPQ-6700-2M	670	335.0	λ/100 – λ/200
WPQ-7800-2M	780	390.0	λ/200 – λ/500
WPQ-8300-2M	830	415.0	λ/200 – λ/500
WPQ-10640-2M	1064	532.0	λ/200 – λ/500
WPQ-13000-2M	1300	650.0	λ/200 – λ/500
WPQ-15500-2M	1550	775.0	λ/200 – λ/500

λ/4

Part Number	Wavelength Range [nm]	Theoretical retardation [nm]	Retardation tolerance
WPQ-2660-4M	266	66.5	<λ/50
WPQ-3250-4M	325	81.3	<λ/50
WPQ-3550-4M	355	88.8	<λ/50
WPQ-4050-4M	405	101.3	λ/100 – λ/200
WPQ-4100-4M	410	102.5	λ/100 – λ/200
WPQ-4416-4M	441.6	110.4	λ/100 – λ/200
WPQ-4579-4M	457.9	114.5	λ/100 – λ/200
WPQ-4880-4M	488	122.0	λ/100 – λ/200
WPQ-5145-4M	514.5	128.6	λ/100 – λ/200
WPQ-5320-4M	532	133.0	λ/100 – λ/200
WPQ-6328-4M	632.8	158.2	λ/100 – λ/200
WPQ-6700-4M	670	167.5	λ/100 – λ/200
WPQ-7800-4M	780	195.0	λ/200 – λ/500
WPQ-8300-4M	830	207.5	λ/200 – λ/500
WPQ-10640-4M	1064	266.0	λ/200 – λ/500
WPQ-13000-4M	1300	325.0	λ/200 – λ/500
WPQ-15500-4M	1550	387.5	λ/200 – λ/500

Quartz Depolarizers | DEQ

Quartz depolarizers convert linearly polarized input beams to unpolarized beams and are used in front of and the behind of measurement equipment that must avoid polarization.

- 1N type is made of single optical quartz plate. It has a wider transmission range, but has a larger beam deviation due to the 2 degrees wedge shape.
- 2S type consists of cemented plates of optical quartz and synthetic fused silica. It does not have beam deviation, but the transmission range is not wide as the single type.
- OP type consists of optical contact. It has a wider transmission range, and without beam deviation.
- It is similar to waveplate and mounted in a frame of ø30mm diameter.

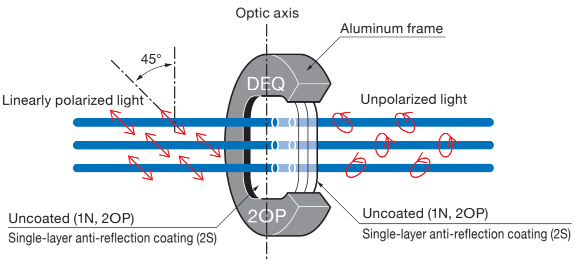
Specifications

Material	Optical Grade Crystalline Quarts Synthetic fused silica
Material of frame	Aluminum Finishing: Black anodized
Surface Quality (Scratch–Dig)	40–20

Attention

▶Be sure to wear laser safety goggles when checking optical path and adjusting optical axis.

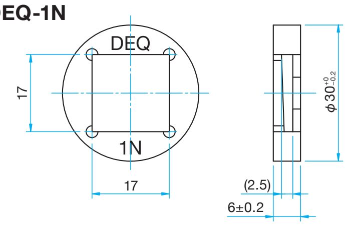
Schematic



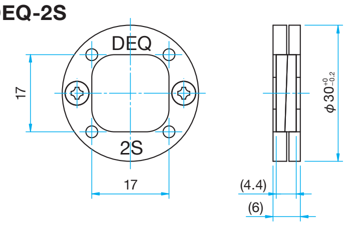
Outline Drawing

(in mm)

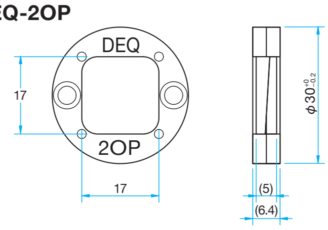
DEQ-1N



DEQ-2S



DEQ-2OP



Specifications

Part Number	Wavelength Range [nm]	Material	Thickness of Optics [mm]	Laser Damage Threshold* [J/cm^2]
DEQ-1N	180 – 3500	Optical Grade Crystalline Quarts	2.5 (Maximum)	—
DEQ-2S	350 – 2500	Optical Grade Crystalline Quarts Synthetic fused silica	4.4	0.3
DEQ-2OP	180 – 3500	Optical Grade Crystalline Quarts	5.0	1

* Laser pulse width 10ns, repetition frequency 20Hz

Compatible Optic Mounts

PH-30-ARS / SPH-30-ARS

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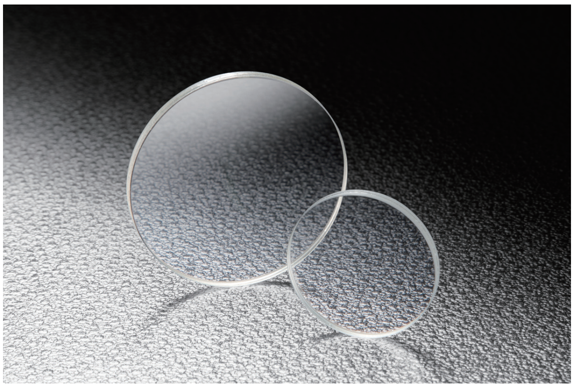
Mica Waveplates | WPM

RoHS Catalog Code W3034

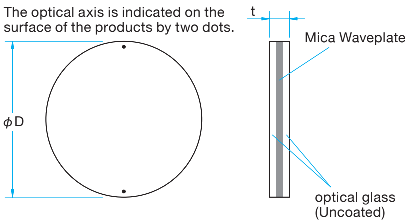
Mica waveplates are zero-order (first-order) retardation plates (phase plates) which are designed at 550nm wavelength and effective at the range from 400 – 700nm. A mica sheet is sandwiched between optical glass discs for protection and ease of use. A mica sheet is sandwiched between optical glass discs for protection and ease of use.

- These products utilize birefringence of mica and give phase difference of λ/4 (π/2, 90°) or λ/2 (π, 180°) to the input beams. λ/4 plates convert linearly polarization to circularly and circularly polarization to linearly. λ/2 plates convert the direction of polarization in 90 degrees.
- Usually linearly polarized beams are input to the waveplates in a leaning of 45 degrees against its optical axis.



Outline Drawing

(in mm)



●Tolerance
Diameter ϕD±0.2
Thickness t ±0.2

Specifications

Material	A mica sheet is sandwiched between optical glass discs for protection and ease of use.
Wavelength Range	400 – 700nm
Transmitted wavefront distortion	2λ λ=550nm
Incident angle	0°
Design wavelength	580nm
Theoretical retardation	λ/4: 145nm λ/2: 290nm
Surface Quality (Scratch–Dig)	40–20

Guide

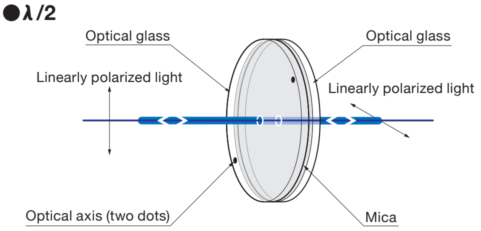
▶Please contact our International Sales Division for customized products. (Customized on size etc.)

Attention

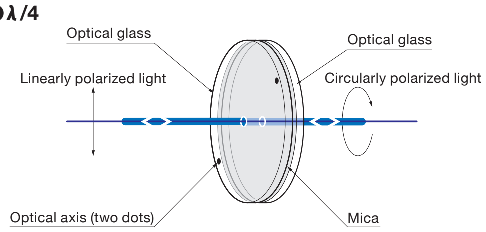
▶Mica waveplates cannot be used for high-power laser applications because of their relatively high absorption coefficient and occasional inhomogeneities.
▶Be sure to wear laser safety goggles when checking optical path and adjusting optical axis.
▶If you want to use the polarization measurement, please use the crystal waveplate. Reference B087

Schematic

●λ/2



●λ/4



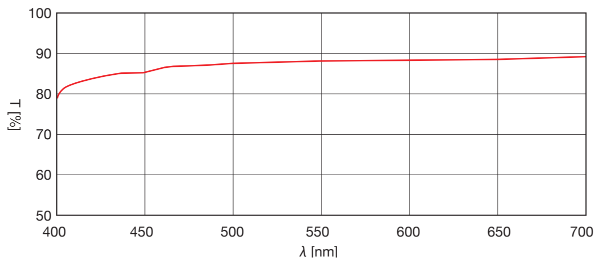
λ/2

Part Number	Diameter ϕD [mm]	Thcikness t [mm]
WPM-10-2P	ϕ10	2.5
WPM-20-2P	ϕ20	2.5
WPM-25-2P	ϕ25	2.5
WPM-30-2P	ϕ30	2.5
WPM-40-2P	ϕ40	3.5
WPM-50-2P	ϕ50	3.5

λ/4

Part Number	Diameter ϕD [mm]	Thcikness t [mm]
WPM-10-4P	ϕ10	2.5
WPM-20-4P	ϕ20	2.5
WPM-25-4P	ϕ25	2.5
WPM-30-4P	ϕ30	2.5
WPM-40-4P	ϕ40	3.5
WPM-50-4P	ϕ50	3.5

Typical Transmittance Data T: Transmission



Compatible Optic Mounts

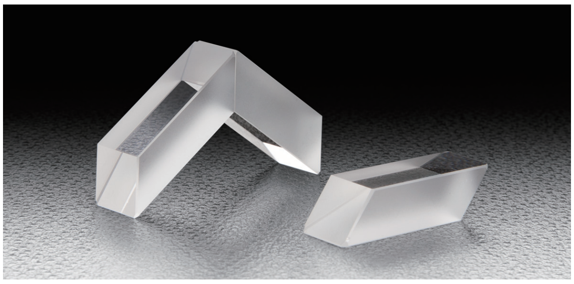
PH-30-ARS / SPH-30-ARS

Fresnel Rhomb Waveplates | FRB

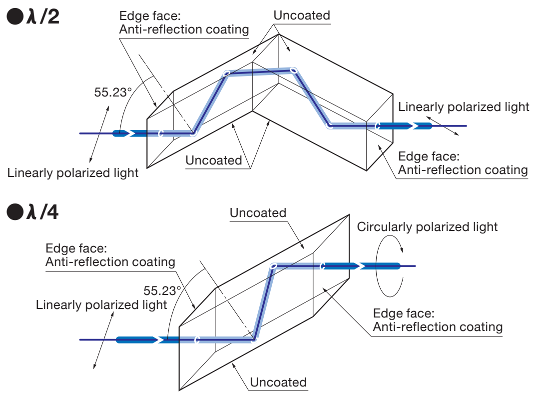
RoHS

The optical retardation can be given without the wavelength dependence for all visible ranges. It can be used in optical systems that change the polarization direction of the white-light source or spectroscopic measurement using polarization.

- There are two types of Fresnel rhomb waveplate. A half waveplate can rotate the polarization direction and a quarter waveplate can convert linear polarization into circular polarization.
- As the entrance, exit and reflecting surfaces are processed at a high parallelism, the beam deflection is suppressed.
- When the linear polarization direction of incident light is 45 degrees against the sides of square faces, the specified optical retardation will be obtained. The light will exit as linear polarization with –45 degrees direction for the half waveplate, and as circular polarization for the quarter waveplate.

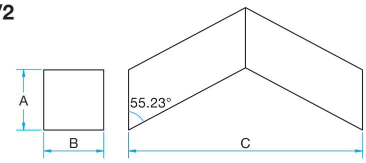


Schematic



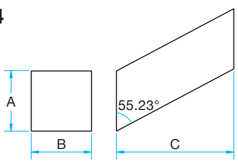
Outline Drawing (in mm)

●λ/2



●Tolerance
A･B±0.1
C±0.2

●λ/4



●Tolerance
A･B±0.1
C±0.2

Specifications

Material	BK7
Surface flatness of substrate	λ/10
Coating	Edge faces: Anti-reflection coating Side surfaces: Uncoated
Design wavelength	587.6nm
Incident angle	0°
Surface Quality (Scratch–Dig)	40–20

Guide

- ▶Fresnel rhomb waveplates made of synthetic fused silica are also available.
- ▶For Fresnel rhomb waveplates with different size, wavelength range, or retardation, please contact our International Sales Division.

Attention

- ▶The quarter waveplate has optical axis shift (refer to the optical axis shift listed in the table below). Use the Fresnel rhomb waveplate by mounting it horizontally or vertically and rotating the polarization orientation of the incidence beam.
- ▶If finger prints or grease stain the polished surfaces of the Fresnel rhomb waveplate, the specified optical retardation will not be obtained. Use it carefully to prevent the side surfaces contact with anything. (An FRH mounted in a holder is also available).
- ▶If the incidence angle varies, the specified optical retardation performance will not be obtained.
- ▶The Fresnel rhomb waveplate is less dependant to the wavelength, and it can be used in extended range outside the visible range. However the effectiveness of the anti-reflection coating drops outside the visible range and the transmittance decreases.
- ▶When the linear polarization direction of incident light is aligned at 0 degrees or 90 degrees against the side of square face, the polarization direction will not change and output. (this is same for half waveplate and quarter waveplate)

λ/2

Part Number	A×B×C [mm]	optical axis shift [mm]
FRB-1010-2	10×10×40.0	<0.5
FRB-1515-2	15×15×58.6	<0.5

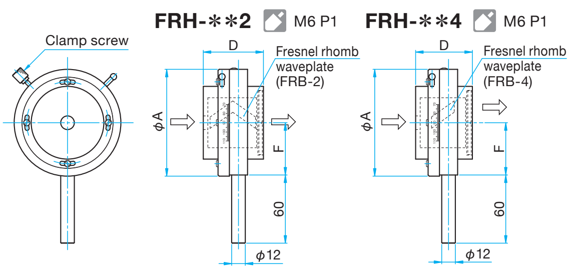
λ/4

Part Number	A×B×C [mm]	optical axis shift [mm]
FRB-1010-4	10×10×20.0	13.5
FRB-1515-4	15×15×29.3	20.2

Fresnel Rhomb Waveplate Holders

This is a product with Fresnel rhomb waveplate mounted in a holder.
For a λ/2 plate (FRH-✽✽2), the optical axis of waveplate and rotation axis of holder are aligned.

Outline Drawing (in mm)



Part Number	Center height F [mm]	Diameter φA [mm]	Length D [mm]
FRH-102	46	φ94	53
FRH-152	57.5	φ116	74
FRH-104	46	φ94	50
FRH-154	57.5	φ116	46

Specifications

Part Number	Part number of waveplate	Sensitivity [°]	Weight [kg]
FRH-102	FRB-1010-2	1	0.59
FRH-152	FRB-1515-2	1	1.05
FRH-104	FRB-1010-4	1	0.57
FRH-154	FRB-1515-4	1	1.81

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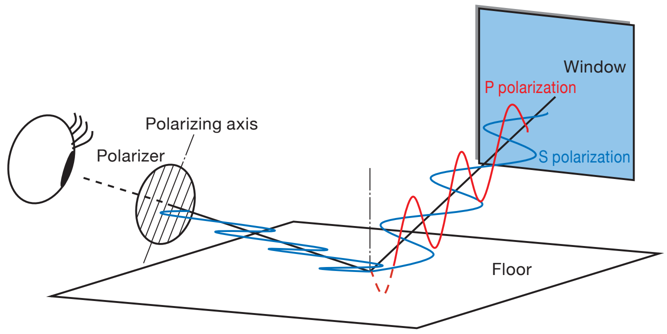
Application Note

Human with naked eye can not make the differencs in between a linear polarized light and a circularly polarized light. But polarizer optics will allow you to see the polarized light situation. Here we introduce the fundamentals of the usage of the polarizer optics.

How to affirm the polarizing axis of a polarizer optics

The following method will show you how to find the polarizing direction when there is no marking shown on the optics neither the direction of the polarizing axis.
Observe the reflection of a slanting ray of light from a window over a brilliant mat. Use the light polarizer to confirm the light direction of the reflected light.
Peep the reflected light with the polarizer by turning the polarizer, the illumination go up and down. When the light is dark, the upside and downside of the polarizer shows the polarization axis of the reflected light. We don't need any particular tool and location to confirm the light direction.



What is the normal coordinate of the polarizer

A single polarizer optic can not perform a circular polarized light. It depends on the object that the light hits. That is the reason why the experiment sample or the experiment target depends on the direction of the normal coordinate.

①Polarizing axis

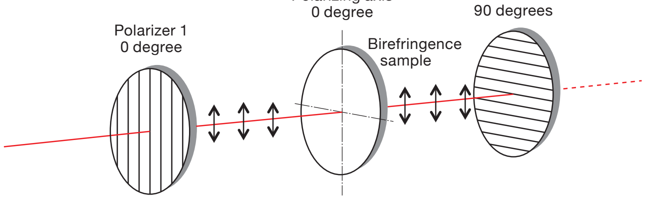
A standard experiment sets up with a laser a fixed polarizer and a linear polarizer axis.

◯Polarizer optic case:

⇒ When turning the Polarizer 2 at 90 degrees, the light axis went through the Polarizer 1 disappears.

◯Birefringence sample (waveplate):

⇒ Set a standard experiment with a laser, the polarizer 1 and the polarizer 2. A waveplate sample sets in between the Polarizer 1 and Polarizer 2. Turn the waveplate till the darkest position and mark the position as 0 degrees.



②Vertical direction on a table

There is no necessary of any particular setting; the optics can be at any direction. This experiment will be done at a vertical direction.

◯In case of none adjusted polarized optics:

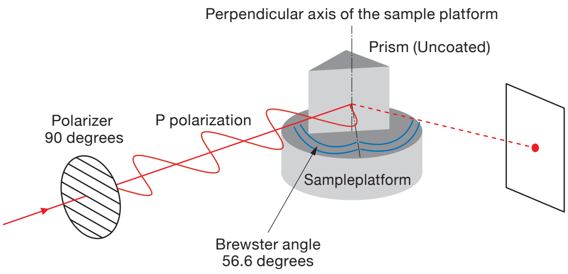
⇒ Take the polarizer optic as a standard and set it up vertically onto holders and adjust the polarizer at 0 degree. Set other optics according to the standard, see ① setting.

◯Requirement of adjusting the polarizer:

⇒ For optics that being sold mounted with a holder, the polarizer direction can be pre-set at 90 degrees before the shipment. For a waveplate to be adjusted at fast direction 90 degrees, the tolerance of 2 degrees or 3 degrees of the polarizer direction mounted with a holder may happen.

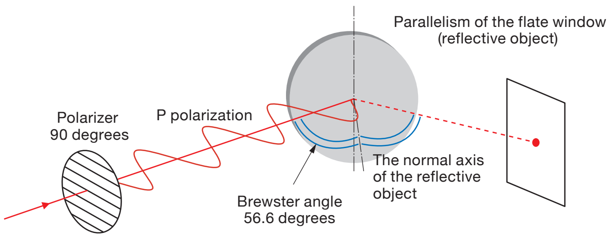
③Perpendicular to the sample axis

Experiment with a BK7 prism. Set an incident angle at 56.6 degrees to the polished surface of the prism. Incident with a light-source through the polarizer and turn the polarizer then observe the changing power of reflected light from the prism. When the incident ray angle matches the angle 56.6 degrees which is called Brewster's angle then the reflection ray disappears. The smallest reflection angle from the prism is the P polarization; the polarizer angle is 90 degrees or 0 degrees.



④Match the polarization to the reflective object

Set the polarization axis according to the reflective object and incident direction.
The reflection ray and the laser ray produce a plane oscillation polarization axis is called P polarization, the vertical oscillation polarization axis is called the S polarization.
Place an uncoated BK7 flat window as a test sample.
Incident ray at Brewster s angle 56.6 degrees. Place a polarizer optic in the incident ray. Turn the polarizer and observe the change of the power of the light reflected from the flat window. There is surface reflection and back reflection of light from the flat window.
Similar to ③ setting, turn the angle to the smallest polarization angle of 90 degrees or 0 degrees.
Replace the BK7 window by another sample; similar to ① setting and adjust the waveplate to execute the experiment.

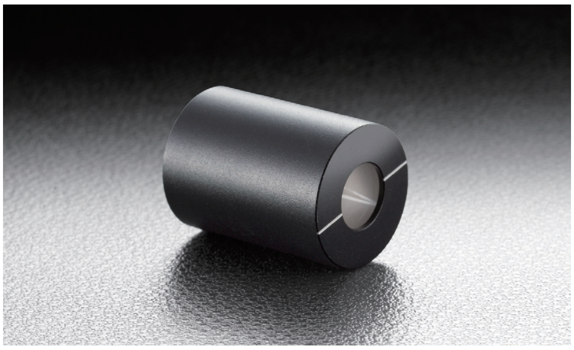


Glan Thompson Prisms | GTPB/GTPC

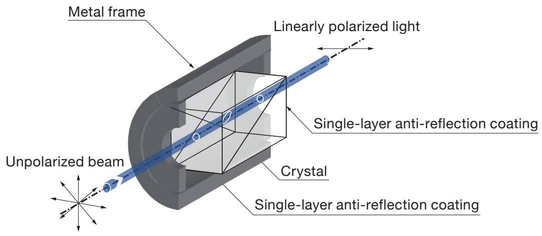
Catalog Code W3450

This is a special polarizer with minimal transmission loss, and a high extinction ratio below 5×10^{-5} is obtained. It is used in high-precision polarization experiments.
The Calcite type that can be used in the range of the visible region to the infrared region, and α-BBO crystal type usable in the ultraviolet region are both available.

- Glan Thompson prism is housed in a metal frame, and no stress is applied to the inner element when frame is mounted in the holder.
- For Calcite type Glan Thompson prism, the acceptance angle is chosen in two levels.
- A single-layer anti-reflection coating has been applied on the surface of the Glan Thompson prism, a high transmittance is obtained.

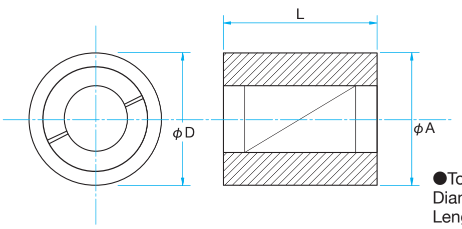


Schematic



Outline Drawing

(in mm)



●Tolerance
Diameter ϕD $^{+0}_{-0.2}$
Length L ±0.1

Specifications

Material	α-BBO, Calcite
Beam Deviation	<3″
Surface Flatness	λ/4
Coating	MgF_2 Single-layer anti-reflection coating
Laser Damage Threshold	0.3J/cm^2 (Pulse duration 10ns)
Surface Quality (Scratch–Dig)	20–10
Material of metal frame	Aluminum Finishing: Black anodized

Guide

▶Glan laser prism for high-power laser (GLPB / GLPC) and Wollaston prism (WPPB / WPPC) are also available.
▶If you need uncoated Glan Thompson prism or anti-reflection coating with specific reflectance, please contact our International Sales Division.
▶About the dedicated holder of the Glan Thompson prism, please contact our International Sales Division.

Attention

▶A change in the incident angle may also change the extinction ratio of the linearly polarized transmitted light.
▶Separation angle will vary depending on the wavelength. Please confirm the wavelength characteristic graph for separation angle.
▶Because of natural calcite crystals, there are individual differences, and variations in quality.

α-BBO

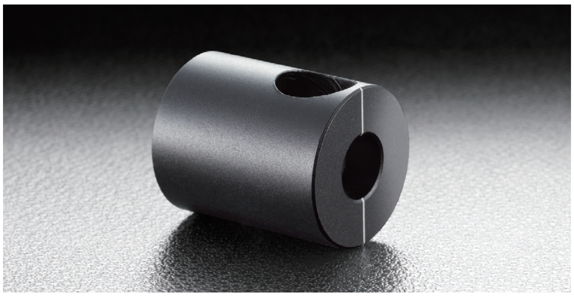
Part Number	Wavelength Range [nm]	Extinction ratio	Acceptance angle [°]	ϕA [mm]	ϕD×L
GTPB-06-18SN	200 – 900	<5×10^{-6}	±7.5	ϕ6	15×18
GTPB-08-21SN	200 – 900	<5×10^{-6}	±7.5	ϕ8	25.4×21
GTPB-10-24.5SN	200 – 900	<5×10^{-6}	±7.5	ϕ10	25.4×24.5
GTPB-15-32.5SN	200 – 900	<5×10^{-6}	±7.5	ϕ15	30×32.5

Calcite

Part Number	Wavelength Range [nm]	Extinction ratio	Acceptance angle [°]	ϕA [mm]	ϕD×L
GTPC-06-23SN	350 – 2300	<5×10^{-5}	±7	ϕ6	15×23
GTPC-08-28SN	350 – 2300	<5×10^{-5}	±7	ϕ8	25.4×28
GTPC-10-33SN	350 – 2300	<5×10^{-5}	±7	ϕ10	25.4×33
GTPC-15-45.5SN	350 – 2300	<5×10^{-5}	±7	ϕ15	30×45.5
GTPC-06-26SN	350 – 2300	<5×10^{-5}	±12.5	ϕ6	15×26
GTPC-08-32SN	350 – 2300	<5×10^{-5}	±12.5	ϕ8	25.4×32
GTPC-10-38SN	350 – 2300	<5×10^{-5}	±12.5	ϕ10	25.4×38
GTPC-15-53SN	350 – 2300	<5×10^{-5}	±12.5	ϕ15	30×53

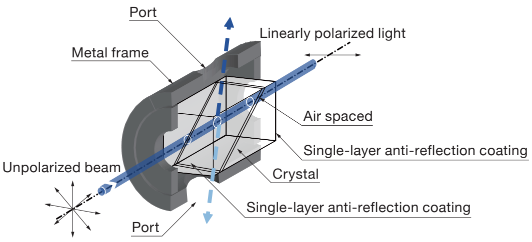
Glan Laser Prisms | GLPB/GLPC

A polarizer with enhanced laser damage threshold for high power lasers and high energy laser pulses. The transmission loss is minimal, and a high extinction ratio below 5×10^{-5} is obtained. The Calcite type that can be used in the range of the visible region to the infrared region, and α-BBO crystal type usable in the ultraviolet region are both available.



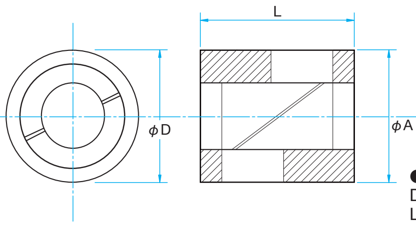
- The two prisms are connected with a small gap (air-gap). And reduction in laser damage and absorption by the adhesive are not caused by this.
- Gran Laser prism is housed in a metal frame. The polarization component which does not pass through the prism exits out of the frame through port (hole) of the metal frame.
- Since there are two ports, the prism can also be used by replacing the input and output direction.
- A single-layer anti-reflection coating has been applied on the surface of the Glan Laser prism, a high transmittance is obtained.

Schematic



Outline Drawing

(in mm)



●Tolerance
Diameter φD $^{+0}_{-0.2}$
Length L ±0.1

Specifications

Material	α-BBO, Calcite
Beam Deviation	<3″
Surface Flatness	λ/4
Coating	MgF_2 Single-layer anti-reflection coating
Laser Damage Threshold	2J/cm² (Pulse duration 10ns)
Surface Quality (Scratch−Dig)	20−10
Material of metal frame	Aluminum Finishing: Black anodized

Guide

- Glan Thompson prism with wider acceptance angle (GTPB / GTPC) and Wollaston prism (WPPB / WPPC) are also available.
- If you need uncoated Glan Laser prism or anti-reflection coating with specific reflectance, please contact our International Sales Division.
- About the dedicated holder of the Glan Laser prism, please contact our International Sales Division.

Attention

- A change in the incident angle may also change the extinction ratio of the linearly polarized transmitted light.
- Because of natural calcite crystals, there are individual differences, and variations in quality.

α-BBO

Part Number	Wavelength Range [nm]	Extinction ratio	Acceptance angle [°]	φA [mm]	φD×L
GLPB2-06-29SN-2/3	200 – 270	$<5\times10^{-6}$	±3.0	φ6	15×29
GLPB2-08-31SN-2/3	200 – 270	$<5\times10^{-6}$	±3.0	φ8	25.4×31
GLPB2-10-31SN-2/3	200 – 270	$<5\times10^{-6}$	±3.0	φ10	25.4×31
GLPB2-15-38.6SN-2/3	200 – 270	$<5\times10^{-6}$	±3.0	φ15	30×38.6
GLPB2-20-48.9SN-2/3	200 – 270	$<5\times10^{-6}$	±3.0	φ20	38×48.9
GLPB2-06-25SN-3/7	300 – 700	$<5\times10^{-6}$	±3.0	φ6	15×25
GLPB2-08-25SN-3/7	300 – 700	$<5\times10^{-6}$	±3.0	φ8	25.4×25
GLPB2-10-26SN-3/7	300 – 700	$<5\times10^{-6}$	±3.0	φ10	25.4×26
GLPB2-15-33.4SN-3/7	300 – 700	$<5\times10^{-6}$	±3.0	φ15	30×33.4
GLPB2-20-43.6SN-3/7	300 – 700	$<5\times10^{-6}$	±3.0	φ20	38×43.6
GLPB2-06-23SN-7/30	700 – 3000	$<5\times10^{-6}$	±3.0	φ6	15×23
GLPB2-08-24.7SN-7/30	700 – 3000	$<5\times10^{-6}$	±3.0	φ8	25.4×24.7
GLPB2-10-25.9SN-7/30	700 – 3000	$<5\times10^{-6}$	±3.0	φ10	25.4×25.9
GLPB2-15-33SN-7/30	700 – 3000	$<5\times10^{-6}$	±3.0	φ15	30×33
GLPB2-20-43.6SN-7/30	700 – 3000	$<5\times10^{-6}$	±3.0	φ20	38×43.6

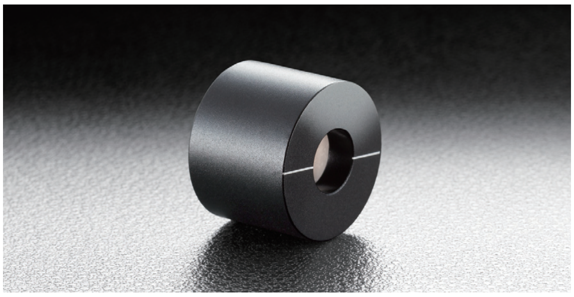
Calcite

Part Number	Wavelength Range [nm]	Extinction ratio	Acceptance angle [°]	φA [mm]	φD×L
GLP2-06-21SN	350 – 2300	$<5\times10^{-5}$	±3.85	φ6	15×21
GLP2-08-24.5SN	350 – 2300	$<5\times10^{-5}$	±3.85	φ8	25.4×24.5
GLP2-10-26.2SN	350 – 2300	$<5\times10^{-5}$	±3.85	φ10	25.4×26.2
GLP2-15-33.3SN	350 – 2300	$<5\times10^{-5}$	±3.85	φ15	30×33.3
GLP2-20-42.3SN	350 – 2300	$<5\times10^{-5}$	±3.85	φ20	38×42.3

Glan Tayler Prisms | GYPB/GYPC

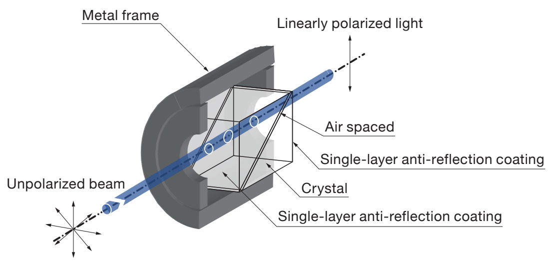
Catalog Code W3452

A polarizer with shortest prism length.
The transmission loss is minimal, and a high extinction ratio below 5×10^{-5} is obtained.
The Calcite type that can be used in the range of the visible region to the infrared region, and α-BBO crystal type usable in the ultraviolet region are both available.



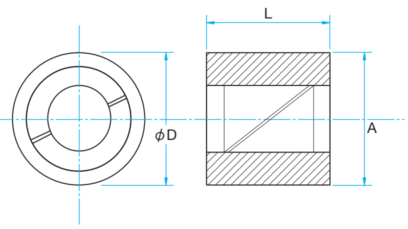
- The two prisms are connected with a small gap (air-gap).
- And reduction in laser damage and absorption by the adhesive are not caused by this.
- A single-layer anti-reflection coating has been applied on the surface of the polarizing prism, a high transmittance is obtained.

Schematic



Outline Drawing

(in mm)



- Tolerance
Diameter $\phi D^{+0}_{-0.2}$
Length L ±0.1

Specifications

Material	α-BBO, Calcite
Beam Deviation	<3″
Surface Flatness	λ/4
Coating	MgF_2 Single-layer anti-reflection coating
Laser Damage Threshold	1J/cm² (Pulse duration 10ns)
Surface Quality (Scratch–Dig)	20–10
Material of metal frame	Aluminum Finishing: Black anodized

Guide

- ▶Glan laser prism for high-power laser (GLPB / GLPC) and Wollaston prism (WPPB / WPPC) are also available.
- ▶If you need uncoated Glan Thompson prism or anti-reflection coating with specific reflectance, please contact our International Sales Division.
- ▶About the dedicated holder of the Glan Tayler prism, please contact our International Sales Division.

Attention

- ▶A change in the incident angle may also changes the extinction ratio of the linearly polarized transmitted light.
- ▶Light not transmitted through the Gran Taylor prism is absorbed and scattered in all side faces of the prism. In the high-precision measurement system, it is necessary to use pinhole to block light scattered in the side face of the prism.
- ▶Because of natural calcite crystals, there are individual differences, and variations in quality.

α-BBO

Part Number	Wavelength Range [nm]	Extinction ratio	Acceptance angle [°]	ϕA [mm]	ϕD×L
GYPB-06-15SN-2/3	200 – 270	$<5\times10^{-6}$	±3.0	ϕ6	15×15
GYPB-08-17SN-2/3	200 – 270	$<5\times10^{-6}$	±3.0	ϕ8	25.4×17
GYPB-10-19SN-2/3	200 – 270	$<5\times10^{-6}$	±3.0	ϕ10	25.4×19
GYPB-15-23SN-2/3	200 – 270	$<5\times10^{-6}$	±3.0	ϕ15	30×23
GYPB-20-29SN-2/3	200 – 270	$<5\times10^{-6}$	±3.0	ϕ20	38×29
GYPB-06-15SN-3/7	300 – 700	$<5\times10^{-6}$	±3.0	ϕ6	15×15
GYPB-08-17SN-3/7	300 – 700	$<5\times10^{-6}$	±3.0	ϕ8	25.4×17
GYPB-10-19SN-3/7	300 – 700	$<5\times10^{-6}$	±3.0	ϕ10	25.4×19
GYPB-15-23SN-3/7	300 – 700	$<5\times10^{-6}$	±3.0	ϕ15	30×23
GYPB-20-29SN-3/7	300 – 700	$<5\times10^{-6}$	±3.0	ϕ20	38×29
GYPB-06-15SN-7/30	700 – 3000	$<5\times10^{-6}$	±3.0	ϕ6	15×15
GYPB-08-17SN-7/30	700 – 3000	$<5\times10^{-6}$	±3.0	ϕ8	25.4×17
GYPB-10-19SN-7/30	700 – 3000	$<5\times10^{-6}$	±3.0	ϕ10	25.4×19
GYPB-15-23SN-7/30	700 – 3000	$<5\times10^{-6}$	±3.0	ϕ15	30×23
GYPB-20-29SN-7/30	700 – 3000	$<5\times10^{-6}$	±3.0	ϕ20	38×29

Calcite

Part Number	Wavelength Range [nm]	Extinction ratio	Acceptance angle [°]	ϕA [mm]	ϕD×L
GYPC-06-15SN	350 – 2300	$<5\times10^{-5}$	±3.85	ϕ6	15×15
GYPC-08-17SN	350 – 2300	$<5\times10^{-5}$	±3.85	ϕ8	25.4×17
GYPC-10-19SN	350 – 2300	$<5\times10^{-5}$	±3.85	ϕ10	25.4×19
GYPC-15-23SN	350 – 2300	$<5\times10^{-5}$	±3.85	ϕ15	30×23
GYPC-20-29SN	350 – 2300	$<5\times10^{-5}$	±3.85	ϕ20	38×29

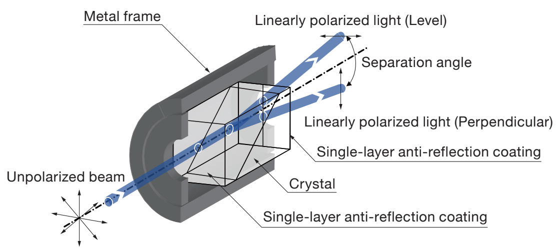
It is a prism for separating the incident beam into two linearly polarized beams with orthogonal polarizing direction.
Used in the optical system of a phase-contrast microscope.

- Outgoing beam is emitted with deviation. In this case, the emitted beams are in opposite directions depending on the direction of polarization.
- A single-layer anti-reflection coating has been applied on the surface of the Wollaston prism, a high transmittance is obtained.

Specifications

Material	α-BBO, Calcite
Beam Deviation	<3″
Surface Flatness	λ/4
Coating	MgF_2 Single-layer anti-reflection coating
Laser Damage Threshold	0.3J/cm^2 (Pulse duration 10ns)
Surface Quality (Scratch–Dig)	20–10
Material of metal frame	Aluminum Finishing: Black anodized

Schematic



Guide

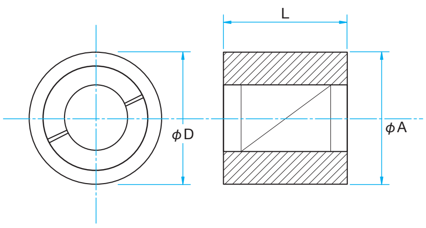
- ▶Glan Thompson prism with wider acceptance angle (GTPB / GTPC) and Glan laser prism for high-power laser (GLPB / GLPC) are also available.
- ▶If you need uncoated Glan Laser prism or anti-reflection coating with specific reflectance, please contact our International Sales Division.
- ▶About the dedicated holder of the Wollaston prism, please contact our International Sales Division.

Attention

- ▶A change in the incident angle may also change the extinction ratio of the linearly polarized transmitted light.
- ▶Separation angle will vary depending on the wavelength. Please confirm the wavelength characteristic graph for separation angle.
- ▶Because of natural calcite crystals, there are individual differences, and variations in quality.

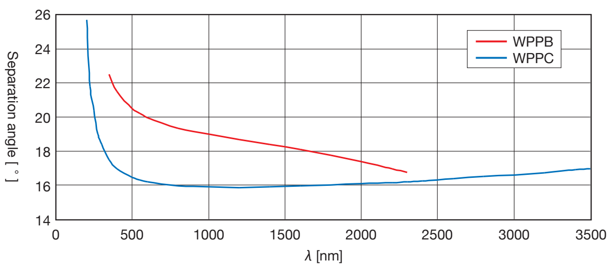
Outline Drawing

(in mm)



●Tolerance
Diameter $\phi D^{+0}_{-0.2}$
Length L ±0.1

Typical Separation angle Data



α-BBO

Part Number	Wavelength Range [nm]	Extinction ratio	Separation angle 190nm [°]	Separation angle 800nm [°]	Separation angle 3500nm [°]	ϕA [mm]	ϕD×L
WPPB-06-14SN	190 – 3500	$<5\times10^{-6}$	27	16	17	ϕ6	15×14
WPPB-08-16SN	190 – 3500	$<5\times10^{-6}$	27	16	17	ϕ8	25.4×16
WPPB-10-18SN	190 – 3500	$<5\times10^{-6}$	27	16	17	ϕ10	25.4×18
WPPB-15-23SN	190 – 3500	$<5\times10^{-6}$	27	16	17	ϕ15	30×23
WPPB-20-28SN	190 – 3500	$<5\times10^{-6}$	27	16	17	ϕ20	38×28

Calcite

Part Number	Wavelength Range [nm]	Extinction ratio	Separation angle 350nm [°]	Separation angle 980nm [°]	Separation angle 2300nm [°]	ϕA [mm]	ϕD×L
WPPC-06-14SN	350 – 2300	$<5\times10^{-5}$	22.5	19	16.7	ϕ6	15×14
WPPC-08-16SN	350 – 2300	$<5\times10^{-5}$	22.5	19	16.7	ϕ8	25.4×16
WPPC-10-18SN	350 – 2300	$<5\times10^{-5}$	22.5	19	16.7	ϕ10	25.4×18
WPPC-15-23SN	350 – 2300	$<5\times10^{-5}$	22.5	19	16.7	ϕ15	30×23
WPPC-20-28SN	350 – 2300	$<5\times10^{-5}$	22.5	19	16.7	ϕ20	38×28

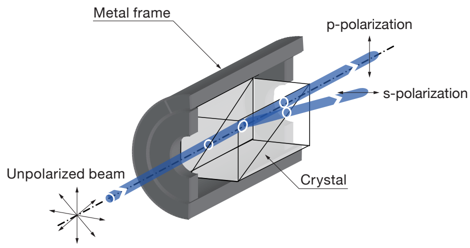
Roshon polarizing Prism | RSPCQ/RSPMF

Catalog Code W3451

It is a polarizer to separate the incident light into two linearly polarized light that crosses perpendicular.
It corresponds to the wide range of wavelength range from ultraviolet to infrared.

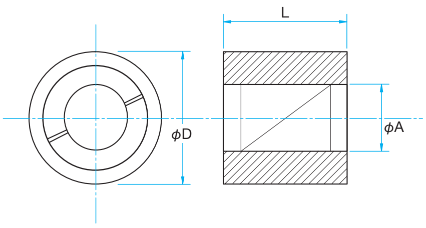
- P polarized light is emitted straight without the displacement of the optical path, and S-polarized light is emitted with a separation angle.
- We offer the RSPCQ-10 of crystalline quartz product and RSPMF-10 of MgF_2 single crystal corresponding to the broad-band more than DUV.

Schematic



Outline Drawing

(in mm)



●Tolerance
Diameter ϕD ±0.1
Length L ±0.1

Specifications

Beam Deviation	<3″
Surface Flatness	λ/4
Coating	Uncoated
Laser Damage Threshold	0.3J/cm^2 (Pulse duration 10ns)
Surface Quality (Scratch–Dig)	20–10
Material of metal frame	Aluminum Finishing: Black anodized

Guide

- ▶If you need anti-reflective coating, please contact our international sales division.
- ▶For exclusive holder of Roshon polarizing prism, please contact our international sales division.

Attention

- ▶The incident angle changes and the extinction ratio of linear polarization of the transmitted light also changes.

Specifications

Part Number	Material	Wavelength Range [nm]	Extinction ratio	Separation angle [°]	ϕA [mm]	ϕD×L [mm]
RSPCQ-10	Quartz	200 – 2300	$<2\times10^{-4}$	1 – 1.5	ϕ10	25.4×28
RSPMF-10	MgF_2	130 – 7000	$<1\times10^{-4}$	1 – 2	ϕ10	25.4×28

Sheet Polarizers | SPF/NSPFU/SPFN

RoHS Catalog Code W3037

By the use of dichroic dye film, a good linear polarization can be obtained in a wide range. The sheet polarizer can be used in the basic polarization experiment which does not require the high precision, and for the light intensity adjustment.

- Since the polarizing film is sandwiched between the protective glass plate, its is hardly get scratched, and dirt can be wiped off.
- Because it is mounted in the frame, the handling of the optics and mounting to the holder is easy.
- There are three teepees in wavelength range, for Visible, UV and Near Infrared.
- Since the anti-reflection film is applied on both sides, you can reduce stray light and back reflection to the light source.

Specifications

Material	Dicrhoic dye film Sheet glass (Quartz glass for NSPFU) Film laminated between optical glasses
Coating	Anti-reflection coating on both surfaces
Material of metal frame	Aluminum Finishing: Black anodized

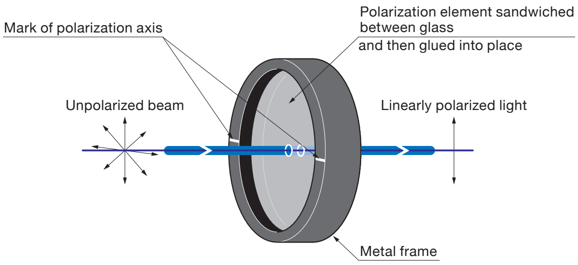
Guide

▶A sheet polarizer other than the size listed in catalog, or without the frame are also available.
▶If there is a demand in transmittance, extinction ratio and wavelength range, please contact our International Sales Division.
▶Glan Thompson prism (GTPC) with high transmittance and high extinction ratio is also available. Reference B094

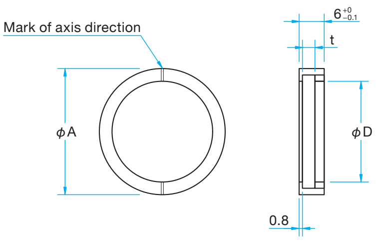
Attention

▶Dichroic dye polarizing film has the amount of light loss due to absorption in addition to polarization characteristics.
▶Because the product is made of a heat-sensitive film, do not use it near high power lasers, or high temperature light source.
▶The extinction ratio varies by wavelength. The violet light may be observed in some extinction condition.
▶The marks on the surface of the frame are perpendicular to the polarization direction of the output linearly polarized beam.

Schematic



Outline Drawing (in mm)



●Tolerance
Diameter φA +0 -0.1

400 – 700nm

Part Number	Wavelength Range [nm]	Diameter of frame φA [mm]	Clear aperture φD [mm]	Thcikness t [mm]
SPF-30C-32	400 – 700	φ30	φ24	3
SPF-50C-32	400 – 700	φ50	φ44	3

320 – 400nm

Part Number	Wavelength Range [nm]	Diameter of frame φA [mm]	Clear aperture φD [mm]	Thcikness t [mm]
NSPFU-30C	320 – 400	φ30	φ24	2.4

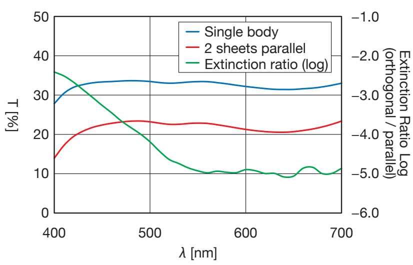
760 – 2000nm

Part Number	Wavelength Range [nm]	Diameter of frame φA [mm]	Clear aperture φD [mm]	Thcikness t [mm]
SPFN-30C-26	760 – 2000	φ30	φ24	3

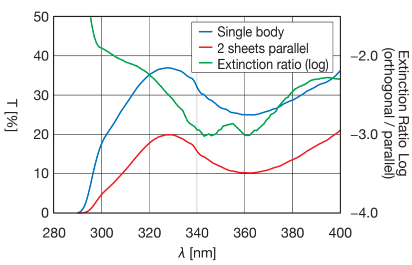
Typical Transmittance Data

T: Transmission

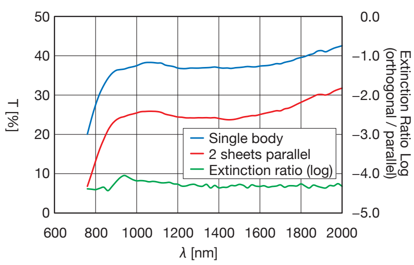
SPF-32



NSPFU



SPFN



Compatible Optic Mounts

PH-30-ARS / PH-50-ARS / SPH-30-ARS / SPH-50-ARS

Wire grid polarizing filter | WGPF

RoHS Catalog Code W3175

Since it is used the wire grid film processed with aluminum wire mesh of the interval of 100nm to 150nm, (Therefore), it is possible to extract the linearly polarized light from the visible light to the infrared region. It is available in the light quantity (intensity) adjustment by using the polarization or (and) polarization experiment.

- In the infrared region, extinction ratio of 10^{-3} degree can be obtained.
- It has excellent heat resistance than polarizing film of the absorption type.
- It is fixed to the frame so it is easy to handle this filter, and fixing (to fix) to the holder is easy.
- Only linearly polarized light that is vibrated (swings) in the direction of the mark of the metal frame is transmitted.

Specifications

Material	Optical glass, Wire grid polarizing film
Coating	Uncoated
Material of metal frame	Aluminum Finishing: Black alumite (anodized)

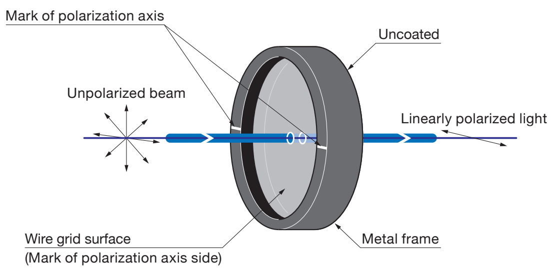
Guide

▶Other sizes are available, please consult our sales division.
▶Glan-Thompson prism (GTPB / GTPC), which can be obtained high transmittance and extinction ratio is also available. Reference B094

Attention

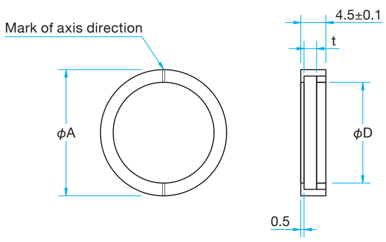
▶Most of which is not transmitted light will be reflected.
▶Please note processing of the reflected (return) light when used with a laser. Because it is easy to be scratched, please do not wipe with a cloth or paper on wire grid surface.
▶If the dust got to the surface of the filter, please blow off the dust with the air blower.

Schematic



Outline Drawing

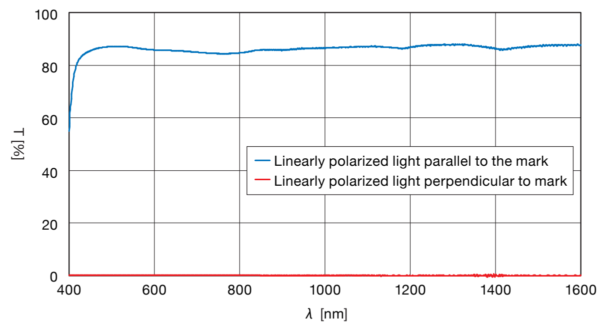
(in mm)



●Tolerance
Diameter ϕA±0.1

Typical Transmittance Data

T: Transmission



Specifications

Part Number	Wavelength Range [nm]	Diameter of frame ϕA [mm]	Clear aperture ϕD [mm]	Thcikness t [mm]
WGPF-30C	420 – 1600	ϕ30	ϕ23	1.2

Compatible Optic Mounts

PH-30-ARS / PH-50-ARS / SPH-30-ARS / SPH-50-ARS

Application Systems
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Actuators
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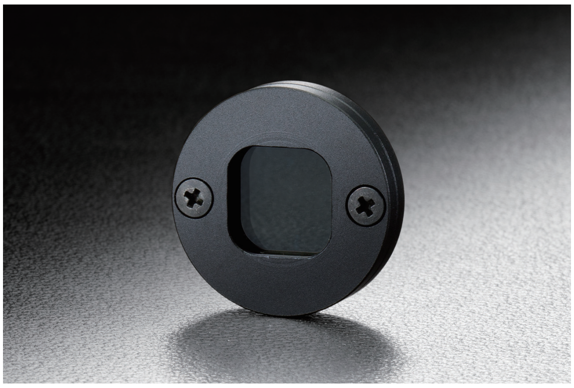
Polarizing Beamsplitters
Waveplates
Polarizers

Polarcor Polarizers | PLC

RoHS Catalog Code W3038

**Polarcor is a glass made polarizer; it offers a high extinction ratio in the infrared region.
It is widely used in experiments of telecommunication LD.**

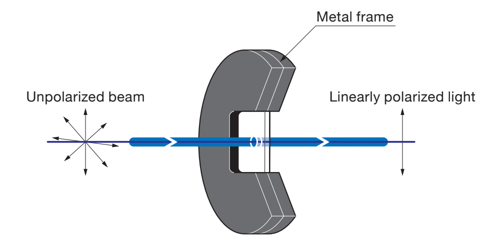
- Strong against corrosion and scratches resistant; offers an excellent durability.
- High transmittance in the infrared region, usable for high power laser.
- Mounted in aluminum frame; easy to be placed in any mirror holder.



Specifications

Material	Alkali Borosilicate Glass
Extinction ratio	1×10^{-4}
Angular Field	±15°
Transmitted wavefront	λ
Beam Deviation	<20″
Coating	Dielectric multi-layer AR coating
Material of frame	Aluminum Finishing: Lusterless black anodized
Surface Quality (Scratch–Dig)	40–20
Laser Damage Threshold	0.1J/cm^2 (Laser pulse width 13ns) 25W/cm^2 (CW Laser)

Schematic



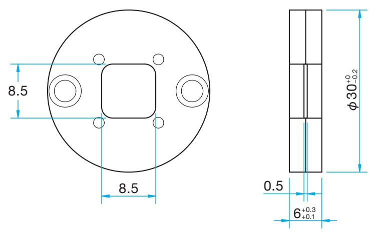
Guide

▶For larger effective diameter, please see our NIR polarizer product.
Reference B099
▶For unmounted product, please contact our International Sales Divison.

Attention

▶Low transmittance if it used in visible region.
▶For use in unconformity wavelength the extinction ratio is worsen.

Outline Drawing (in mm)



Specifications

Part Number	Wavelength Range [nm]	Transmittance [%]
PLC-10-660	630 – 700	>83
PLC-10-800	740 – 860	>91
PLC-10-900	840 – 960	>94
PLC-10-1060	960 – 1160	>95
PLC-10-1310	1275 – 1345	>98
PLC-10-1550	1510 – 1590	>98

Compatible Optic Mounts

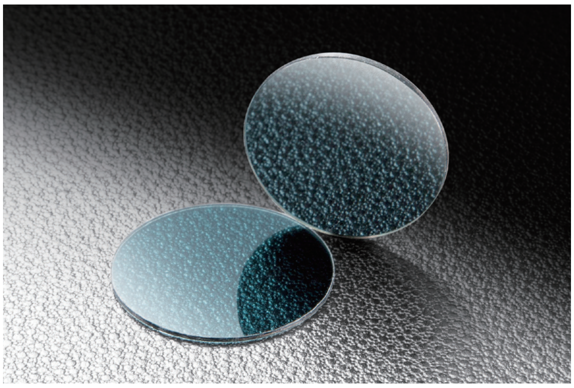
PH-30-ARS / SPH-30-ARS

Plastic polarizer | USP

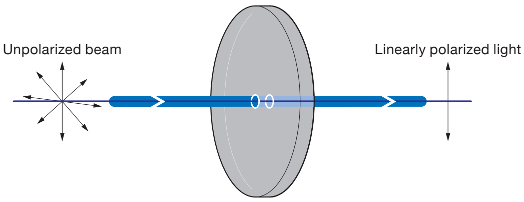
RoHS Catalog Code W3039

Look for a low cost polarization solution, USP is for you.
Usage in Photo-elasticity experiments and simple polarization experiment or light intensity adjustment in illumination application.

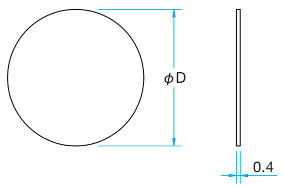
- Possible to use 2 plastic polarizers for various experiments.
- Place 2 polarizers onto the light axis by changing the polarization of each polarizer, it allows you to experience the light intensity adjustment at a wide dynamic range.
- The plastic polarizer is thin; convenient for confined experiments space.
- Since this is made of plastic, there is no risk to be broken when it falls.



Schematic



Outline Drawing
(in mm)



●Tolerance
Diameter $\phi D^{+0}_{-0.4}$

Specifications

Material and structure	Polarizing high-polymer film laminated between plastic sheets
Wavelength Range	400 – 700nm

Guide

- For product size that is not listed on this catalog, please ask our International Sales Divison.
- Because of plastic, it is easy to cut and provide the product at any form.
- For high extinction ratio products, we suggest our polarizer filet (SPF) or the Glan Thompson prism (GTPC). Reference B099, B094
- We suggest to use our filter holder (FHS) for your polarizer.

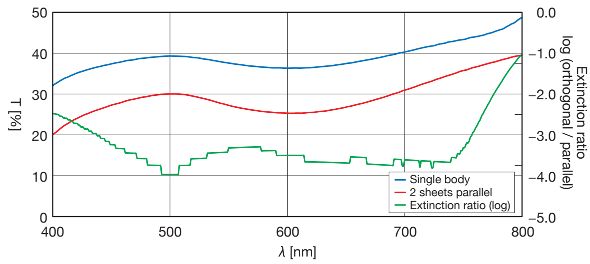
Attention

- The polarizer light axis direction is not indicated, please see our application note for find out the right direction. Reference B093
- Do not use this plastic filter for high power laser application; it may get burned.
- Do not use solvents other than alcohol to wipe the polarizer.
- Do not use paper to wipe the polarizer, you may scratch the surface and may not be efficient for your experiment due to scattering and diffraction problem. Please use polarizer filter (SPF) it you care about this problem. Reference B099
- The extinction ratio may be changed according to the wavelength.

400 – 700nm

Part Number	Diameter ϕD [mm]
USP-25.4C0.4-38	ϕ25.4
USP-30C0.4-38	ϕ30
USP-50C0.4-38	ϕ50

Typical Transmittance Data T: Transmission

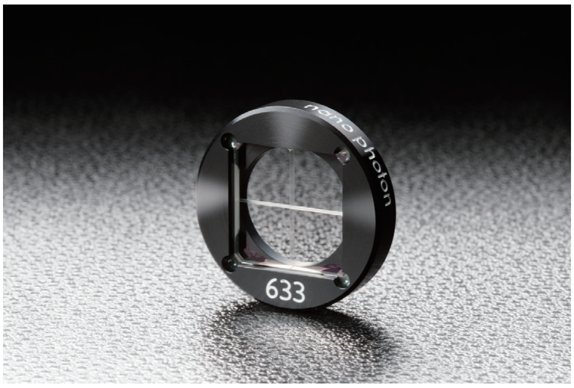


Compatible Optic Mounts

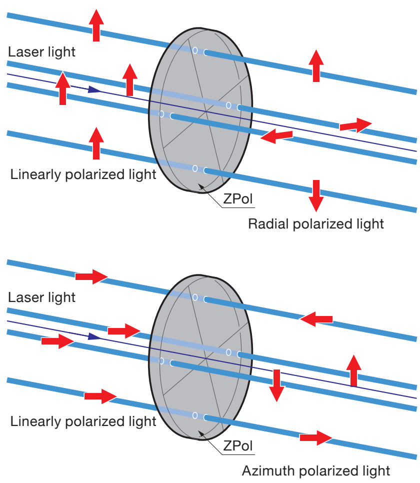
FHS-25 / FHS-50

Z-polarizer produces light polarization in the direction of its propagation.
It enables you to obtain 3D measurement of molecules and crystal.

- Useful for various application such as laser scanning microscopy, tip-enhanced near-field microscopy, Raman microscopy, laser trapping, and laser processing.
- Z-polarizer is comprised of four-segment waveplate. Since that the direction of the optical axis of each of the segmented waveplate is different, you can generate both radial polarization and azimuth polarization.
- In combination with condenser lens, Z-polarizer can produce a field of the light beam with a large electric field component in the z-direction (radial polarization). It can also produce a field of the light collecting with zero electric field component in the z-direction (azimuthal polarization).



Schematic



Specifications

Material	Synthetic fused silica, fused quartz or quartz (below 350nm)
Diameter	ϕ25mm
Clear aperture	ϕ10mm
Incident angle	0°
Selectable wavelength range	200 – 2000nm
Center wavelength tolerance	±4% from center wavelength
Retardation	±0.05λ at center wavelength
Axis orientation accuracy	±2°

Guide

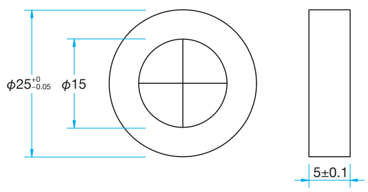
▶ If you need a mount to hold the Z-polarizer, please contact our International Sales Division.

Attention

▶ The condenser lens are not included for the Z-polarizer.

Outline Drawing

(in mm)



Schematic of Z-vector generation