EKSMA OPTICS

LASER OPTICAL COMPONENTS

- Optical Systems
- Opto-Mechanics
- Optical Components
- Nonlinear & Laser Crystals
- FemtoLine Optics & Crystals
- Nd:YAG LaserLine Optics & Crystals

Laser
Optical Components

2022

Rev. 20220510

EKSMA OPTICS

EKSMA Optics is a manufacturer of precision laser components, used in high power lasers, laser systems and various other photonic devices and optical instruments. Rooted in laser community and with more than 30 years of experience in lasers and photonic components EKSMA Optics is your partner for enabling photonics innovations, offering fast delivery components tailored to customer applications.

This optical components catalog contains products dedicated to lasers and laser systems manufacturers, integrators, innovators, and scientists. The standard catalog components are available for fast off-the-shelf delivery. We also develop and customize our optical components tailoring the parameters of the particular laser and its applications.

All components provided by EKSMA Optics are subject to performance and quality testing and certification in Quality Control laboratory. Through stringent inspection procedures, quality control assessments and commitment to new advanced technologies, we are continuously improving and delivering exceptional quality.

EKSMA Optics is an ISO 9001:2015 certified company.

Your Partner in Photonics Innovations!

2021

All production units and offices move to the own **new** 7000 square meters EKSMA Optics **building** in Vilnius.

2015

Establishment of a CNC-based facility for **spherical, aspherical** and **conical lens production**. Commenced production of **ultrafast** electro-optical **pulse picking systems**.

2014

Establishment of dielectric coatings facility based on **Ion Beam Sputtering technology**.

2010

Commenced production of **Pockels cells**.

2007

Investment into and expansion of flat **optics production** and **nonlinear crystals polishing** facilities.

2006

Establishment of EKSMA daughter company **"EKSMA Optics"** for optical and laser crystal components business activities.

1992

State-owned company privatization and **EKSMA UAB** joint-stock company **establishment**.

1987

First-time participation at Munich laser Fair. EKSMA shows high pulse energy **picosecond Nd:YAG laser**.

1983

Establishment of experimental optics and opto-mechanics company **EKSMA**, a spin-off from the Vilnius Physics Institute

Ordering Information

PRICES

Prices are indicated F.C.A. Vilnius, Lithuania and are exclusive of any taxes, duties or freight. Quantity as well as research application discounts are subject to quote. EKSMA Optics reserves the right to change prices without prior written notice.

PRODUCT DELIVERY TIME

Most of the standard products provided in catalogue are available for fast-off-the shelf delivery. Delivery time of the stock products can be estimated on the website. Estimated product delivery time is displayed on each product page. Search in our e-shop using product code.
If delivery term is indicated as "Request", please add the required items to the shopping cart and choose "Get Official Quotation". Our sales team will contact you soon and provide the estimated delivery time for the shopping cart.

SHIPPING

EKSMA Optics works with the biggest express freight carriers (UPS, DHL, FedEx). Other freight forwarders are available on request.
If not specified by customer, the default freight forwarder is DHL or UPS (depending on the country). Final shipping costs are subject to quote depending on individual order. EKSMA Optics reserves the right to change the prices without prior written notice depending on freight forwarder's pricing. Shipping charges are prepaid and added as a separate item to the invoice.

CERTIFICATE OF ORIGIN

All items shown in this catalogue are of Lithuanian Origin (EU). Certificate of Origin is available under request.

ORDERING

Purchase orders to EKSMA Optics can be placed using our e-shop, by e-mail or by fax. Customs paperwork and fees if any applied must be handled by customers.

COMPANY DETAILS

EKSMA Optics, UAB
Dvarcioniu St. 2B, LT-10233 Vilnius, Lithuania
VAT No.: LT100002802516
Tel: +370 5 272 99 00; Fax: +370 5 272 92 99
info@eksmaoptics.com; www. eksmaoptics.com

PAYMENT OPTIONS

Standard payment is by wire transfer. We also accept payments by major credit cards using PayPal or SEB Bank money transfer systems.

WIRE TRANSFER DETAILS

Account number (IBAN)	LT16 7044 0600 0577 4220
Bank name	AB SEB Bankas
Bank address	Gedimino Ave. 12, LT-01103 Vilnius, LITHUANIA
SWIFT Code	CBVILT2X
Beneficiary	EKSMA Optics UAB

Please note that customer's bank transfer fee associated with payment service should be paid by customer.

RETURN POLICY

30 days customer satisfaction warranty covers all standard products. Please contact EKSMA Optics if you are not satisfied with the product to arrange a refund. EKSMA Optics does not cover any costs associated with shipping.

WARRANTY

All products are guaranteed to be free from defects in material and workmanship for a period of 1 year after delivery. EKSMA Optics does not assume liability from installation, labour or consequential damages.

EKSMA OPTICS

Table of Contents

Optics

Crystals

Nd:YAG LaserLine Components

Femtoline Components

Optical Systems

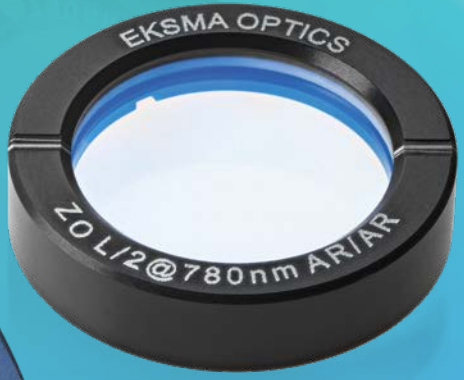
Opto-Mechanics

Appendixes

EKSMA OPTICS

Optical Components

Table of Contents



Coatings

For appropriate coating, please add the number of the chosen coating to the required optical component catalogue number.

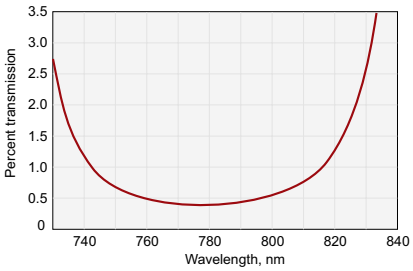
These multilayer coatings are stacks intended to achieve the highest possible reflectivity at specific laser line wavelengths at normal or 45 degrees incidence. Laser line high reflectivity coatings are intended for external beam manipulation applications where even slight losses may be intolerable.

HIGH REFLECTIVITY COATINGS

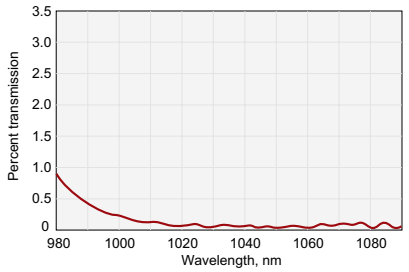
LASER LINE COATINGS

Wavelength, nm	AOI = 0°		AOI = 45°		Recommended substrate	Damage threshold, J/cm² in 10 ns
	Reflectivity, %	Coating number	Reflectivity, %	Coating number		
226	>99	1007-i0	>99	1007-i45	UV FS	1
248	>99	1009-i0	>99	1009-i45	UV FS	1.5
266	>99.5	1011-i0	>99	1011-i45	UV FS	1.5
308	>99.5	1013-i0	>99.2	1013-i45	UV FS	1.5
325	>99.5	1015-i0	>99.2	1015-i45	UV FS	1.5
337	>99.7	1017-i0	>99.5	1017-i45	UV FS	1.5
355	>99.7	1019-i0	>99.5	1019-i45	UV FS	1.5
400	>99.7	1021-i0	>99.5	1021-i45	UV FS	1.5
473	>99.7	1023-i0	>99.5	1023-i45	UV FS, BK7	1.5
488-515	>99.7	1024-i0	>99.5	1024-i45	UV FS, BK7	1.5
532	>99.7	1025-i0	>99.5	1025-i45	UV FS, BK7	5
589	>99.7	1027-i0	>99.5	1027-i45	UV FS, BK7	5
616	>99.7	1029-i0	>99.5	1029-i45	UV FS, BK7	5
633	>99.7	1030-i0	>99.5	1030-i45	UV FS, BK7	5
780	>99.7	1031-i0	>99.5	1031-i45	UV FS, BK7	5
800	>99.7	1032-i0	>99.5	1032-i45	UV FS, BK7	5
830	>99.7	1033-i0	>99.5	1033-i45	UV FS, BK7	5
852	>99.7	1034-i0	>99.5	1034-i45	UV FS, BK7	5
946	>99.7	1035-i0	>99.5	1035-i45	UV FS, BK7	5
1064	>99.7	1037-i0	>99.5	1037-i45	UV FS, BK7	5
1320	>99.7	1039-i0	>99.5	1039-i45	UV FS, BK7	1.5
1550	>99.7	1045-i0	>99.5	1045-i45	UV FS, BK7	1.5
2000	>99	1047-i0	>99	1047-i45	UV FS, Sapphire	1.5
2100	>99	1049-i0	>99	1049-i45	UV FS, Sapphire	1.5

Contact us for other wavelengths and AOI's values.



1031. HR>99.5% @ 780 nm, AOI = 45°.

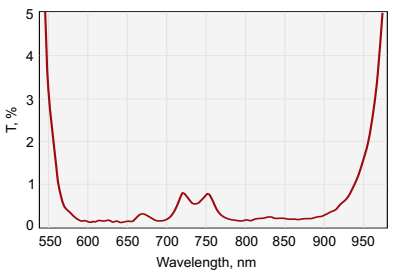


1037. HR>99.8% @ 1064 nm, AOI = 0°.

BROADBAND COATINGS

Wavelength, nm	AOI = 0°		AOI = 45°		Recommended substrate	Damage threshold, J/cm² in 10 ns
	Reflectivity, %	Coating number	Reflectivity, %	Coating number		
220-250	>99	1106-i0	>99	1106-i45	UV FS	1
260-340	>99	1110-i0	>99	1110-i45	UV FS	1
350-450	>99	1114-i0	>99	1114-i45	UV FS	1
420-680	>99	1116-i0	>99	1116-i45	UV FS, BK7	1
600-900	>99	1130-i0	>99	1130-i45	UV FS, BK7	1
720-880	>99	1132-i0	>99	1132-i45	UV FS, BK7	1
760-840	>99	1133-i0	>99	1133-i45	UV FS, BK7	1
900-1100	>99	1142-i0	>99	1142-i45	UV FS, BK7	1.5
1100-1400	>99	1144-i0	>99	1144-i45	UV FS, BK7	1.5

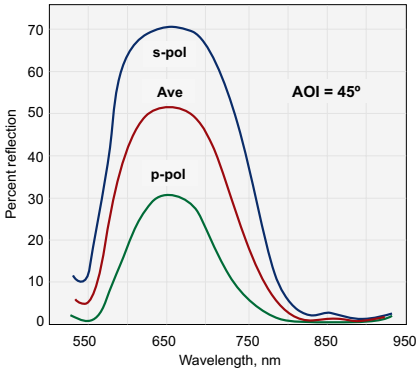
Contact us for other wavelengths and AOI's values.



1130. HR>99% @ 600–900nm, AOI= 0°.

PARTIAL REFLECTING COATINGS

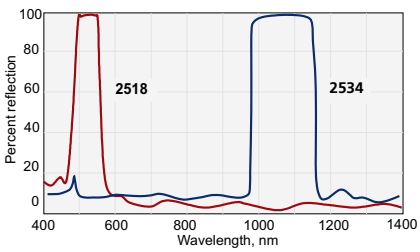
Partial reflecting coatings are durable multilayer dielectric coatings intended for efficient beam splitting as well as for output coupling in laser cavities. They are used in high power laser applications. Please refer to the Substrates for Laser Mirrors or Windows section for substrates for these coatings.



Wavelength, nm	Reflectivity, %	Coating number		Recommended substrate	Damage threshold, J/cm² in 10 ns
		AOI = 0°	AOI = 45°		
248	25±3	2012-i0	2012-i45	UV FS	1
	50±3	2015-i0	2015-i45		
	75±3	2017-i0	2017-i45		
266	25±3	2022-i0	2022-i45	UV FS	1
	50±3	2025-i0	2025-i45		
	75±3	2027-i0	2027-i45		
308	25±3	2032-i0	2032-i45	UV FS	1
	50±3	2035-i0	2035-i45		
	75±3	2037-i0	2037-i45		
355	25±3	2042-i0	2042-i45	UV FS	2
	50±3	2045-i0	2045-i45		
	75±3	2047-i0	2047-i45		
400	25±3	2052-i0	2052-i45	UV FS	3
	50±3	2055-i0	2055-i45		
	75±3	2057-i0	2057-i45		
532	25±3	2062-i0	2062-i45	UV FS, BK7	3
	50±3	2065-i0	2065-i45		
	75±3	2067-i0	2067-i45		
633	25±3	2069-i0	2069-i45	UV FS, BK7	1.5
	50±3	2070-i0	2070-i45		
	75±3	2071-i0	2071-i45		
800	25±3	2072-i0	2072-i45	UV FS, BK7	3
	50±3	2075-i0	2075-i45		
	75±3	2077-i0	2077-i45		
852	25±3	2079-i0	2079-i45	UV FS, BK7	1
	50±3	2080-i0	2080-i45		
	75±3	2081-i0	2081-i45		
1064	25±3	2082-i0	2082-i45	UV FS, BK7	3
	50±3	2085-i0	2085-i45		
	75±3	2087-i0	2087-i45		
1550	25±3	2089-i0	2089-i45	UV FS, BK7	2
	50±3	2090-i0	2090-i45		
	75±3	2091-i0	2091-i45		

Contact us for other wavelengths and AOI's values.

LASER HARMONIC SEPARATORS



These harmonic separators comprise a dichroic reflector coating and should be applied on the front surface of high precision windows. They are used to separate the various harmonic components of frequency doubled laser systems by selective spectral reflection and transmission. In all cases one wavelength is selected out by reflection and the other wavelengths are transmitted.

Wavelength, nm	AOI = 0°			AOI = 45°			Recommended substrate	Damage threshold, J/cm² in 10 ns
	R, %	T, %	Coating number	R, %	T, %	Coating number		
355 / 532+1064	>99.0	>93	2510-i0	>99.0	>90	2510-i45	UV FS	1
380-420 / 720-820	>99.0	>90	2514-i0	>99.0	>90	2514-i45	UV FS, BK7	1
532 / 1064	>99.5	>95	2518-i0	>99.5	>95	2518-i45	UV FS, BK7	1
600 / 1200	>99.5	>95	2522-i0	>99.5	>95	2522-i45	UV FS, BK7	2
800 / 400	>99.5	>90	2526-i0	>99.5	>90	2526-i45	UV FS, BK7	2
1064 / 400-700	>99.5	>85	2530-i0	>99.5	>80	2530-i45	UV FS, BK7	2
1064 / 532	>99.5	>93	2534-i0	>99.5	>90	2534-i45	UV FS, BK7	2

Contact us for other wavelengths and AOI's values.

ANTI-REFLECTION COATINGS

These multilayer anti-reflection coatings are designed for reducing the reflectivity of a component to near-zero for one very specific wavelength. Therefore, valuable laser energy is efficiently transferred through complex optical systems rather than being lost to glare and scatter. Our AR coatings are intended for use at normal incidence, and when used in this way will achieve maximum efficiency transmission.

LASER LINE ANTI-REFLECTION COATINGS

Standard Laser Line Anti-Reflection Coatings

Wavelength, nm	Reflection per surface (AOI=0°)	Laser Damage Threshold *, J/cm²	Coating suffix		
266	R<0.4%	2	AR266		
333 – 353	R<0.5%	3	AR343		
355	R<0.25%	4	AR355		
380 – 420	R<0.5%	3	AR400		
500 – 530	R<0.3%	5	AR515		
532	R<0.2%	5	AR532		
760 – 840	R<0.4%	8	AR800		
1000 – 1060	R<0.3%	10	AR1030		
1064	R<0.2%	20	AR1064		

* Measured at design wavelength, 10 ns, 50 Hz.

IBS Laser Line Anti-Reflection Coatings

Wavelength, nm	Reflection per surface (AOI=0°)	Laser Damage Threshold *, J/cm²	Coating suffix		
266	R<0.3%	3.5	AR266HT		
333 – 353	R<0.2%	4	AR343HT		
355	R<0.2%	4	AR355HT		
380 – 420	R<0.2%	4	AR400HT		
500 – 530	R<0.1%	7	AR515HT		
532	R<0.1%	7	AR532HT		
760 – 840	R<0.1%	10	AR800HT		
1000 – 1060	R<0.1%	15	AR1030HT		
1064	R<0.1%	15	AR1064HT		
1530 – 1570	R<0.1%	10	AR1550HT		
1530 – 1570	R<0.01%	10			

Other laser line coatings are available for the wavelength range from 193 nm to 12 µm.

DUAL BAND ANTI-REFLECTION COATINGS

Standard Dual Band Anti-Reflection Coatings

Wavelength, nm	Reflection per surface (AOI=0°)	Laser Damage Threshold *, J/cm²	Coating suffix		
343 + 515	R<0.5%	2	ARD515		
355 + 532	R<0.5%	2	ARD532		
515 + 1030	R<0.5%	4	ARD1030		
532 + 1064	R<0.5%	4	ARD1064		

IBS Dual Band Anti-Reflection Coatings

Wavelength, nm	Reflection per surface (AOI=0°)	Laser Damage Threshold *, J/cm²	Coating suffix		
400 + 800	R<0.2%	4	ARD800HT		
515 + 1030	R<0.1%	10	ARD1030HT		
532 + 1064	R<0.1%	10	ARD1064HT		

* Measured at design wavelength, 10 ns, 50 Hz.

Other dual band coatings are available in the wavelength range from 193 nm to 12 µm.

BROADBAND ANTI-REFLECTION COATINGS

Standard Broadband Anti-Reflection Coatings

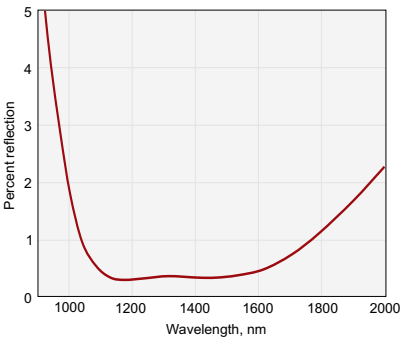
Wavelength, nm	Reflection per surface (AOI=0°)	Laser Damage Threshold *, J/cm²	Coating suffix		
210 – 400	R<2%	1	ARB300		
400 – 700	R<0.9%	2	ARB550		
350 – 900	R<1.5%	2	ARB625		
650 – 1100	R<0.7%	3	ARB825		
700 – 900	R<0.5%	3	ARB800		
1050 – 1700	R<0.7%	2	ARB1375		

IBS Broadband Anti-Reflection Coatings

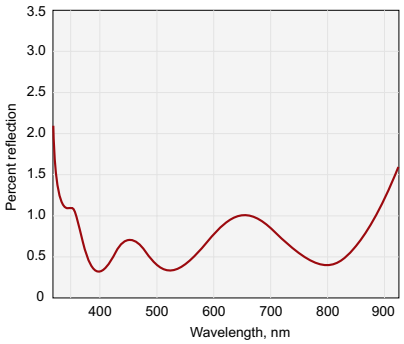
Wavelength, nm	Reflection per surface (AOI=0°)	Laser Damage Threshold *, J/cm²	Coating suffix		
700 – 900	R<0.1%	5	ARB800HT		
900 – 1100	R<0.1%	5	ARB1000HT		

* Measured at design wavelength, 10 ns, 50 Hz.

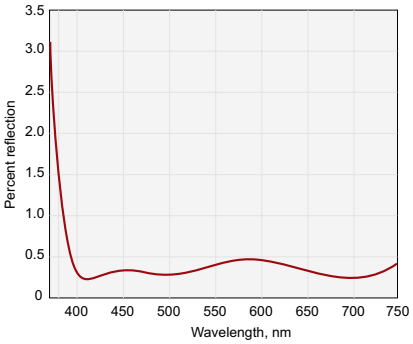
Other broadband coatings are available for the wavelength range from 193 nm to 12 µm.



ARB1375. R<0.7% @ 1050–1700 nm, AOI=0°.



ARB625. R<1.5% @ 350–900 nm, AOI = 0°.

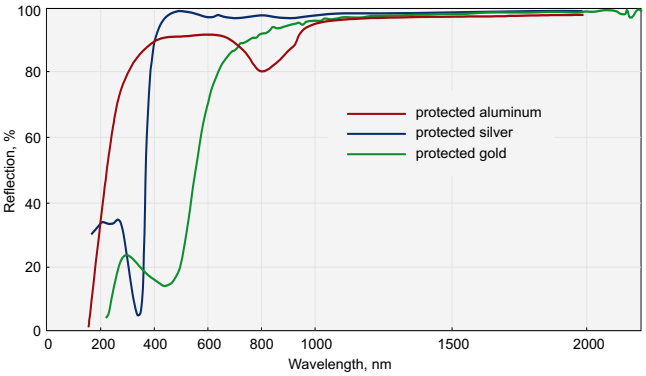


ARB550. R<0.9% @ 400–700 nm, AOI = 0°.

METALLIC COATINGS

Protected metallic coatings provide a moderate level of reflection over a very broad spectral range and are widely used as mirrors. These coatings are protected by a thin layer of dielectric material in order to make them durable. Enhanced metallic coatings provide greater reflection across the operating bandwidth. These coatings are enhanced by adding a multilayer dielectric stack.

Metal coatings modify the state of polarization of an incident beam of light and are therefore inappropriate for most polarization sensitive applications.



Features

- Protected gold
- Protected aluminium
- Protected silver
- Enhanced aluminium

Wavelength, nm	Average reflection, %	Type	Laser Induced Damage Threshold at 1064 nm, 50 Hz, 11 nsec, J/cm²	Coating number		
250–350	>88	UV enhanced aluminium	0.25	**0005**		
450–650	>91	VIS enhanced aluminium	0.25	**0010**		
300–IR	>86	Protected aluminium	0.25	**0015**		
400–IR	>96	Protected silver	1.8	**0025**		
900–IR	>98	Protected gold	1.0	**0030**		

Please contact us for other wavelengths and AOI's.

Windows & Filters

CURVED WINDOWS

Features

- Made from BK7 glass or UV grade fused silica
- Polished to high surface quality
- Standard substrates are available with a variety of radii of concave curvature

We offer two substrate materials spanning a range of thermal expansion coefficients. For applications in which thermal shock is absent and thermal stability is not critical, BK7 glass is a suitable and inexpensive material. For applications requiring high thermal stability or involving severe thermal shock, UV grade fused silica is a good choice.

Specifications

Material	BK7, UV FS
S1/S2 Surface Quality	20 – 10 scratch & dig (MIL-PRF-13830B)
S1/S2 Surface Flatness	λ/10 @ 633 nm
Curved Surface Radius Tolerance	±1%
Diameter Tolerance	+0.00 / -0.12 mm
Thickness Tolerance	±0.2 mm

PLANO-CONCAVE WINDOWS

Presented substrates are ***uncoated***.
For appropriate coating, please refer to the ***Coatings section***.

Diameter D, mm	Edge thickness ET, mm	ROC, mm	BK7 Catalogue number		UV FS Catalogue number	
12.7	3.0	-25	010-0101E		010-1101E	
12.7	3.0	-50	010-0103E		010-1103E	
12.7	3.0	-75	010-0104E		010-1104E	
12.7	3.0	-100	010-0105E		010-1105E	
12.7	3.0	-150	010-0107E		010-1107E	
12.7	3.0	-200	010-0108E		010-1108E	
12.7	3.0	-250	010-0110E		010-1110E	
12.7	3.0	-300	010-0111E		010-1111E	
12.7	3.0	-400	010-0109E		010-1109E	
12.7	3.0	-500	010-0115E		010-1115E	
12.7	3.0	-1000	010-0120E		010-1120E	
12.7	3.0	-1500	010-0123E		010-1123E	
12.7	3.0	-2000	010-0125E		010-1125E	
12.7	3.0	-3000	010-0130E		010-1130E	
12.7	3.0	-4000	010-0140E		010-1140E	
12.7	3.0	-5000	010-0150E		010-1150E	

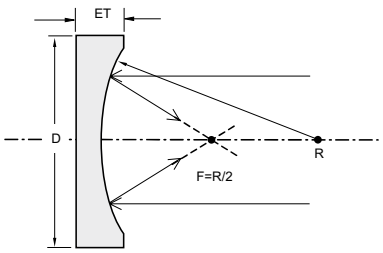
Diameter D, mm	Edge thickness ET, mm	ROC, mm	BK7 Catalogue number		UV FS Catalogue number	
12.7	6.0	-25	010-0101T6		010-1101T6	
12.7	6.0	-50	010-0103T6		010-1103T6	
12.7	6.0	-75	010-0104T6		010-1104T6	
12.7	6.0	-100	010-0105T6		010-1105T6	
12.7	6.0	-150	010-0107T6		010-1107T6	
12.7	6.0	-200	010-0108T6		010-1108T6	
12.7	6.0	-250	010-0110T6		010-1110T6	
12.7	6.0	-300	010-0111T6		010-1111T6	
12.7	6.0	-400	010-0109T6		010-1109T6	
12.7	6.0	-500	010-0115T6		010-1115T6	
12.7	6.0	-1000	010-0120T6		010-1120T6	
12.7	6.0	-1500	010-0123T6		010-1123T6	
12.7	6.0	-2000	010-0125T6		010-1125T6	
12.7	6.0	-3000	010-0130T6		010-1130T6	
12.7	6.0	-4000	010-0140T6		010-1140T6	
12.7	6.0	-5000	010-0150T6		010-1150T6	

Diameter D, mm	Edge thickness ET, mm	ROC, mm	BK7	UV FS
			Catalogue number	Catalogue number
25.4	6.0	-50	010-0201E	010-1201E
25.4	6.0	-75	010-0207E	010-1207E
25.4	6.0	-100	010-0202E	010-1202E
25.4	6.0	-125	010-0208E	010-1208E
25.4	6.0	-150	010-0203E	010-1203E
25.4	6.0	-200	010-0204E	010-1204E
25.4	6.0	-250	010-0205E	010-1205E
25.4	6.0	-300	010-0206E	010-1206E
25.4	6.0	-350	010-0211E	010-1211E
25.4	6.0	-400	010-0209E	010-1209E
25.4	6.0	-500	010-0210E	010-1210E
25.4	6.0	-600	010-0212E	010-1212E
25.4	6.0	-700	010-0214E	010-1214E
25.4	6.0	-750	010-0215E	010-1215E
25.4	6.0	-800	010-0216E	010-1216E
25.4	6.0	-900	010-0217E	010-1217E
25.4	6.0	-1000	010-0220E	010-1220E
25.4	6.0	-1500	010-0222E	010-1222E
25.4	6.0	-2000	010-0225E	010-1225E
25.4	6.0	-2500	010-0226E	010-1226E
25.4	6.0	-3000	010-0227E	010-1227E
25.4	6.0	-4000	010-0229E	010-1229E
25.4	6.0	-5000	010-0230E	010-1230E
25.4	6.0	-6000	010-0235E	010-1235E
25.4	6.0	-8000	010-0240E	010-1240E
25.4	6.0	-10000	010-0250E	010-1250E

Diameter D, mm	Edge thickness ET, mm	ROC, mm	BK7	UV FS
			Catalogue number	Catalogue number
50.8	10.0	-100	010-0501E	010-1501E
50.8	10.0	-150	010-0508E	010-1508E
50.8	10.0	-200	010-0502E	010-1502E
50.8	10.0	-250	010-0503E	010-1503E
50.8	10.0	-300	010-0506E	010-1506E
50.8	10.0	-400	010-0504E	010-1504E
50.8	10.0	-500	010-0505E	010-1505E
50.8	10.0	-600	010-0507E	010-1507E
50.8	10.0	-750	010-0510E	010-1510E
50.8	10.0	-800	010-0511E	010-1511E
50.8	10.0	-1000	010-0515E	010-1515E
50.8	10.0	-1500	010-0518E	010-1518E
50.8	10.0	-2000	010-0520E	010-1520E
50.8	10.0	-2500	010-0521E	010-1521E
50.8	10.0	-3000	010-0522E	010-1522E
50.8	10.0	-4000	010-0524E	010-1524E
50.8	10.0	-5000	010-0525E	010-1525E
50.8	10.0	-6000	010-0530E	010-1530E
50.8	10.0	-8000	010-0540E	010-1540E
50.8	10.0	-10000	010-0550E	010-1550E

Diameter D, mm	Edge thickness ET, mm	ROC, mm	BK7	UV FS
			Catalogue number	Catalogue number
76.2	12.7	-200	010-0705E	010-1705E
76.2	12.7	-300	010-0708E	010-1708E
76.2	12.7	-400	010-0710E	010-1710E
76.2	12.7	-500	010-0712E	010-1712E
76.2	12.7	-600	010-0714E	010-1714E
76.2	12.7	-800	010-0720E	010-1720E
76.2	12.7	-1000	010-0725E	010-1725E
76.2	12.7	-1500	010-0730E	010-1730E
76.2	12.7	-2000	010-0735E	010-1735E
76.2	12.7	-3000	010-0745E	010-1745E

Diameter D, mm	Edge thickness ET, mm	ROC, mm	BK7	UV FS
			Catalogue number	Catalogue number
101.6	15.0	-300	010-0808E	010-1808E
101.6	15.0	-400	010-0810E	010-1810E
101.6	15.0	-500	010-0812E	010-1812E
101.6	15.0	-600	010-0814E	010-1814E
101.6	15.0	-800	010-0820E	010-1820E
101.6	15.0	-1000	010-0825E	010-1825E
101.6	15.0	-1500	010-0830E	010-1830E
101.6	15.0	-2000	010-0835E	010-1835E
101.6	15.0	-3000	010-0845E	010-1845E



Housing accessories

Kinematic Mirror Mount 840-0020

Find more at EksmaOptics.com

PLANO-CONVEX WINDOWS

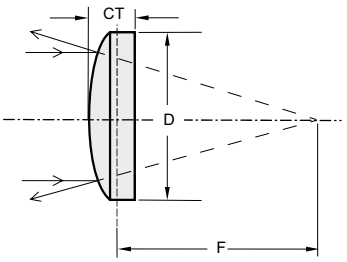
Presented substrates are ***uncoated***.
For appropriate coating, please refer to the ***Coatings Section***.

We provide a wide selection of shapes and sizes, with plano, spherical or cylindrical surfaces.

Diameter D, mm	Center thickness CT, mm	ROC, mm	BK7		UV FS	
			Catalogue number		Catalogue number	
12.7	6.0	+50	011-0103E		011-1103E	
12.7	6.0	+100	011-0105E		011-1105E	
12.7	6.0	+150	011-0107E		011-1107E	
12.7	6.0	+200	011-0108E		011-1108E	
12.7	6.0	+300	011-0111E		011-1111E	
12.7	6.0	+400	011-0113E		011-1113E	
12.7	6.0	+500	011-0115E		011-1115E	

Diameter D, mm	Center thickness CT, mm	ROC, mm	BK7		UV FS	
			Catalogue number		Catalogue number	
50.8	10.0	+100	011-0502E		011-1502E	
50.8	10.0	+150	011-0503E		011-1503E	
50.8	10.0	+200	011-0504E		011-1504E	
50.8	10.0	+300	011-0505E		011-1505E	
50.8	10.0	+400	011-0506E		011-1506E	
50.8	10.0	+500	011-0509E		011-1509E	
50.8	10.0	+600	011-0510E		011-1510E	
50.8	10.0	+800	011-0512E		011-1512E	
50.8	10.0	+1000	011-0515E		011-1515E	
50.8	10.0	+1500	011-0518E		011-1518E	
50.8	10.0	+2000	011-0520E		011-1520E	
50.8	10.0	+3000	011-0522E		011-1522E	
50.8	10.0	+4000	011-0525E		011-1525E	

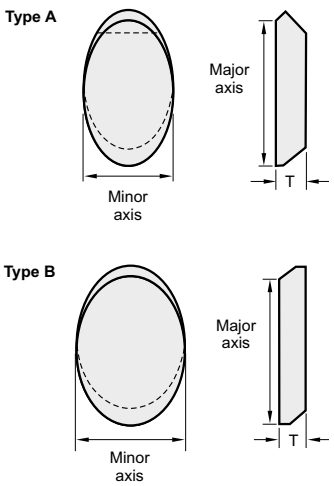
Diameter D, mm	Center thickness CT, mm	ROC, mm	BK7		UV FS	
			Catalogue number		Catalogue number	
25.4	6.0	+50	011-0201E		011-1201E	
25.4	6.0	+75	011-0207E		011-1207E	
25.4	6.0	+100	011-0202E		011-1202E	
25.4	6.0	+150	011-0203E		011-1203E	
25.4	6.0	+200	011-0204E		011-1204E	
25.4	6.0	+300	011-0205E		011-1205E	
25.4	6.0	+400	011-0206E		011-1206E	
25.4	6.0	+500	011-0209E		011-1209E	
25.4	6.0	+600	011-0210E		011-1210E	
25.4	6.0	+800	011-0212E		011-1212E	
25.4	6.0	+1000	011-0215E		011-1215E	
25.4	6.0	+1500	011-0216E		011-1216E	
25.4	6.0	+2000	011-0220E		011-1220E	
25.4	6.0	+3000	011-0222E		011-1222E	
25.4	6.0	+4000	011-0225E		011-1225E	
25.4	6.0	+5000	011-0227E		011-1227E	



ELLIPTICAL WINDOWS

Features

- Bend light at precise angles with minimum wave distortion



Elliptical windows bend light at precise angles with minimum wave distortion due to elongated major axis. Precision 45 degree elliptical flat mirrors are ideal for technical and astronomical applications.

Specifications

Material	BK7, UV FS
Surface Quality S1, S2	20 – 10 scratch & dig (MIL-PRF-13830B)
Surface Flatness S1, S2	λ/4 @ 633 nm
Axis Tolerance	+0.00 / -0.12 mm
Thickness Tolerance	±0.25 mm
Parallelism	<3 min

Presented substrates are ***uncoated***. For appropriate coating, please refer to the ***Coatings Section***.

Material	Minor axis, mm	Major axis, mm	Thickness T, mm	Catalogue number	
BK7	18.0	25.0	3.0	020-0183	
	25.0	35.0	4.0	020-0254	
	30.0	42.5	4.0	020-0304	
UV FS	18.0	25.0	3.0	020-1183	
	25.0	35.0	4.0	020-1254	
	30.0	42.5	4.0	020-1304	

Please add letter A to the catalogue number for type A and letter B for type B.
Contact us for other size or precision requirements.

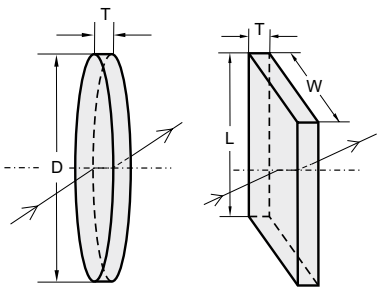
FLAT WINDOWS

Features

- Have high transmittance, low wavefront distortion and low scatter
- Are durable and strong
- BK7 glass is an economical and ideal choice for high-quality visible applications
- UV FS has the deepest UV range and the highest transmittance

Windows are used to allow optical radiation to pass from one environment to another without allowing other components of these environments to mix. Considerations in selecting windows may include transmission, scattering, wavefront distortion and resistance to certain environments. An ideal window allows an optical beam to pass from one medium to the next without changing the wavelength distribution of the beam, the transmitted wavefront or scatter any of the light out of the beam. We offer windows made from three different materials, from which you may choose in view of the properties you need: BK7 or UV grade fused silica.

Windows can be anti-reflection coated. For a required coating, please refer to the ***Coatings Section****. Diameters of up to 250 mm are available on request.*



Specifications

Material	BK7, UV FS
Surface quality	60 – 40 scratch & dig (MIL-PRF-13830B)
Clear aperture	>80% of the diameter
Diameter tolerance	+0.00 / -0.5 mm
Thickness tolerance	±0.2 mm
Surface flatness	1 λ per inch @ 633 nm
Parallelism	2 arcmin

ROUND WINDOWS

Housing accessories

Kinematic Mirror Mount 840-0020

Find more at EksmaOptics.com

Diameter D, mm		Thickness T, mm	BK7		UV FS	
Metric	English		Catalogue number		Catalogue number	
12.5	12.7	2.0	210-0102		210-1102	
12.5	12.7	3.0	210-0103		210-1103	
25.0	25.4	2.0	210-0202		210-1202	
25.0	25.4	3.0	210-0203		210-1203	
40.0	38.1	2.0	210-0402		210-1402	
40.0	38.1	3.0	210-0403		210-1403	
50.0	50.8	2.0	210-0502		210-1502	
50.0	50.8	3.0	210-0503		210-1503	
75.0	76.2	6.3	210-0703		210-1703	

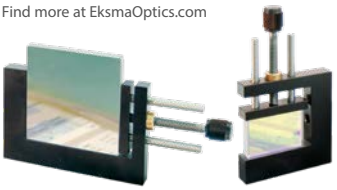
Please add letter M to the catalogue number for metric dimensions and letter E for English.

RECTANGULAR WINDOWS

Housing accessories

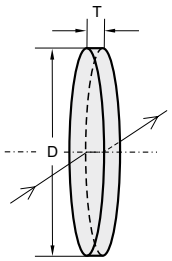
Rectangular Optics Holders
830-0100, 830-0110

Find more at EksmaOptics.com



Rectangular dimensions		Thickness T, mm	BK7		UV FS	
Width W, mm	Length L, mm		Catalogue nr.		Catalogue nr.	
15.0	20.0	2.0	215-0122		215-1122	
25.4	25.4	2.0	215-0222		215-1222	
20.0	30.0	2.0	215-0232		215-1232	
25.4	50.8	2.0	215-0252		215-1252	
50.8	50.8	2.0	215-0552		215-1552	
50.8	50.8	6.3	215-0556		215-1556	

PRECISION THIN ROUND WINDOWS



Specifications

Material	UV FS
Surface quality	20 – 10 scratch & dig (MIL-PRF-13830B)
Clear aperture	>90% of the diameter
Diameter tolerance	+0.00 / -0.12 mm
Thickness tolerance	±0.2 mm
Surface flatness	λ/4 or λ/10 @ 633 nm
Parallelism	<1 arcmin or <30 arcsec

Housing accessories

Optical Component Mount 830-0037

Find more at EksmaOptics.com

Plate Clamp 830-0055

Find more at EksmaOptics.com

Universal Plate Holder 830-0075

Find more at EksmaOptics.com

Diameter D, mm		Thickness T, mm	Flatness	Parallelism	Catalogue number	
Metric	English					
12.5	12.7	1.0	λ/10	30 arcsec	226-1111	
12.5	12.7	2.0	λ/10	30 arcsec	226-1121	
20.0	20.0	1.0	λ/10	30 arcsec	226-1191	
20.0	20.0	2.0	λ/10	30 arcsec	226-1201	
25.0	25.4	1.0	λ/10	30 arcsec	226-1211	
25.0	25.4	2.0	λ/10	30 arcsec	226-1221	
50.0	50.8	3.0	λ/10	30 arcsec	226-1531	
12.5	12.7	1.0	λ/4	1 arcmin	226-1116	
12.5	12.7	2.0	λ/4	1 arcmin	226-1126	
25.0	25.4	1.0	λ/4	1 arcmin	226-1216	
25.0	25.4	2.0	λ/4	1 arcmin	226-1226	
50.0	50.8	1.0	λ/4	1 arcmin	226-1516	
50.0	50.8	2.0	λ/4	1 arcmin	226-1526	
50.0	50.8	3.0	λ/4	1 arcmin	226-1536	

Please add letter M to the catalogue number for metric dimensions and letter E for English.

PRECISION WINDOWS

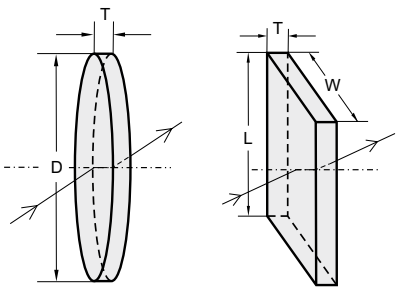
Features

- Manufactured from the high quality UV FS and BK7
- Precision polished on both surfaces and held parallel up to 3 arcsec

These windows are designed to be used in precision optical systems. The optical transmission is high with little distortion of the transmitted signal. λ/10 transmitted wavefront distortion is usually preferred but λ/4 is offered as an option when this is not an issue.

*Windows can be anti-reflection coated. For required coating, please refer to the **Coatings Section**. Diameters of up to 250 mm are available on request.*

Please refer to the UV and IR Optics section for windows made from other materials: LiF, ZnSe, Ge, Sapphire, etc.



Specifications

Material	BK7, UV FS
Surface quality	20 – 10 scratch & dig (MIL-PRF-13830B)
Clear aperture	>90% of the diameter
Diameter tolerance	+0.00 / -0.12 mm
Thickness tolerance	±0.2 mm
Surface flatness	λ/4 or λ/10 @ 633 nm
Parallelism	<1 arcmin, <30 arcsec or <3 arcsec

ROUND WINDOWS

Diameter D, mm		Thickness T, mm	Flatness	Parallelism	BK7		UV FS	
Metric	English				Catalogue nr.		Catalogue nr.	
12.5	12.7	3.0	λ/10	30 arcsec	220-0101		220-1101	
12.5	12.7	6.0	λ/10	30 arcsec	220-0161		220-1161	
20.0	20.0	3.0	λ/10	30 arcsec	220-0191		220-1191	
20.0	20.0	5.0	λ/10	30 arcsec	220-0211		220-1211	
25.0	25.4	3.0	λ/10	30 arcsec	220-0231		220-1231	
25.0	25.4	6.0	λ/10	30 arcsec	220-0201		220-1201	
40.0	38.1	6.0	λ/10	30 arcsec	220-0462		220-1462	
40.0	38.1	8.0	λ/10	30 arcsec	220-0402		220-1402	
50.0	50.8	6.0	λ/10	30 arcsec	220-0562		220-1562	
50.0	50.8	8.0	λ/10	30 arcsec	220-0582		220-1582	
50.0	50.8	10.0	λ/10	30 arcsec	220-0502		220-1502	
75.0	76.2	12.7	λ/10	30 arcsec	220-0722		220-1722	
75.0	76.2	15.0	λ/10	30 arcsec	220-0752		220-1752	
100.0	101.6	15.0	λ/10	30 arcsec	220-0852		220-1852	
12.5	12.7	3.0	λ/10	3 arcsec	220-0103		220-1103	
12.5	12.7	6.0	λ/10	3 arcsec	220-0163		220-1163	
12.5	12.7	10.0	λ/10	3 arcsec	220-0193		220-1193	
25.0	25.4	6.0	λ/10	3 arcsec	220-0203		220-1203	
25.0	25.4	10.0	λ/10	3 arcsec	220-0293		220-1293	
40.0	38.1	10.0	λ/10	3 arcsec	220-0403		220-1403	
50.0	50.8	12.0	λ/10	3 arcsec	220-0503		220-1503	
12.5	12.7	3.0	λ/4	1 arcmin	220-0106		220-1106	
12.5	12.7	6.0	λ/4	1 arcmin	220-0166		220-1166	
25.0	25.4	3.0	λ/4	1 arcmin	220-0236		220-1236	
25.0	25.4	6.0	λ/4	1 arcmin	220-0206		220-1206	
40.0	38.1	6.0	λ/4	1 arcmin	220-0466		220-1466	
40.0	38.1	8.0	λ/4	1 arcmin	220-0406		220-1406	
50.0	50.8	6.0	λ/4	1 arcmin	220-0566		220-1566	
50.0	50.8	8.0	λ/4	1 arcmin	220-0586		220-1586	
75.0	76.2	8.0	λ/4	1 arcmin	220-0786		220-1786	
75.0	76.2	12.7	λ/4	1 arcmin	220-0726		220-1726	

Please add letter M to the catalogue number for metric dimensions and letter E for English.

Housing accessories

Kinematic Mirror and Beamsplitter Mount 840-0030-02

Find more at EksmaOptics.com

RECTANGULAR WINDOWS

Surface flatness: λ/10 @633nm. Parallelism: <30 arcsec

Rectangular dimensions		Thickness T, mm	BK7		UV FS	
Width W, mm	Length L, mm		Catalogue nr.		Catalogue nr.	
15.0	20.0	3.0	225-0123		225-1123	
15.0	20.0	6.0	225-0126		225-1126	
25.4	25.4	6.0	225-0226		225-1226	
20.0	30.0	6.0	225-0236		225-1236	
25.4	50.8	10.0	225-0250		225-1250	
50.8	50.8	10.0	225-0550		225-1550	

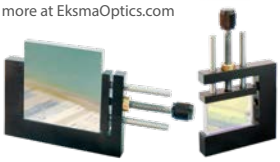
Related products

We offer AR Coated Precision Windows for Nd:YAG laser applications

See page 3.12

Rectangular Optics Holders 830-0100, 830-0110

Find more at EksmaOptics.com



For applications where fine adjusment is required, use Prism Holders 840-0160, 840-0170

Find more at EksmaOptics.com

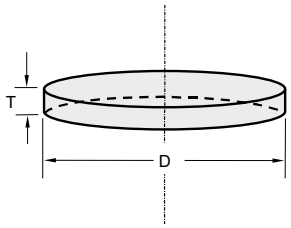
OPTICAL FLATS

Features

- Flatness of reference surface λ/20

Optical flats are used for testing and evaluating other optical elements. An interference pattern is formed in the air between the flat and object being evaluated, and this pattern is usually more easily seen through the flat than through the object. The pattern consists of alternating bright and dark bands or fringes which are a contour map of the thickness of the air film. If the surface of the optic is significantly flatter than the surface being evaluated, it is correct to interpret the interference pattern directly as a contour map of the surface being evaluated. If the flat is used on the top of the object, and the interference pattern viewed through the flat, it is advantageous to have an anti-reflection coating on the top surface of the flat (the surface which does not touch the object being evaluated).

*For an appropriate AR coating, please refer to the **Coatings Section** (see pages 1.5-1.6).*



Specifications

Material	UV FS
Diameter tolerance	+0.00 / -0.12 mm
Thickness tolerance	±0.2 mm
Surface flatness: 1st surface	λ/20 @ 633 nm
2nd surface	2 λ @ 633 nm

Diameter D, mm		Thickness T, mm	Catalogue number	
Metric	English			
25.0	25.4	8.0	230-1208	
40.0	38.1	10.0	230-1410	

For metric dimensions please add to catalogue number letter M, for English – letter E.

CRYSTALLINE MATERIALS FOR OPTICAL UV BAND PASS FILTERS

Almost all UV radiation (especially 240–280 nm) is absorbed by the Earth's ozone layer, and UV radiation that is created by some objects near the Earth surface can be detected only using special ozone filters.

Crystalline materials are robust substrates from which optical filters of high purity and optical homogeneity can be fabricated.

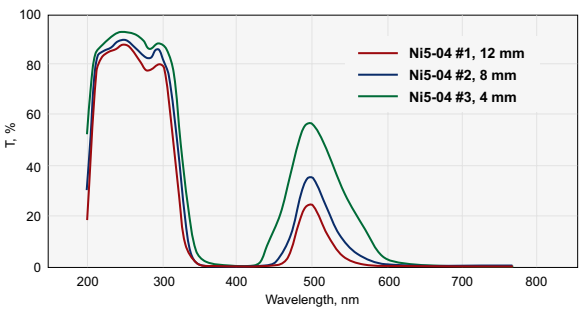
Available crystalline materials: $NiSO_4*6H_2O$ (NSH) and $K_2Ni(SO_4)^2*6H_2O$ (KNSH).

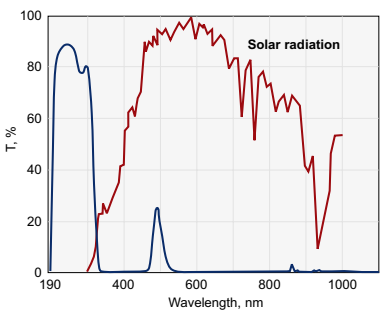
Specifications

Surface quality	60 – 40 scratch & dig (MIL-PRF-13830B)
Surface flatness	λ – λ/2 @ 633 nm
Parallelism	1 arcmin
Side surfaces	fine grinding
Coating	uncoated

Polished cylinders of $NiSO_4*6H_2O$ measuring up to Ø60x40 mm are available.

Polished cylinders of $K_2Ni(SO_4)^2*6H_2O$ measuring up to Ø60x40 mm are available.





Typical spectral transmittance curves of different thickness $NiSO_4*6H_2O$ elements

NOTCH FILTERS

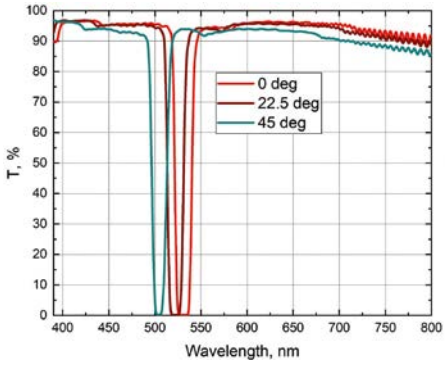
Notch filters are designed to block a specific narrow wavelength range (stop band) and to transmit broad wavelength ranges outside of this band (pass bands). These optical filters feature high optical density (OD), which is a logarithmic measurement of the percent transmission (T%): $OD = \log_{10} {}^{1}/_{T\%}$. OD is specified for the center wavelength of the stop band.

EKSMA Optics Notch filters feature OD 6.0 (transmission less than 0.0001%) that ensures effective blocking of the designated laser wavelength. The back side of the filter is anti-reflection coated at pass band regions to minimize the reflection.

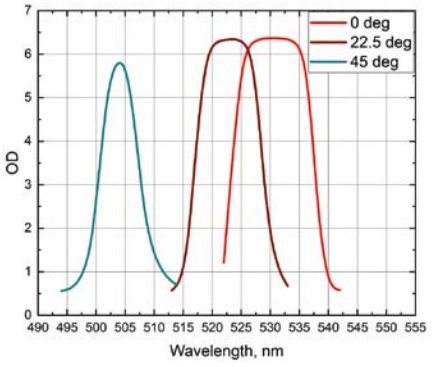
The spectral characteristics of Notch filters strongly depend on the angle of incidence (AOI). We specify OD for the design wavelength at 0° AOI. As angle of incidence increases, the stop band shifts to shorter wavelengths. We provide transmission curves for different AOI values (0°, 22.5°, 45°) for each of our standard Notch filters.

Specifications

Material	UV grade fused silica
Surface Flatness	λ/2 @ 633 nm
Surface Quality	40 – 20 scratch & dig (MIL-PRF-13830B)
Outer Diameter	25.4 mm
Tickness	6 mm
Clear Aperture	Ø 22 mm
Coating	S1: Hard dielectric filter coating S2: BBAR coating
Optical Density	OD>6 at central wavelength ±2 nm
Transmission at Passbands	T_{ave}>90%
Laser Damage Treshold	>1 J/cm² 10 ns, 10 Hz at central wavelength



246-2506-532.
Typical transmission, design wavelength – 532 nm



246-2506-532.
Typical OD, design wavelength – 532 nm

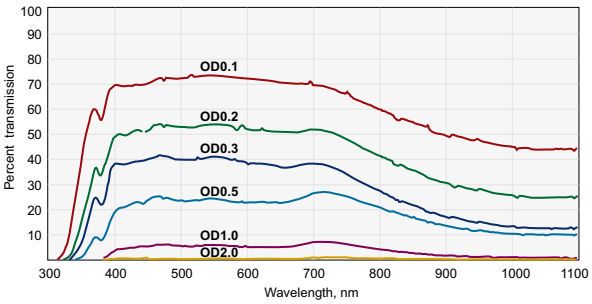
Optical Density	Central Wavelength, nm	Pass Bands, nm	FWHM, nm	Catalogue number	
6.0	488	400-471 + 504-700	15	**246-2506-488**	
6.0	514	400-496 + 532-700	17	**246-2506-514**	
6.0	532	400-517 + 548-710	17	**246-2506-532**	
6.0	561	425-542 + 580-740	19	**246-2506-561**	

NEUTRAL DENSITY ABSORPTION TYPE FILTERS AT 450 – 650 nm

Specifications

Material	Neutral density colour glass
Surface quality	60 – 40 scratch & dig (MIL-PRF-13830B)
Surface flatness	1λ per inch @ 633 nm
Parallelism	3 arcmin
Diameter tolerance	+0.0 / -0.2 mm
Clear aperture	90% of the diameter
Design wavelength	450 – 650 nm
Optical density tolerance	±5% of density

Neutral density absorption type filters decrease the intensity of light without altering the relative spectral distribution of energy. They are used to filter the entire visible spectrum evenly, allowing light reduction without influencing the colour or contrast. Attenuation is accomplished by using light-absorbing glass.



External transmission curves
(include reflections from uncoated surfaces)

Optical Density	Internal Transmittance, % @ 546 nm	Ø25.4 mm Catalogue nr.	25.4x25.4 mm Catalogue nr.	Ø50.8 mm Catalogue nr.	50.8x50.8 mm Catalogue nr.
0.05	89	240-2500	240-2600	240-5000	240-5600
0.1	80	240-2501	240-2601	240-5001	240-5601
0.2	63	240-2502	240-2602	240-5002	240-5602
0.3	50	240-2503	240-2603	240-5003	240-5603
0.4	40	240-2504	240-2604	240-5004	240-5604
0.5	32	240-2505	240-2605	240-5005	240-5605
0.6	25	240-2506	240-2606	240-5006	240-5606
0.7	20	240-2507	240-2607	240-5007	240-5607
0.8	15	240-2508	240-2608	240-5008	240-5608
0.9	12.5	240-2509	240-2609	240-5009	240-5609
1.0	10	240-2510	240-2610	240-5010	240-5610
1.5	3	240-2515	240-2615	240-5015	240-5615
2.0	1	240-2520	240-2620	240-5020	240-5620
3.0	0.1	240-2530	240-2630	240-5030	240-5630
4.0	0.01	240-2540	240-2640	240-5040	240-5640
5.0	0.001	240-2550	240-2650	240-5050	240-5650
6.0	0.0001	240-2560	240-2660	240-5060	240-5660

Related products

Variable Wheel Attenuator 990-0604
Find more at EksmaOptics.com

Filter Holder 830-0060A, 830-0070A
Find more at EksmaOptics.com

NEUTRAL DENSITY REFLECTIVE TYPE FILTERS AT 400 – 2000 nm

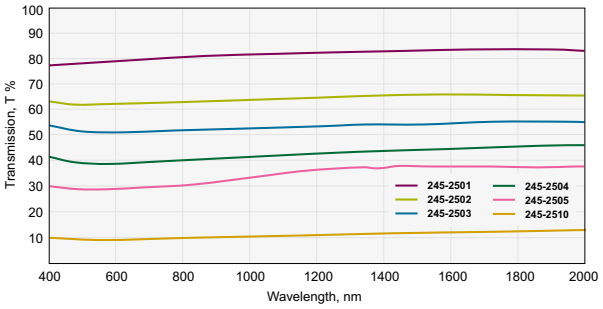
Neutral density reflective type filters of 1" (25.4 mm) size with optical density that varies from 0.1 to 2.5 are available.

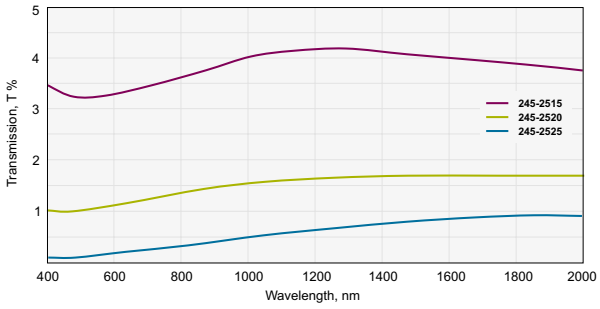
Neutral density filters of Corning 7059 glass provide spectrally uniform attenuation from 400 nm to 2000 nm.

The reflective coatings enable to reduce thermal effects when these filters are used with moderate power lasers.

Specifications

Glass Material	Corning 7059 (Borosilicate)
Surface Quality	40 – 20 scratch & dig (MIL-PRF-13830B)
Surface Flatness	λ @ 633 nm
Parallelism	<2 arcmin
Outer Diameter	25.4 mm +0.0/-0.2 mm
Thickness	1.1 mm ± 0.1 mm
Coating	Reflective
Laser Damage Threshold	20 mJ/cm² (10 ns pulse)
Design Wavelength	400 – 2000 nm
Optical Density Tolerance	±10% Nominal





Optical Density	Transmission T, % @ 550 nm	Catalogue number	
0.1	79	245-2501	
0.2	63	245-2502	
0.3	50	245-2503	
0.4	40	245-2504	
0.5	32	245-2505	
1.0	10	245-2510	
1.5	3	245-2515	
2.0	1	245-2520	
2.5	0.3	245-2525	

Related products

Plate Clamp 830-0055
Find more at EksmaOptics.com

Universal Plate Holder 830-0075
Find more at EksmaOptics.com

Variable Wheel Attenuator 990-0604-02
Find more at EksmaOptics.com

Filters Holder with 90° Flip 990-0400
See page 5.18

COLOR GLASS FILTERS

Color glass filters are made from optically polished highest quality Schott coloured optical glass. The spectral properties of these filters are uniform over the entire aperture and independent of the angle of incidence. Color glass filters can be used alone or in conjunction with monochromators or interference filters to isolate various spectral regions.

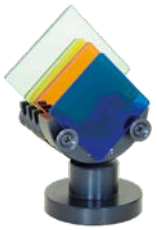
Specifications

Material	Schott colour glass
Surface quality	60 – 40 scratch & dig (MIL-PRF-13830B)
Surface flatness	1λ per inch @ 633 nm
Parallelism	3 arcmin
Diameter tolerance	+0.0 / -0.2 mm
Thickness	3.0 ± 0.2 mm
Clear aperture	90% of the diameter

Related products

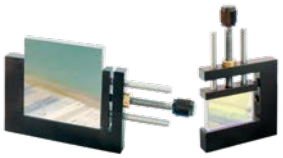
Filter Holders 830-0070A

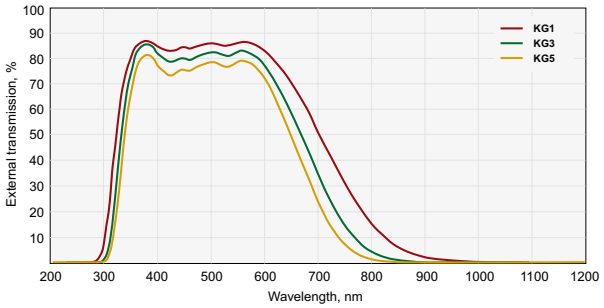
Find more at EksmaOptics.com

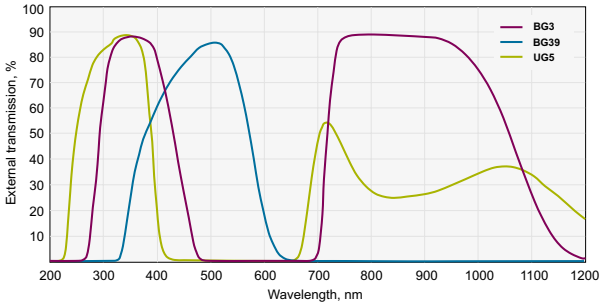


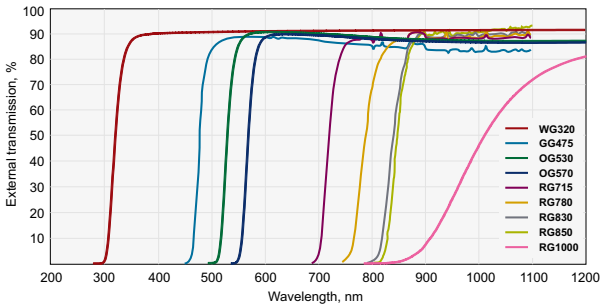
Rectangular Optics Holders 830-0100, 830-0110

Find more at EksmaOptics.com









External transmission curves
(include reflections from uncoated surfaces)

Material	Ø25.4 mm		25.4×25.4 mm		Ø50.8 mm		50.8×50.8 mm	
	Catalogue nr.		Catalogue nr.		Catalogue nr.		Catalogue nr.	
BG3	241-2003		241-3003		241-5003		241-6003	
UG5	241-2005		241-3005		241-5005		241-6005	
BG39	241-2039		241-3039		241-5039		241-6039	
KG1	242-2001		242-3001		242-5001		242-6001	
KG3	242-2003		242-3003		242-5003		242-6003	
KG5	242-2005		242-3005		242-5005		242-6005	
WG320	243-2320		243-3320		243-5320		243-6320	
GG475	243-2475		243-3475		243-5475		243-6475	
OG530	243-2530		243-3530		243-5530		243-6530	
OG570	243-2570		243-3570		243-5570		243-6570	
RG715	243-2715		243-3715		243-5715		243-6715	
RG780	243-2780		243-3780		243-5780		243-6780	
RG830	243-2830		243-3830		243-5830		243-6830	
RG850	243-2850		243-3850		243-5850		243-6850	
RG1000	243-2990		243-3990		243-5990		243-6990	

LASER SAFETY EYEWEAR

Features

- Wide spectrum of visibility
- Comfort and universal fit
- For Nd:YAG, Yb/KGW/KYW, Ti:sapphire applications

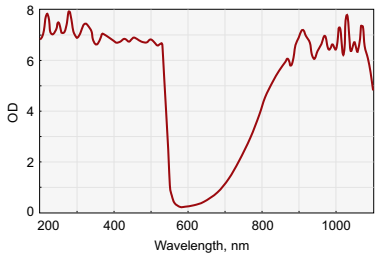
EKSMA Optics offers two different kinds of laser safety eyewear in two different styles: spectacles and goggles. The eyewear are amber colour and suitable for safe operation with Nd:YAG, Ti:Sapphire, Yb:KGW/KYW fundamental, second, third, fourth harmonics.

The eyewear absorbs laser radiation and gives perfect visibility. Both goggles and spectacles can be worn on prescription glasses. The goggles have air vents that prevent fogging. Laser beam cannot pass through the air vents. Goggles and spectacles come with protective case.

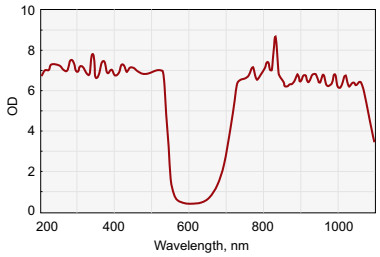
The models match the requirements for health and protection mentioned in the Directive of the European Community on Personal Protective Equipment (PPE) 89/686/EEC.

251-1064 Goggles

250-0800 Spectacles



Nd:YAG and Harmonics, VLT 35%



Nd:YAG + Ti:Sapphire and Harmonics, VLT 11%

250-1064, 251-1064

Wavelength, nm	Optical Density
190–534	7+
850–925	5+
960–1064	7+
625–1070	6+

250-0800, 251-0800

Wavelength, nm	Optical Density
180–534	7+
720–730	5+
730–740	6+
740–1070	7+

Description	Catalogue number	
Spectacles for Nd:YAG + Ti:Sapphire applications	**250-0800**	
Goggles for Nd:YAG + Ti:Sapphire applications	**251-0800**	
Spectacles for Nd:YAG applications	**250-1064**	
Goggles for Nd:YAG applications	**251-1064**	

VISUALIZER WITH A HOLDER

Features

- Produces a diffused second-harmonic reflection (visible) from an infrared (invisible) beam
- High mechanical durability
- High sensitivity to laser radiation
- Damage threshold for pulse laser – 1 J/cm², 10 ns
- Damage threshold for CW laser – 400 W/cm²

990-0840

Laser Beam Visualizer 990-0840 is used for visualization of CW or pulsed laser radiation with wavelength 880 – 1070 nm. When CW or pulsed laser radiation of wavelength 880 – 1070 nm falls onto the working surface, the latter glows in the second harmonic of the beam. Use this item to adjust and check a shape of a laser beam. It helps to see the structure of a laser beam intensity distribution. Working surface diameter – 35 mm.

Laser Beam Visualizer 990-0841 visualize IR and UV coherent and incoherent radiation from various light sources, lasers and others. Made of rare-earth materials, it is an eco-friendly ceramic tablet.

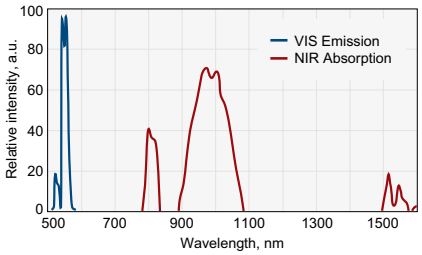
Laser Beam Visualizer 990-0842 combines 990-0840 and 990-0841 in one for user convenience. One side visualizes radiation with wavelength 190-1600 nm by emitting red color and the other side visualizes radiation with 880-1070 nm by emitting green color.

Spectral range, nm	Emitted light colour	Threshold sensitivity, W/cm²	Catalogue number	
880 – 1070	Green	0.02	**990-0840**	
190 – 1090 + 1470 – 1600	Red	0.01	**990-0841**	
190 – 1090 + 1470 – 1600 / 880 – 1070	Red / Green	0.01 / 0.02	**990-0842**	

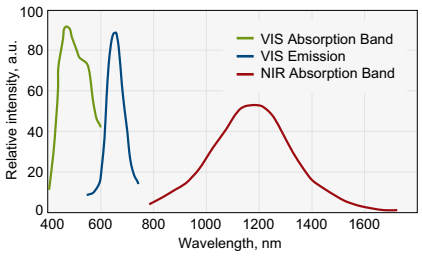
LASER DETECTION CARDS

Features

- Covering Visible and Near-IR (NIR) spectral ranges
- Plastic, credit-card-sized (86 × 54 mm)
- Large sensor area (54 × 44 mm) extending to the edges



990-0847 NIR Detection Card



990-0846 VIS & IR Detection Card

Laser detection cards provide instant, fade free operation for simple alignment, location and safety purpose visualization of laser light. They are made of durable 0.8 mm plastic and have photosensitive region 44 x 54 mm that extends all the way to the three edges of the cards to facilitate use in laser alignment procedures.

990-0846 VIS & IR Laser Detection Card Laser detection card has a sensitive active region which can be used to visualize weak power laser beams, to detect beam reflections or scattered IR laser light. Proper function of this card requires charging it with visible/ day light before use. Additionally, because emissions from the active region are not persistent, the user must move the card around for optimal brightness of the beam spot.

990-0847 NIR Laser Detection Card does not require charging. The emission is persistent even when used in CW applications in a darkened room. In addition, when the active region is used in a darkened room with sufficiently bright source, the fluorescence from the activated photosensitive region can be seen through the back side or the photosensitive region can be activated by illuminating the back of the card. This is especially useful for aligning the overlap of two beams.

Specifications

Model	990-0846 VIS & IR Detection Card	990-0847 NIR Detection Card
Absorption Bands	400 – 640 nm 800 – 1700 nm	790 – 840 nm 870 – 1070 nm 1500 – 1590 nm
Emission Bands	Broadband 600 – 730 nm Peak @ 660 nm	520 – 580 nm Peak @ 550 nm
Persistence (stimulation removed)	VIS: 0.5 – 3 s, dependent on ambient light IR: <0.5 s	800 µs
Minimum Stimulation Continuous [1]	<1 nW/cm² @ 450 nm <25 µW/cm² @ 950 nm	<2 µW/cm² @ 808 nm <175 nW/cm² @ 960 nm <100 µW/cm² @ 1550 nm
Minimum Stimulation Pulsed [1]	2 kW/cm² @ 1064 nm, 7 ns, 10 Hz	250 kW/cm² @ 1064 nm, 7 ns, 10 Hz
Maximum Stimulation Continuous	100 W/cm² @ 512 nm	100 W/cm² @ 1064 nm
Maximum Stimulation Pulsed	60 MW/cm² @ 1064 nm, 7 ns, 10 Hz	35 MW/cm² @ 1064 nm, 7 ns, 10 Hz
Typical Applications	Ar-Ion, HeNe, HeCd, 880 nm, 960-980 nm laser diodes, Yb:KGW, Nd:YLF, Nd:Glass, Nd:YAG	808 nm, 820 nm, 830 nm, 880 nm, 960-9680 nm laser diodes, Yb:KGW, Nd:YLF, Nd:Glass, Nd:YAG, 1550 nm telecommunications

[1] Measured in darkened conditions.

Catalogue code	Spectral range	
990-0846	400 – 640 and 800 – 1700 nm	
990-0847	790 – 840, 870 – 1070 and 1500 – 1590 nm	

LASER MIRRORS

Laser mirrors are dielectric reflectors providing an optimised performance at stated wavelengths. High polishing quality is important for low wave front distortion, low scattering and high laser damage threshold. Mirrors are designed to work at 0 or 45 degrees.

Substrate

Material	UV grade fused silica or BK7 glass
S1 Surface Flatness	λ/10 typical at 633 nm
S1 Surface Quality	20 – 10 scratch & dig (MIL-PRF-13830B)
S2 Surface Quality	Commercial polish
Diameter Tolerance	+0.00 mm / -0.12 mm
Thickness Tolerance	±0.25 mm
Wedge	< 3 min
Chamfer	0.3 mm at 45° typical

Coating

Technology	Electron beam multilayer dielectric or Ion beam sputtering
Adhesion and Durability	Per MIL-C-675A. Insoluble in lab solvents
Clear Aperture	Exceeds central 85% of diameter
Coated Surface Flatness	λ/10 at 633 nm over 85% of diameter available
Angle of Incidence	0 or 45°

LASER LINE MIRRORS

Substrate material: BK7, grade A. AOI = 45°. Laser damage threshold: 6 J/cm², 8 nsec pulse, 1064 nm typical.

Wavelength, nm	Application	R, % (s+p)/2	Ø12.7 × 3 mm	Ø12.7 × 6 mm	Ø25.4 × 6 mm	Ø50.8 × 8 mm
			Catalogue nr.		Catalogue nr.	Catalogue nr.
351 – 361	Nd:YAG 3H	99.5	031-0350	031-0350T6	032-0350	035-0350
380 – 420	Ti: Sa 2H	99.5	031-0400	031-0400T6	032-0400	035-0400
442	HeCd	99.5	031-0442	031-0442T6	032-0442	035-0442
488 – 515	Ar+	99.5	031-0490	031-0490T6	032-0490	035-0490
500 – 530	Yb:KGW/KYW 2H	99.5	031-0515	031-0515T6	032-0515	035-0515
527 – 532	Nd:YAG 2H	99.5	031-0530	031-0530T6	032-0530	035-0530
589	Dye	99.5	031-0590	031-0590T6	032-0590	035-0590
633 – 670	HeNe+Diode	99.5	031-0630	031-0630T6	032-0630	035-0630
694	Ruby	99.5	031-0694	031-0694T6	032-0694	035-0694
760 – 840	Ti:Sa 1H	99.5	031-0800	031-0800T6	032-0800	035-0800
780	Diode	99.5	031-0780	031-0780T6	032-0780	035-0780
852	Diode	99.5	031-0850	031-0850T6	032-0850	035-0850
980	Diode	99.5	031-0980	031-0980T6	032-0980	035-0980
1000 – 1060	Yb:KGW/KYW 1H	99.5	031-1030	031-1030T6	032-1030	035-1030
1047 – 1064	Nd:YAG 1H	99.5	031-1060	031-1060T6	032-1060	035-1060
1300 – 1320	YAG	99.5	031-1300	031-1300T6	032-1300	035-1300
1520 – 1570	Diode	99.5	031-1550	031-1550T6	032-1550	035-1550

Mirrors provided are of AOI=45°.
Mirrors with AOI=0° can be ordered by adding **-i0** to catalogue number.
Reflectivity R (s+p)/2 for AOI=0° is 99.8%.

The examples:
031-0350-i0, 037-0400-i0.

BK7 Ø76.2×12.7 mm. AOI = 45°. Laser damage threshold: 6 J/cm², 8 nsec pulse, 1064 nm typical.

Wavelength, nm	Application	R, % (s+p)/2	Catalogue number
380 – 420	Ti: Sa 2H	99.5	037-0400
500 – 530	Yb:KGW/KYW 2H	99.5	037-0515
527 – 532	Nd:YAG 2H	99.5	037-0530
760 – 840	Ti: Sa 1H	99.5	037-0800
1000 – 1060	Yb:KGW/KYW 3H	99.5	037-1030
1047 – 1064	Nd:YAG 1H	99.5	037-1060

Substrate material: UV grade Fused Silica. AOI = 45°. Laser damage threshold: 6 J/cm², 8 nsec pulse, 1064 nm typical.

Wavelength, nm	Application	R, % (s+p)/2	Ø12.7 × 3 mm	Ø12.7 × 6 mm	Ø12.7 mm	Ø25.4 × 6 mm		Ø50.8 × 8 mm	
			Catalogue nr.			Catalogue nr.		Catalogue nr.	
244 – 248	KrF	99.0	041-0240	041-0240T6		042-0240		045-0240	
262 – 266	Nd:YAG	99.0	041-0260	041-0260T6		042-0260		045-0260	
257 – 275	Ti:Sa 3H	99.0	041-0266	041-0266T6		042-0266		045-0266	
308	XeCl	99.2	041-0300	041-0300T6		042-0300		045-0300	
325	HeCd	99.5	041-0325	041-0325T6		042-0325		045-0325	
333 – 353	Yb:KGW/KYW 3H	99.5	041-0343	041-0343T6		042-0343		045-0343	
347	Ruby	99.5	041-0347	041-0347T6		042-0347		045-0347	
351 – 361	Nd:YAG 3H	99.5	041-0350	041-0350T6		042-0350		045-0350	
380 – 420	Ti:Sa 2H	99.5	041-0400	041-0400T6		042-0400		045-0400	
500 – 530	Yb:KGW/KYW 2H	99.5	041-0515	041-0515T6		042-0515		045-0515	
527 – 532	Nd:YAG 2H	99.5	041-0530	041-0530T6		042-0530		045-0530	
760 – 840	Ti:Sa 1H	99.5	041-0800	041-0800T6		042-0800		045-0800	
1000 – 1060	Yb:KGW/KYW 1H	99.5	041-1030	041-1030T6		042-1030		045-1030	
1047 – 1064	Nd:YAG 1H	99.5	041-1060	041-1060T6		042-1060		045-1060	

Mirrors provided are of AOI=45°.
Mirrors with AOI=0° can be ordered by adding **-i0** to catalogue number.
Reflectivity R (s+p)/2 for AOI=0° is 99.8%.

The examples:
042-0240-i0, 047-0266-i0.

Substrate material: UV grade Fused Silica Ø76.2x12.7 mm. AOI = 45°.
Laser damage threshold: 6 J/cm², 8 nsec pulse, 1064 nm typical.

Wavelength, nm	Application	R, % (s+p)/2	Catalogue number	
257 – 275	Ti:Sa 3H	99.0	047-0266	
333 – 353	Yb:KGW/KYW 3H	99.5	047-0343	
351 – 361	Nd:YAG 3H	99.5	047-0350	
380 – 420	Ti:Sa 2H	99.5	047-0400	
500 – 530	Yb:KGW/KYW 2H	99.5	047-0515	
527 – 532	Nd:YAG 2H	99.5	047-0530	
760 – 840	Ti:Sa 1H	99.5	047-0800	
1000 – 1060	Yb:KGW/KYW 1H	99.5	047-1030	
1047 – 1064	Nd:YAG 1H	99.5	047-1060	

DUAL BAND MIRRORS

Substrate: BK7, grade A. AOI = 45°. Laser damage threshold: 3 J/cm², 8 nsec pulse, 1064 nm typical.

Wavelength, nm	Application	R, % (s+p)/2	Ø12.7 × 3 mm	Ø12.7 × 6 mm		Ø25.4 × 6 mm		Ø50.8 × 8 mm		Ø76.2 × 12.7 mm	
			Catalogue number			Catalogue number		Catalogue number		Catalogue number	
390 – 410 + 780 – 820	Ti:Sa 2H+1H	99.5	051-4080	051-4080T6		052-4080		055-4080		057-4080	
500 – 530 + 1000 – 1060	Yb:KGW/KYW 2H+1H	99.5	051-5103	051-5103T6		052-5103		055-5103		057-5103	
532 + 1064	Nd:YAG 2H+1H	99.5	051-5306	051-5306T6		052-5306		055-5306		057-5306	
633 + 1064	HeNe:Nd:YAG 1H	99.5	051-6306	051-6306T6		052-6306		055-6306		057-6306	

Mirrors provided are of AOI=45°. Mirrors with AOI=0° can be ordered by adding -i0 to catalogue number. The price remains the same as for AOI=45°. An example: ***042-4080-i0.***

Substrate material: UV grade Fused Silica. AOI = 45°. Laser damage threshold: 5 J/cm², 8 nsec pulse, 1064 nm typical.

Wavelength, nm	Application	R, % (s+p)/2	Ø12.7 × 3 mm	Ø12.7 × 6 mm		Ø25.4 × 6 mm		Ø50.8 × 8 mm		Ø76.2 × 12.7 mm	
			Catalogue number			Catalogue number		Catalogue number		Catalogue number	
266 + 355	Nd:YAG 4H+3H	99.0	061-2635	061-2635T6		062-2635		065-2635		067-2635	
266 + 532	Nd:YAG 4H+2H	99.0	061-2653	061-2653T6		062-2653		065-2653		067-2653	
355 + 532	Nd:YAG 3H+2H	99.5	061-3553	061-3553T6		062-3553		065-3553		067-3553	
355 + 1064	Nd:YAG 3H+1H	99.0	061-3506	061-3506T6		062-3506		065-3506		067-3506	
390-410 + 780-820	Ti:Sa 2H+1H	99.5	061-4080	061-4080T6		062-4080		065-4080		067-4080	
500-530 + 1000-1060	Yb:KGW/KYW 2H+1H	99.5	061-5103	061-5103T6		062-5103		065-5103		067-5103	
532 + 1064	Nd:YAG 2H+1H	99.5	061-5306	061-5306T6		062-5306		065-5306		067-5306	
633 + 1064	HeNe:Nd:YAG 1H	99.5	061-6306	061-6306T6		062-6306		065-6306		067-6306	

Mirrors provided are of AOI=45°. Mirrors with AOI=0° can be ordered by adding -i0 to catalogue number. The price remains the same as for AOI=45°. An example: ***062-3553-i0.***

BROADBAND LASER MIRRORS

Substrate: BK7, grade A. AOI = 45°. Laser damage threshold: 1 J/cm², 8 nsec pulse, 1064 nm typical.

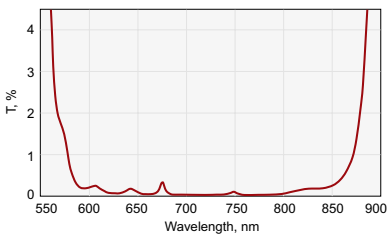
Wavelength, nm	Application	R, % (s+p)/2	Ø12.7 × 3 mm	Ø12.7 × 6 mm		Ø25.4 × 6 mm		Ø50.8 × 8 mm	
			Catalogue number			Catalogue nr.		Catalogue nr.	
360 – 440	Ti:Sa 2H	99	071-3644	071-3644T6		072-3644		075-3644	
420 – 540	Dye	99	071-4254	071-4254T6		072-4254		075-4254	
520 – 650	Dye	99	071-5265	071-5265T6		072-5265		075-5265	
600 – 850	Diode	99	071-6085	071-6085T6		072-6085		075-6085	
730 – 950	Ti:Sa	99	071-7395	071-7395T6		072-7395		075-7395	
800 – 1100	Diode,YAG	99	071-8011	071-8011T6		072-8011		075-8011	

Mirrors provided are of AOI=45°. Mirrors with AOI=0° can be ordered by adding -i0 to catalogue number. The price remains the same as for AOI=45°. An example: ***072-3644-i0***.

Substrate: UV grade Fused Silica. AOI = 45°. Laser damage threshold: 1 J/cm², 8 nsec pulse, 1064 nm typical.

Wavelength, nm	Application	R, % (s+p)/2	Ø12.7 × 3 mm	Ø12.7 × 6 mm		Ø25.4 × 6 mm		Ø50.8 × 8 mm	
			Catalogue number			Catalogue nr.		Catalogue nr.	
260 – 380	Spectroscopy	99	081-2638	081-2638T6		082-2638		085-2638	
360 – 440	Ti:Sa 2H	99	081-3644	081-3644T6		082-3644		085-3644	
420 – 540	Dye	99	081-4254	081-4254T6		082-4254		085-4254	
520 – 650	Dye	99	081-5265	081-5265T6		082-5265		085-5265	
600 – 850	Diode	99	081-6085	081-6085T6		082-6085		085-6085	
730 – 950	Ti:Sa	99	081-7395	081-7395T6		082-7395		085-7395	
800 – 1100	Diode, YAG	99	081-8011	081-8011T6		082-8011		085-8011	

Mirrors provided are of AOI=45°. Mirrors with AOI=0° can be ordered by adding -i0 to catalogue number. The price remains the same as for AOI=45°. An example: ***082-2225-i0***.



071-6085. HR > 99% @ 600-850 nm

Related Products

Broadband Low GDD Ultrafast Laser Mirrors

See page 4.5

Kinematic Mirror/Beamsplitter Mounts 840-0056

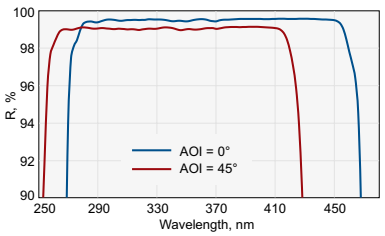
Find more at EksmaOptics.com

UV FS BROADBAND AND LASER LINE MIRRORS FOR AOI FROM 0 TO 45°

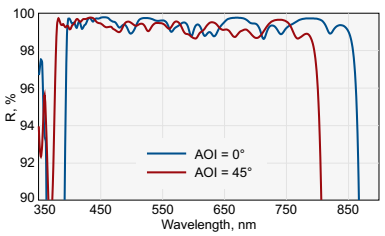
Features

- R_{avg} > 99% for (s+p)/2 polarization that operates at all angles of incidence from 0 to 45°

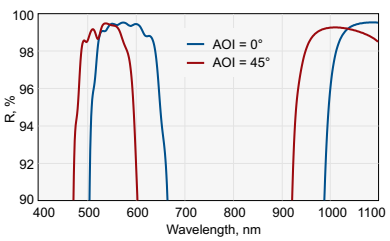
EKSMA OPTICS introduces broadband and laser line dielectric mirrors with high reflectance (greater than 99% over specified range minimum) that operate at all angles of incidence from 0° to 45°. Broadband and laser line mirrors are available for 280-400 nm, 349-355 nm, 400-750 nm, 524-532 nm, 532+1064 nm, 750-1100 nm, 1047-1064 nm wavelength ranges.



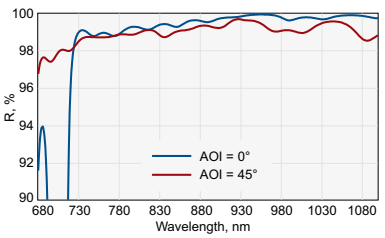
081-2840-i0-45.
HR>99% @ 280-400 nm, AOI from 0 to 45°



081-4075-i0-45.
HR>99% @ 400-750 nm, AOI from 0 to 45°



062-5306HHR-i0-45.
HR>99.7% @ 532+1064 nm, AOI from 0 to 45°



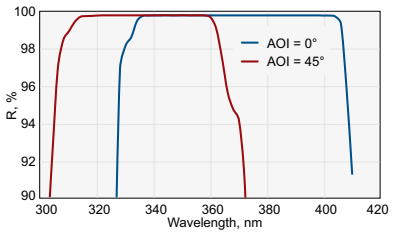
081-7511-i0-45.
HR>99% @ 750-1100 nm, AOI from 0 to 45°

Substrate: UV grade Fused Silica

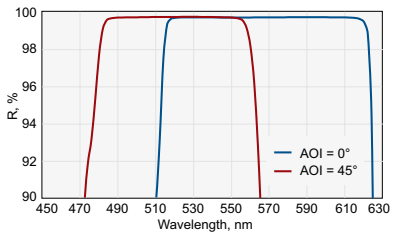
Wavelength, nm	AOI, deg	R, % (s+p)/2	LDT, J/cm² 10 ns, 10 Hz	Ø12.7 × 6 mm	Ø25.4 × 6 mm	Ø50.8 × 8 mm
				Catalogue number	Catalogue number	Catalogue number
257	0-45	99.0	0.5	041-0257-i0-45	042-0257-i0-45	–
280 – 400	0-45	99.0	0.5	086-2840-i0-45	082-2840-i0-45	–
343 – 355	0-45	99.5	1	041-0350-i0-45	042-0350-i0-45	–
400 – 750	0-45	99.0	1	086-4075-i0-45	082-4075-i0-45	085-4075-i0-45
524 – 532	0-45	99.9	10	041-0530HHR-i0-45	042-0530HHR-i0-45	–
532 + 1064	0-45	99.7	3	061-5306HHR-i0-45	062-5306HHR-i0-45	–
750 – 1100	0-45	99.0	1	086-7511-i0-45	082-7511-i0-45	085-7511-i0-45
760 – 840 Low GDD	0-45	99.9	3	041-7684HHR-i0-45	042-7684HHR-i0-45	–
1047 – 1064	0-45	99.7	20	041-1060HHR-i0-45	042-1060HHR-i0-45	–

Substrate: BK7

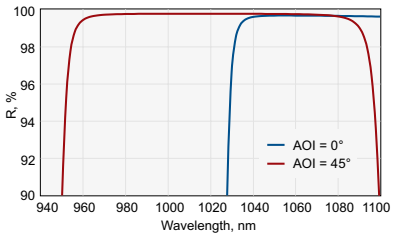
Wavelength, nm	AOI, deg	R, % (s+p)/2	LDT, J/cm² 10 ns, 10 Hz	Ø12.7 × 6 mm	Ø25.4 × 6 mm	Ø50.8 × 8 mm
				Catalogue number	Catalogue number	Catalogue number
400 – 750	0-45	99.0	1	076-4076-i0-45	072-4075-i0-45	075-4075-i0-45
750 – 1100	0-45	99.0	1	076-7511-i0-45	072-7511-i0-45	075-7511-i0-45



042-0350-i0-45.
HR>99.5% @ 343-355 nm, AOI from 0 to 45°



042-0530HHR-i0-45.
HR>99.9% @ 524-532 nm, AOI from 0 to 45°



042-1060HHR-i0-45.
HR>99.7% @ 1047-1064 nm, AOI from 0 to 45°

Housing accessories

Kinematic Mirror Mount 840-0010

Find more at EksmaOptics.com

Adapter for Mirror at 45° 840-0115

Find more at EksmaOptics.com

HIGH POWER IBS COATED LASER MIRRORS FOR PICOSECOND APPLICATIONS

Substrate

Material	UV grade fused silica
S1 Surface Flatness	λ/10 at 633 nm
S1 Surface Quality	20 – 10 scratch & dig (MIL-PRF-13830B)
S2 Surface Quality	Commercial polish
Diameter Tolerance	+0.00 mm / -0.12 mm
Thickness Tolerance	±0.25 mm
Wedge	< 3 min
Chamfer	0.3 mm at 45° typical

Coating

Technology	Ion Beam Sputtering (IBS)
Adhesion and Durability	Per MIL-C-675A, Insoluble in lab solvents
Clear Aperture	Exceeds central 85% of diameter
Coated Surface Flatness	λ/10 at 633 nm over clear aperture

FOR PICOSECOND APPLICATIONS

Design wavelength – 343 nm. **LIDT >0.9 J/cm²**, 10 ps pulse, 50 kHz, 343 nm typical.

Wavelength, nm	AOI, deg	R, % (s+p)/2	Ø 12.7 x 6 mm		Ø 25.4 x 6 mm		Ø 50.8 x 12 mm	
			Catalogue number		Catalogue number		Catalogue number	
343	45	99.8	041-0343PHR		042-0343PHR		045-0343PHR	
343	0	99.8	041-0343PHR-i0		042-0343PHR-i0		045-0343PHR-i0	

Design wavelength – 515 nm. **LIDT >1 J/cm²**, 10 ps pulse, 20 kHz, 515 nm typical.

Wavelength, nm	AOI, deg	R, % (s+p)/2	Ø 12.7 x 6 mm		Ø 25.4 x 6 mm		Ø 50.8 x 12 mm	
			Catalogue number		Catalogue number		Catalogue number	
515	45	99.9	041-0515PHR		042-0515PHR		045-0515PHR	
515	0	99.95	041-0515PHR-i0		042-0515PHR-i0		045-0515PHR-i0	
515	0-45	99.9	041-0515PHR-i0-45		042-0515PHR-i0-45		045-0515PHR-i0-45	

Design wavelength – 515 nm. **LIDT >2.5 J/cm²**, 10 ps pulse, 20 kHz, 515 nm typical.

Wavelength, nm	AOI, deg	R, % (s+p)/2	Ø 12.7 x 6 mm		Ø 25.4 x 6 mm		Ø 50.8 x 12 mm	
			Catalogue number		Catalogue number		Catalogue number	
515	45	99.9	041-0515PUHR		042-0515PUHR		045-0515PUHR	
515	0	99.95	041-0515PUHR-i0		042-0515PUHR-i0		045-0515PUHR-i0	

Design wavelength – 1030 nm. **LIDT >1.5 J/cm²**, 10 ps pulse, 20 kHz, 1030 nm typical.

Wavelength, nm	AOI, deg	R, % (s+p)/2	Ø 12.7 x 6 mm		Ø 25.4 x 6 mm		Ø 50.8 x 12 mm	
			Catalogue number		Catalogue number		Catalogue number	
1030	45	99.9	041-1030PHR		042-1030PHR		045-1030PHR	
1030	0	99.95	041-1030PHR-i0		042-1030PHR-i0		045-1030PHR-i0	
1030	0-45	99.9	041-1030PHR-i0-45		042-1030PHR-i0-45		045-1030PHR-i0-45	

Design wavelength – 1030 nm. **LIDT >3 J/cm²**, 10 ps pulse, 20 kHz, 1030 nm typical.

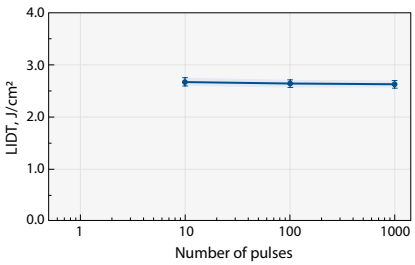
Wavelength, nm	AOI, deg	R, % (s+p)/2	Ø 12.7 x 6 mm		Ø 25.4 x 6 mm		Ø 50.8 x 12 mm	
			Catalogue number		Catalogue number		Catalogue number	
1030	45	99.9	041-1030PUHR		042-1030PUHR		045-1030PUHR	
1030	0	99.95	041-1030PUHR-i0		042-1030PUHR-i0		045-1030PUHR-i0	

Design wavelength – 515 + 1030 nm. **LIDT >1 J/cm²**, 10 ps pulse, 20 kHz, 515 and 1030 nm typical.

Wavelength, nm	AOI, deg	R, % (s+p)/2	Ø 12.7 x 6 mm		Ø 25.4 x 6 mm		Ø 50.8 x 12 mm	
			Catalogue number		Catalogue number		Catalogue number	
515 + 1030	45	99.9	061-5103PHR		062-5103PHR		065-5103PHR	
515 + 1030	0	99.9	061-5103PHR-i0		062-5103PHR-i0		065-5103PHR-i0	

Design wavelength – 515 + 1030 nm. **LIDT >2 J/cm²**, 10 ps pulse, 50 kHz, 515 and 1030 nm typical.

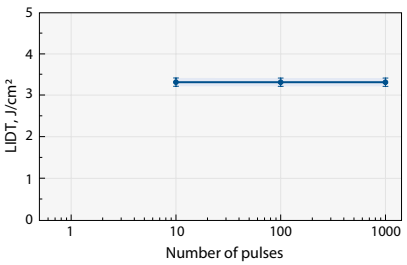
Wavelength, nm	AOI, deg	R, % (s+p)/2	Ø 12.7 x 6 mm		Ø 25.4 x 6 mm		Ø 50.8 x 12 mm	
			Catalogue number		Catalogue number		Catalogue number	
515 + 1030	45	99.5	061-5103PUHR		062-5103PUHR		065-5103PUHR	
515 + 1030	0	99.5	061-5103PUHR-i0		062-5103PUHR-i0		065-5103PUHR-i0	



LIDT of High Power Laser Mirrors @ 515 nm

Test conditions:

Wavelength	515 nm
Pulse duration	10.0 ps
Repetition rate	20 kHz
AOI	45°
Polarization	linear P
Beam diameter (1/e²)	(32.0 ± 0.2) µm



LIDT of High Power Laser Mirrors @ 1030 nm

Test conditions:

Wavelength	1030 nm
Pulse duration	10.2 ps
Repetition rate	20 kHz
AOI	45°
Polarization	linear P
Beam diameter (1/e²)	(91.5 ± 0.6) µm

DICHROIC MIRRORS

Features

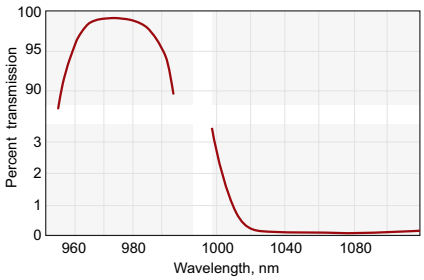
- Laser Damage Threshold:
  > 2 J/cm², 8 ns pulse, 1064 nm typical for BK7 substrates
  > 5 J/cm², 8 ns pulse, 1064 nm typical for UV FS substrates
- Back side antireflection coated: R < 0.5%
- Parallelism: 30 arcsec

Substrate

Material	UV grade fused silica or BK7 glass
S1 Surface Flatness	λ/10 typical at 633 nm
S1 Surface Quality	20 – 10 scratch & dig (MIL-PRF-13830B)
S2 Surface Flatness	λ/10 typical at 633 nm
S2 Surface Quality	20 – 10 scratch & dig (MIL-PRF-13830B)
Diameter Tolerance	+0.00 mm / -0.12 mm
Thickness Tolerance	±0.25 mm
Parallelism	30 arcsec
Chamfer	0.3 mm at 45° typical

DICHROIC MIRRORS WITH HIGH TRANSMISSION

042-6200HT.
HR > 99.5%
@ 1028 – 1080 nm,
HT > 98%
@ 965 – 982 nm,
AOI = 0°



Coating

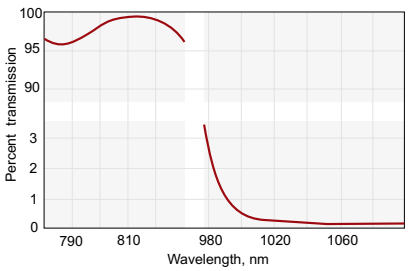
Technology	Ion Beam Sputtering (IBS)
Back side antireflection coated	R < 0.1% at AOI = 0° R < 0.5% at AOI = 45°

Reflected wavelength, nm, R > 99.5%	Transmitted wavelength, nm	Transmission, %	AOI	Laser Damage Threshold [1], J/cm²	Substrate material	Ø12.7x3 mm Catalogue number		Ø25.4x6 mm Catalogue number	
1064	808	>99	0	>10	UV FS	041-6800HT		042-6800HT	
1064	808	>99	45	>10	UV FS	041-6805HT		042-6805HT	
1028 – 1080	965 – 982	>98	0	>10	UV FS	041-6200HT		042-6200HT	
1028 – 1080	965 – 982	>98	45	>3	UV FS	041-6205HT		042-6205HT	
1028 – 1080	965 – 982	>98	22.5	>3	UV FS	041-6202HT		042-6202HT	

[1] Measured with 10 ns, 10 Hz pulse, 1064 nm typical.

STANDARD DICHROIC MIRRORS

031-6800.
HR > 99.5% @ 1064 nm,
HT > 95% @ 808 nm,
AOI = 0°



Coating

Technology	Electron beam multilayer dielectric
Adhesion and Durability	Per MIL-C-675A. Insoluble in lab solvents
Clear Aperture	Exceeds central 85% of diameter
Laser Damage Threshold:	
BK7	2 J/cm², 8 ns pulse, 1064 nm typical
UV FS	5 J/cm², 8 ns pulse, 1064 nm typical
Coated Surface Flatness	λ/10 at 633 nm over 85% of diameter available

Reflected wavelength, nm, R > 99.5%	Transmitted wavelength, nm	Transmission, %	AOI	Substrate material	Ø12.7x3 mm Catalogue number		Ø25.4x6 mm Catalogue number	
633	1064	>95	45	BK7	041-6105		042-6105	
1064	633	>90	45	BK7	041-6605		042-6605	
1064	808	>95	0	BK7	031-6800		032-6800	
1064	808	>95	45	BK7	031-6805		032-6805	
1064	808	>95	0	UV FS	041-6800		042-6800	
1064	808	>95	45	UV FS	041-6805		042-6805	

METAL COATED MIRRORS

EKSMA OPTICS offers various size round, rectangular, spherical mirrors protected gold, silver or aluminium.

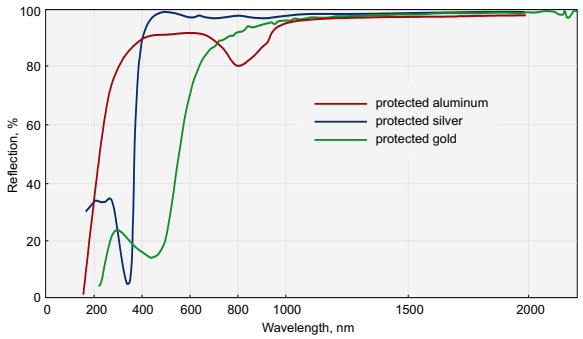
Metallic mirrors are widely used due to a moderate level of reflection over a very broad spectral range. Protected gold coatings have the highest reflectance in IR, silver is most efficient in VIS, while aluminium is economical reflector over entire 300-IR region.

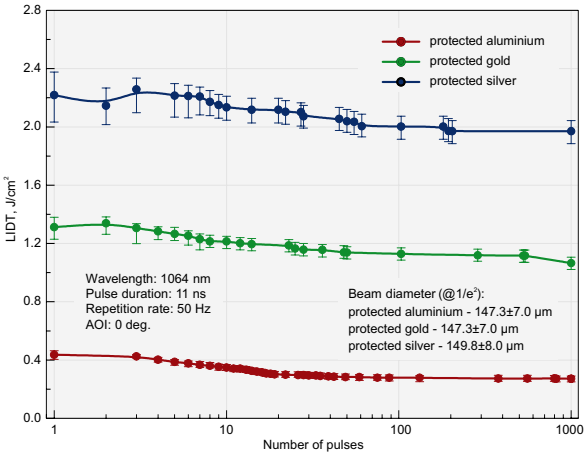
A layer of dielectric material protects the coatings of the mirrors in order to make them durable. Enhanced metallic coatings provide greater reflection across the operating bandwidth.

As metallic coatings modify the state of polarization of an incident beam, they are inappropriate for polarization sensitive applications.

Type	Average reflection, %	Wavelength, nm	Laser Induced Damage Threshold at 1064 nm, 50 Hz, 11 nsec, J/cm²
Protected aluminium	>86	300–IR	0.25
Protected silver	>96	400–IR	1.8
Protected gold	>98	900–IR	1.0

* Laser Induced Damage Threshold results are measured according to ISO 21254-2: 1000-on-1 test procedure.





Comparison of Protected Ag, Al and Au Mirrors @ 1064 nm, 50 Hz, 11 nsec

Specifications for Flat Substrates

Material	BK7, UV FS
S1 Surface Flatness	λ/10 @ 633 nm
S1 Surface Quality	40 – 20 scratch & dig (MIL-PRF-13830B)
S2 Surface Quality	Commercial polish
Clear Aperture	>90% of the diameter
Wedge	<3 min

Specifications for Spherical Substrates

Material	BK7, UV FS
S1 (curved) Surface Flatness	λ/10 @ 633 nm
S1 (curved) Surface Quality	40 – 20 scratch & dig (MIL-PRF-13830B)
S2 (plane) Surface Quality	Commercial polish
Clear Aperture	>90% of the diameter
Diameter Tolerance	0.00 / -0.13 mm
Thickness Tolerance	±0.2 mm

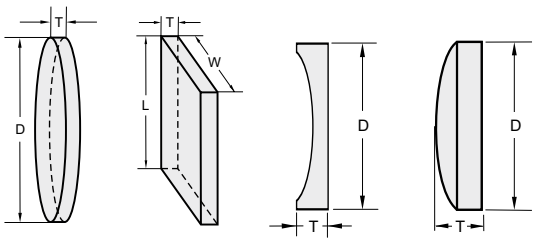
PROTECTED ALUMINIUM MIRRORS

Features

- LIDT – 0.25 J/cm² at 1064 nm, 50 Hz, 11 nsec pulses*
- LIDT – 0.1 J/cm² at 355 nm, 50 Hz, 5.7 nsec pulses*
- Average Reflection >86% for 300 nm – IR
- BK7, UVFS, Zerodur® substrates available
- Round, Square and Flat or Spherical Mirrors available
- OEM capabilities - please contact for special pricing

* Laser Induced Damage Threshold results are measured according to ISO 21254-2: 1000-on-1 test procedure.

Protected Aluminium (Al) Mirrors serve as an economical reflector over entire 300-IR region. Enhanced metallic coatings provide greater reflection across the operating bandwidth.



Drawings of flat round, flat rectangular and spherical mirrors

Flat Rectangular Mirrors. Substrate type: plano-plano

Width W, mm	Length L, mm	Thickness T, mm	Substrate material	Catalogue number
15.0	20.0	6.0	BK7	091-0315
20.0	30.0	6.0	BK7	092-0315
25.4	25.4	6.0	BK7	093-0315
25.4	50.8	10.0	BK7	094-0315
50.8	50.8	10.0	BK7	095-0315
15.0	20.0	6.0	UV FS	091-3315
20.0	30.0	6.0	UV FS	092-3315
25.4	25.4	6.0	UV FS	093-3315
25.4	50.8	10.0	UV FS	094-3315
50.8	50.8	10.0	UV FS	095-3315

Flat Round Mirrors. Substrate type: plano-plano

Diameter D, mm	Thickness T, mm	Substrate material	Catalogue number
12.7	3.0	BK7	091-0015
12.7	6.0	BK7	091-0015T6
25.4	6.0	BK7	092-0015
50.8	8.0	BK7	095-0015
76.2	12.7	BK7	097-0015
101.6	15.0	BK7	098-0015
12.7	3.0	UV FS	091-3015
12.7	6.0	UV FS	091-3015T6
25.4	6.0	UV FS	092-3015
50.8	8.0	UV FS	095-3015
76.2	12.7	UV FS	097-3015
101.6	15.0	UV FS	098-3015

Spherical Mirrors. Diameter, D = 12.7 mm. Thickness (edge for plano-concave, center for plano-convex), T = 6.0 mm

Radius, mm	Substrate type	Substrate material	Catalogue number
-50	Plano-concave	BK7	091-0115R-50
-75	Plano-concave	BK7	091-0115R-75
-100	Plano-concave	BK7	091-0115R-100
-150	Plano-concave	BK7	091-0115R-150
-200	Plano-concave	BK7	091-0115R-200
-250	Plano-concave	BK7	091-0115R-250
-300	Plano-concave	BK7	091-0115R-300
-400	Plano-concave	BK7	091-0115R-400
-500	Plano-concave	BK7	091-0115R-500
-1000	Plano-concave	BK7	091-0115R-1000
-1500	Plano-concave	BK7	091-0115R-1500
-2000	Plano-concave	BK7	091-0115R-2000
-50	Plano-concave	UV FS	091-3115R-50
-75	Plano-concave	UV FS	091-3115R-75
-100	Plano-concave	UV FS	091-3115R-100
-150	Plano-concave	UV FS	091-3115R-150
-200	Plano-concave	UV FS	091-3115R-200
-250	Plano-concave	UV FS	091-3115R-250
-300	Plano-concave	UV FS	091-3115R-300
-400	Plano-concave	UV FS	091-3115R-400

Radius, mm	Substrate type	Substrate material	Catalogue number
-500	Plano-concave	UV FS	091-3115R-500
-1000	Plano-concave	UV FS	091-3115R-1000
-1500	Plano-concave	UV FS	091-3115R-1500
-2000	Plano-concave	UV FS	091-3115R-2000
+50	Plano-convex	BK7	091-0215R+50
+75	Plano-convex	BK7	091-0215R+75
+100	Plano-convex	BK7	091-0215R+100
+150	Plano-convex	BK7	091-0215R+150
+200	Plano-convex	BK7	091-0215R+200
+300	Plano-convex	BK7	091-0215R+300
+400	Plano-convex	BK7	091-0215R+400
+500	Plano-convex	BK7	091-0215R+500
+50	Plano-convex	UV FS	091-3215R+50
+75	Plano-convex	UV FS	091-3215R+75
+100	Plano-convex	UV FS	091-3215R+100
+150	Plano-convex	UV FS	091-3215R+150
+200	Plano-convex	UV FS	091-3215R+200
+300	Plano-convex	UV FS	091-3215R+300
+400	Plano-convex	UV FS	091-3215R+400
+500	Plano-convex	UV FS	091-3215R+500

Spherical Mirrors. Diameter, D = 25.4 mm. Thickness (edge for plano-concave, center for plano-convex), T = 6.0 mm

Radius, mm	Substrate type	Substrate material	Catalogue number
-50	Plano-concave	BK7	092-0115R-50
-75	Plano-concave	BK7	092-0115R-75
-100	Plano-concave	BK7	092-0115R-100
-150	Plano-concave	BK7	092-0115R-150
-200	Plano-concave	BK7	092-0115R-200
-250	Plano-concave	BK7	092-0115R-250
-300	Plano-concave	BK7	092-0115R-300
-400	Plano-concave	BK7	092-0115R-400
-500	Plano-concave	BK7	092-0115R-500
-600	Plano-concave	BK7	092-0115R-600
-750	Plano-concave	BK7	092-0115R-750
-800	Plano-concave	BK7	092-0115R-800
-1000	Plano-concave	BK7	092-0115R-1000
-1500	Plano-concave	BK7	092-0115R-1500
-2000	Plano-concave	BK7	092-0115R-2000
-2500	Plano-concave	BK7	092-0115R-2500
-3000	Plano-concave	BK7	092-0115R-3000
-4000	Plano-concave	BK7	092-0115R-4000
-5000	Plano-concave	BK7	092-0115R-5000
-6000	Plano-concave	BK7	092-0115R-6000
-8000	Plano-concave	BK7	092-0115R-8000

Radius, mm	Substrate type	Substrate material	Catalogue number
-50	Plano-concave	UV FS	092-3115R-50
-75	Plano-concave	UV FS	092-3115R-75
-100	Plano-concave	UV FS	092-3115R-100
-150	Plano-concave	UV FS	092-3115R-150
-200	Plano-concave	UV FS	092-3115R-200
-250	Plano-concave	UV FS	092-3115R-250
-300	Plano-concave	UV FS	092-0115R-300
-400	Plano-concave	UV FS	092-0115R-400
-500	Plano-concave	UV FS	092-3115R-500
-600	Plano-concave	UV FS	092-3115R-600
-750	Plano-concave	UV FS	092-3115R-750
-800	Plano-concave	UV FS	092-3115R-800
-1000	Plano-concave	UV FS	092-3115R-1000
-1500	Plano-concave	UV FS	092-3115R-1500
-2000	Plano-concave	UV FS	092-3115R-2000
-2500	Plano-concave	UV FS	092-3115R-2500
-3000	Plano-concave	UV FS	092-0115R-3000
-4000	Plano-concave	UV FS	092-3115R-4000
-5000	Plano-concave	UV FS	092-3115R-5000
-6000	Plano-concave	UV FS	092-0115R-6000
-8000	Plano-concave	UV FS	092-0115R-8000

Radius, mm	Substrate type	Substrate material	Catalogue number	
+50	Plano-convex	BK7	092-0215R+50	
+75	Plano-convex	BK7	092-0215R+75	
+100	Plano-convex	BK7	092-0215R+100	
+150	Plano-convex	BK7	092-0215R+150	
+200	Plano-convex	BK7	092-0215R+200	
+300	Plano-convex	BK7	092-0215R+300	
+400	Plano-convex	BK7	092-0215R+400	
+500	Plano-convex	BK7	092-0215R+500	
+600	Plano-convex	BK7	092-0215R+600	
+800	Plano-convex	BK7	092-0215R+800	
+1000	Plano-convex	BK7	092-0215R+1000	
+1500	Plano-convex	BK7	092-0215R+1500	
+2000	Plano-convex	BK7	092-0215R+2000	
+4000	Plano-convex	BK7	092-0215R+4000	
+5000	Plano-convex	BK7	092-0215R+5000	

Radius, mm	Substrate type	Substrate material	Catalogue number	
+50	Plano-convex	UV FS	092-3215R+50	
+75	Plano-convex	UV FS	092-3215R+75	
+100	Plano-convex	UV FS	092-3215R+100	
+150	Plano-convex	UV FS	092-3215R+150	
+200	Plano-convex	UV FS	092-3215R+200	
+300	Plano-convex	UV FS	092-3215R+300	
+400	Plano-convex	UV FS	092-3215R+400	
+500	Plano-convex	UV FS	092-3215R+500	
+600	Plano-convex	UV FS	092-3215R+600	
+800	Plano-convex	UV FS	092-3215R+800	
+1000	Plano-convex	UV FS	092-3215R+1000	
+1500	Plano-convex	UV FS	092-3215R+1500	
+2000	Plano-convex	UV FS	092-3215R+2000	
+4000	Plano-convex	UV FS	092-3215R+4000	
+5000	Plano-convex	UV FS	092-3215R+5000	

Spherical Mirrors. Diameter, D = 50.8 mm. Thickness (edge for plano-concave, center for plano-convex), T = 10.0 mm

Radius, mm	Substrate type	Substrate material	Catalogue number	
-100	Plano-concave	BK7	095-0115R-100	
-150	Plano-concave	BK7	095-0115R-150	
-200	Plano-concave	BK7	095-0115R-200	
-250	Plano-concave	BK7	095-0115R-250	
-300	Plano-concave	BK7	095-0115R-300	
-400	Plano-concave	BK7	095-0115R-400	
-500	Plano-concave	BK7	095-0115R-500	
-600	Plano-concave	BK7	095-0115R-600	
-800	Plano-concave	BK7	095-0115R-800	
-1000	Plano-concave	BK7	095-0115R-1000	
-1500	Plano-concave	BK7	095-0115R-1500	
-2000	Plano-concave	BK7	095-0115R-2000	
-2500	Plano-concave	BK7	095-0115R-2500	
-3000	Plano-concave	BK7	095-0115R-3000	
-4000	Plano-concave	BK7	095-0115R-4000	
-5000	Plano-concave	BK7	095-0115R-5000	
-6000	Plano-concave	BK7	095-0115R-6000	
-8000	Plano-concave	BK7	095-0115R-8000	
-10000	Plano-concave	BK7	095-0115R-10000	
-100	Plano-concave	UV FS	095-3115R-100	
-150	Plano-concave	UV FS	095-3115R-150	
-200	Plano-concave	UV FS	095-3115R-200	
-250	Plano-concave	UV FS	095-3115R-250	
-300	Plano-concave	UV FS	095-3115R-300	
-400	Plano-concave	UV FS	095-3115R-400	
-500	Plano-concave	UV FS	095-3115R-500	
-600	Plano-concave	UV FS	095-3115R-600	
-800	Plano-concave	UV FS	095-3115R-800	
-1000	Plano-concave	UV FS	095-3115R-1000	
-1500	Plano-concave	UV FS	095-3115R-1500	
-2000	Plano-concave	UV FS	095-3115R-2000	
-2500	Plano-concave	UV FS	095-3115R-2500	
-3000	Plano-concave	UV FS	095-3115R-3000	
-4000	Plano-concave	UV FS	095-3115R-4000	
-5000	Plano-concave	UV FS	095-3115R-5000	
-6000	Plano-concave	UV FS	095-3115R-6000	
-8000	Plano-concave	UV FS	095-3115R-8000	
-10000	Plano-concave	UV FS	095-3115R-10000	

Radius, mm	Substrate type	Substrate material	Catalogue number	
+100	Plano-convex	BK7	095-0215R+100	
+150	Plano-convex	BK7	095-0215R+150	
+200	Plano-convex	BK7	095-0215R+200	
+300	Plano-convex	BK7	095-0215R+300	
+400	Plano-convex	BK7	095-0215R+400	
+500	Plano-convex	BK7	095-0215R+500	
+600	Plano-convex	BK7	095-0215R+600	
+800	Plano-convex	BK7	095-0215R+800	
+1000	Plano-convex	BK7	095-0215R+1000	
+1500	Plano-convex	BK7	095-0215R+1500	
+2000	Plano-convex	BK7	095-0215R+2000	
+100	Plano-convex	UV FS	095-3215R+100	
+150	Plano-convex	UV FS	095-3215R+150	
+200	Plano-convex	UV FS	095-3215R+200	
+300	Plano-convex	UV FS	095-3215R+300	
+400	Plano-convex	UV FS	095-3215R+400	
+500	Plano-convex	UV FS	095-3215R+500	
+600	Plano-convex	UV FS	095-3215R+600	
+800	Plano-convex	UV FS	095-3215R+800	
+1000	Plano-convex	UV FS	095-3215R+1000	
+1500	Plano-convex	UV FS	095-3215R+1500	
+2000	Plano-convex	UV FS	095-3215R+2000	

Related Products

Curved Windows. See page 1.6

Kinematic Mirror Mount 840-0010

Find more at EksmaOptics.com

Adapter for Mirror at 45° 840-0115

Find more at EksmaOptics.com

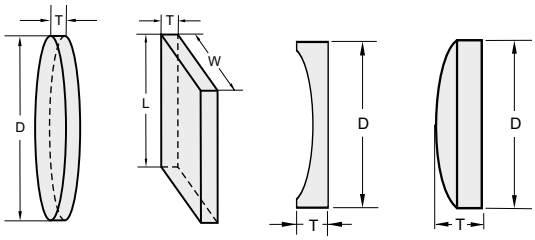
PROTECTED SILVER MIRRORS

Features

- LIDT – 0.25 J/cm^2 at 800 nm, 50 Hz, 94 fsec pulses*
- LIDT – 1.8 J/cm^2 at 1064 nm, 50 Hz, 11 nsec pulses*
- Average Reflection >97% for 400 nm – IR
- BK7, UVFS, Zerodur® substrates available
- Round, Square and Flat or Spherical Mirrors available
- OEM capabilities – please contact for special pricing
- Test samples are available on request

* Laser Induced Damage Threshold results are measured according to ISO 21254-2: 1000-on-1 test procedure.

Protected Silver (Ag) Mirrors feature higher reflectance than aluminium throughout the visible and near-infrared spectral region. Our protected silver mirrors has excellent durability.



Drawings of flat round, flat rectangular and spherical mirrors

Flat Rectangular Mirrors. Substrate type: plano-plano

Width W, mm	Length L, mm	Thickness T, mm	Substrate material	Catalogue number
15.0	20.0	6.0	BK7	091-0325
20.0	30.0	6.0	BK7	092-0325
25.4	25.4	6.0	BK7	093-0325
25.4	50.8	10.0	BK7	094-0325
50.8	50.8	10.0	BK7	095-0325
15.0	20.0	6.0	UV FS	091-3325
20.0	30.0	6.0	UV FS	092-3325
25.4	25.4	6.0	UV FS	093-3325
25.4	50.8	10.0	UV FS	094-3325
50.8	50.8	10.0	UV FS	095-3325

Flat Round Mirrors. Substrate type: plano-plano

Diameter D, mm	Thickness T, mm	Substrate material	Catalogue number
12.7	3.0	BK7	091-0025
12.7	6.0	BK7	091-0025T6
25.4	6.0	BK7	092-0025
50.8	8.0	BK7	095-0025
76.2	12.7	BK7	097-0025
101.6	15.0	BK7	098-0025
12.7	3.0	UV FS	091-3025
12.7	6.0	UV FS	091-3025T6
25.4	6.0	UV FS	092-3025
50.8	8.0	UV FS	095-3025
76.2	12.7	UV FS	097-3025
101.6	15.0	UV FS	098-3025

Spherical Mirrors. Diameter, D = 12.7 mm. Thickness (edge for plano-concave, center for plano-convex), T = 6.0 mm

Radius, mm	Substrate type	Substrate material	Catalogue number
-50	Plano-concave	BK7	091-0125R-50
-75	Plano-concave	BK7	091-0125R-75
-100	Plano-concave	BK7	091-0125R-100
-150	Plano-concave	BK7	091-0125R-150
-200	Plano-concave	BK7	091-0125R-200
-250	Plano-concave	BK7	091-0125R-250
-300	Plano-concave	BK7	091-0125R-300
-400	Plano-concave	BK7	091-0125R-400
-500	Plano-concave	BK7	091-0125R-500
-1000	Plano-concave	BK7	091-0125R-1000
-1500	Plano-concave	BK7	091-0125R-1500
-2000	Plano-concave	BK7	091-0125R-2000
-50	Plano-concave	UV FS	091-3125R-50
-75	Plano-concave	UV FS	091-3125R-75
-100	Plano-concave	UV FS	091-3125R-100
-150	Plano-concave	UV FS	091-3125R-150
-200	Plano-concave	UV FS	091-3125R-200
-250	Plano-concave	UV FS	091-3125R-250
-300	Plano-concave	UV FS	091-3125R-300
-400	Plano-concave	UV FS	091-3125R-400
-500	Plano-concave	UV FS	091-3125R-500
-1000	Plano-concave	UV FS	091-3125R-1000
-1500	Plano-concave	UV FS	091-3125R-1500
-2000	Plano-concave	UV FS	091-3125R-2000

Radius, mm	Substrate type	Substrate material	Catalogue number
+50	Plano-convex	BK7	091-0225R+50
+100	Plano-convex	BK7	091-0225R+100
+150	Plano-convex	BK7	091-0225R+150
+200	Plano-convex	BK7	091-0225R+200
+300	Plano-convex	BK7	091-0225R+300
+400	Plano-convex	BK7	091-0225R+400
+500	Plano-convex	BK7	091-0225R+500
+50	Plano-convex	UV FS	091-3225R+50
+100	Plano-convex	UV FS	091-3225R+100
+150	Plano-convex	UV FS	091-3225R+150
+200	Plano-convex	UV FS	091-3225R+200
+300	Plano-convex	UV FS	091-3225R+300
+400	Plano-convex	UV FS	091-3225R+400
+500	Plano-convex	UV FS	091-3225R+500

Spherical Mirrors. Diameter, D = 25.4 mm. Thickness (edge for plano-concave, center for plano-convex), T = 6.0 mm

Radius, mm	Substrate type	Substrate material	Catalogue number
-50	Plano-concave	BK7	092-0125R-50
-75	Plano-concave	BK7	092-0125R-75
-100	Plano-concave	BK7	092-0125R-100
-150	Plano-concave	BK7	092-0125R-150
-200	Plano-concave	BK7	092-0125R-200
-250	Plano-concave	BK7	092-0125R-250
-300	Plano-concave	BK7	092-0125R-300
-400	Plano-concave	BK7	092-0125R-400
-500	Plano-concave	BK7	092-0125R-500
-600	Plano-concave	BK7	092-0125R-600
-750	Plano-concave	BK7	092-0125R-750
-800	Plano-concave	BK7	092-0125R-800
-1000	Plano-concave	BK7	092-0125R-1000
-1500	Plano-concave	BK7	092-0125R-1500
-2000	Plano-concave	BK7	092-0125R-2000
-2500	Plano-concave	BK7	092-0125R-2500
-3000	Plano-concave	BK7	092-0125R-3000
-4000	Plano-concave	BK7	092-0125R-4000
-5000	Plano-concave	BK7	092-0125R-5000
-6000	Plano-concave	BK7	092-0125R-6000
-8000	Plano-concave	BK7	092-0125R-8000
-50	Plano-concave	UV FS	092-3125R-50
-75	Plano-concave	UV FS	092-3125R-75
-100	Plano-concave	UV FS	092-3125R-100
-150	Plano-concave	UV FS	092-3125R-150
-200	Plano-concave	UV FS	092-3125R-200
-250	Plano-concave	UV FS	092-3125R-250
-300	Plano-concave	UV FS	092-0125R-300
-400	Plano-concave	UV FS	092-0125R-400
-500	Plano-concave	UV FS	092-3125R-500
-600	Plano-concave	UV FS	092-3125R-600
-750	Plano-concave	UV FS	092-3125R-750
-800	Plano-concave	UV FS	092-3125R-800
-1000	Plano-concave	UV FS	092-3125R-1000
-1500	Plano-concave	UV FS	092-3125R-1500

Radius, mm	Substrate type	Substrate material	Catalogue number
-2000	Plano-concave	UV FS	092-3125R-2000
-2500	Plano-concave	UV FS	092-3125R-2500
-3000	Plano-concave	UV FS	092-0125R-3000
-4000	Plano-concave	UV FS	092-3125R-4000
-5000	Plano-concave	UV FS	092-3125R-5000
-6000	Plano-concave	UV FS	092-0125R-6000
-8000	Plano-concave	UV FS	092-0125R-8000
+50	Plano-convex	BK7	092-0225R+50
+100	Plano-convex	BK7	092-0225R+100
+150	Plano-convex	BK7	092-0225R+150
+200	Plano-convex	BK7	092-0225R+200
+300	Plano-convex	BK7	092-0225R+300
+400	Plano-convex	BK7	092-0225R+400
+500	Plano-convex	BK7	092-0225R+500
+600	Plano-convex	BK7	092-0225R+600
+800	Plano-convex	BK7	092-0225R+800
+1000	Plano-convex	BK7	092-0225R+1000
+1500	Plano-convex	BK7	092-0225R+1500
+2000	Plano-convex	BK7	092-0225R+2000
+4000	Plano-convex	BK7	092-0225R+4000
+5000	Plano-convex	BK7	092-0225R+5000
+50	Plano-convex	UV FS	092-3225R+50
+100	Plano-convex	UV FS	092-3225R+100
+150	Plano-convex	UV FS	092-3225R+150
+200	Plano-convex	UV FS	092-3225R+200
+300	Plano-convex	UV FS	092-3225R+300
+400	Plano-convex	UV FS	092-3225R+400
+500	Plano-convex	UV FS	092-3225R+500
+600	Plano-convex	UV FS	092-3225R+600
+800	Plano-convex	UV FS	092-3225R+800
+1000	Plano-convex	UV FS	092-3225R+1000
+1500	Plano-convex	UV FS	092-3225R+1500
+2000	Plano-convex	UV FS	092-3225R+2000
+4000	Plano-convex	UV FS	092-3225R+4000
+5000	Plano-convex	UV FS	092-3225R+5000

Spherical Mirrors. Diameter, D = 50.8 mm. Thickness (edge for plano-concave, center for plano-convex), T = 10.0 mm

Radius, mm	Substrate type	Substrate material	Catalogue number
-100	Plano-concave	BK7	095-0125R-100
-150	Plano-concave	BK7	095-0125R-150
-200	Plano-concave	BK7	095-0125R-200
-250	Plano-concave	BK7	095-0125R-250
-300	Plano-concave	BK7	095-0125R-300
-400	Plano-concave	BK7	095-0125R-400
-500	Plano-concave	BK7	095-0125R-500
-600	Plano-concave	BK7	095-0125R-600
-800	Plano-concave	BK7	095-0125R-800
-1000	Plano-concave	BK7	095-0125R-1000
-1500	Plano-concave	BK7	095-0125R-1500
-2000	Plano-concave	BK7	095-0125R-2000
-2500	Plano-concave	BK7	095-0125R-2500
-3000	Plano-concave	BK7	095-0125R-3000
-4000	Plano-concave	BK7	095-0125R-4000
-5000	Plano-concave	BK7	095-0125R-5000
-6000	Plano-concave	BK7	095-0125R-6000
-8000	Plano-concave	BK7	095-0125R-8000
-10000	Plano-concave	BK7	095-0125R-10000

Radius, mm	Substrate type	Substrate material	Catalogue number
-100	Plano-concave	UV FS	095-3125R-100
-150	Plano-concave	UV FS	095-3125R-150
-200	Plano-concave	UV FS	095-3125R-200
-250	Plano-concave	UV FS	095-0125R-250
-300	Plano-concave	UV FS	095-3125R-300
-400	Plano-concave	UV FS	095-3125R-400
-500	Plano-concave	UV FS	095-3125R-500
-600	Plano-concave	UV FS	095-3125R-600
-800	Plano-concave	UV FS	095-3125R-800
-1000	Plano-concave	UV FS	095-3125R-1000
-1500	Plano-concave	UV FS	095-3125R-1500
-2000	Plano-concave	UV FS	095-3125R-2000
-2500	Plano-concave	UV FS	095-3125R-2500
-3000	Plano-concave	UV FS	095-3125R-3000
-4000	Plano-concave	UV FS	095-3125R-4000
-5000	Plano-concave	UV FS	095-3125R-5000
-6000	Plano-concave	UV FS	095-0125R-6000
-8000	Plano-concave	UV FS	095-0125R-8000
-10000	Plano-concave	UV FS	095-3125R-10000

Radius, mm	Substrate type	Substrate material	Catalogue number	
+100	Plano-convex	BK7	095-0225R+100	
+150	Plano-convex	BK7	095-0225R+150	
+200	Plano-convex	BK7	095-0225R+200	
+300	Plano-convex	BK7	095-0225R+300	
+400	Plano-convex	BK7	095-0225R+400	
+500	Plano-convex	BK7	095-0225R+500	
+600	Plano-convex	BK7	095-0225R+600	
+800	Plano-convex	BK7	095-0225R+800	
+1000	Plano-convex	BK7	095-0225R+1000	
+1500	Plano-convex	BK7	095-0225R+1500	
+2000	Plano-convex	BK7	095-0225R+2000	

Radius, mm	Substrate type	Substrate material	Catalogue number	
+100	Plano-convex	UV FS	095-3225R+100	
+150	Plano-convex	UV FS	095-3225R+150	
+200	Plano-convex	UV FS	095-3225R+200	
+300	Plano-convex	UV FS	095-3225R+300	
+400	Plano-convex	UV FS	095-3225R-400	
+500	Plano-convex	UV FS	095-3225R+500	
+600	Plano-convex	UV FS	095-3225R+600	
+800	Plano-convex	UV FS	095-3225R+800	
+1000	Plano-convex	UV FS	095-3225R+1000	
+1500	Plano-convex	UV FS	095-3225R+1500	
+2000	Plano-convex	UV FS	095-3225R+2000	

Spherical Mirrors. Diameter, D = 76.2 mm. Thickness (edge for plano-concave, center for plano-convex), T = 12.7 mm

Radius, mm	Substrate type	Substrate material	Catalogue number	
-200	Plano-concave	BK7	097-0125R-200	
-300	Plano-concave	BK7	097-0125R-300	
-400	Plano-concave	BK7	097-0125R-400	
-500	Plano-concave	BK7	097-0125R-500	
-600	Plano-concave	BK7	097-0125R-600	
-800	Plano-concave	BK7	097-0125R-800	
-1000	Plano-concave	BK7	097-0125R-1000	
-2000	Plano-concave	BK7	097-0125R-2000	
-3000	Plano-concave	BK7	097-0125R-3000	
-200	Plano-concave	UV FS	097-3125R-200	
-300	Plano-concave	UV FS	097-3125R-300	
-400	Plano-concave	UV FS	097-3125R-400	
-500	Plano-concave	UV FS	097-3125R-500	
-600	Plano-concave	UV FS	097-3125R-600	
-800	Plano-concave	UV FS	097-3125R-800	
-1000	Plano-concave	UV FS	097-3125R-1000	
-2000	Plano-concave	UV FS	097-3125R-2000	
-3000	Plano-concave	UV FS	097-3125R-3000	

Spherical Mirrors. Diameter, D = 101.6 mm. Thickness (edge for plano-concave, center for plano-convex), T = 15.0 mm

Radius, mm	Substrate type	Substrate material	Catalogue number	
-300	Plano-concave	BK7	098-0125R-300	
-400	Plano-concave	BK7	098-0125R-400	
-500	Plano-concave	BK7	098-0125R-500	
-600	Plano-concave	BK7	098-0125R-600	
-800	Plano-concave	BK7	098-0125R-800	
-1000	Plano-concave	BK7	098-0125R-1000	
-2000	Plano-concave	BK7	098-0125R-2000	
-3000	Plano-concave	BK7	098-0125R-3000	
-300	Plano-concave	UV FS	098-3125R-300	
-400	Plano-concave	UV FS	098-3125R-400	
-500	Plano-concave	UV FS	098-3125R-500	
-600	Plano-concave	UV FS	098-3125R-600	
-800	Plano-concave	UV FS	098-3125R-800	
-1000	Plano-concave	UV FS	098-3125R-1000	
-2000	Plano-concave	UV FS	098-3125R-2000	
-3000	Plano-concave	UV FS	098-3125R-3000	

Related Products

Curved Windows. See page 1.6

Kinematic Mirror Mount 840-0010

Find more at EksmaOptics.com

Adapter for Mirror at 45° 840-0115

Find more at EksmaOptics.com

Non Standard Metal Coated Mirrors are available for fast off-the-shelf delivery. Check the availability at **www.eksmaoptics.com**

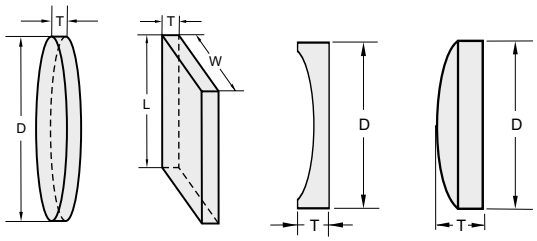
PROTECTED GOLD MIRRORS

Features

- LIDT – 1.0 J/cm² at 1064 nm, 50 Hz, 11 nsec pulses*
- Average Reflection >98% for 900 nm – IR
- BK7, UVFS, Zerodur® substrates available
- Round, Square and Flat or Spherical Mirrors available
- OEM capabilities - please contact for special pricing
- Test samples are available on request
- Bare Gold coated mirrors are available as an option

* Laser Induced Damage Threshold results are measured according to ISO 21254-2: 1000-on-1 test procedure.

Protected Gold (Au) Mirrors have the highest reflectance in infrared. Enhanced metallic coatings provide greater reflection across the operating bandwidth.



Drawings of flat round, flat rectangular and spherical mirrors

Flat Rectangular Mirrors. Substrate type: plano-plano

Width W, mm	Length L, mm	Thickness T, mm	Substrate material	Catalogue number	
15.0	20.0	6.0	BK7	091-0330	
20.0	30.0	6.0	BK7	092-0330	
25.4	25.4	6.0	BK7	093-0330	
25.4	50.8	10.0	BK7	094-0330	
50.8	50.8	10.0	BK7	095-0330	
15.0	20.0	6.0	UV FS	091-3330	
20.0	30.0	6.0	UV FS	092-3330	
25.4	25.4	6.0	UV FS	093-3330	
25.4	50.8	10.0	UV FS	094-3330	
50.8	50.8	10.0	UV FS	095-3330	

Flat Round Mirrors. Substrate type: plano-plano

Diameter D, mm	Thickness T, mm	Substrate material	Catalogue number	
12.7	3.0	BK7	091-0030	
12.7	6.0	BK7	091-0030T6	
25.4	6.0	BK7	092-0030	
50.8	8.0	BK7	095-0030	
76.2	12.7	BK7	097-0030	
101.6	15.0	BK7	098-0030	
12.7	3.0	UV FS	091-3030	
12.7	6.0	UV FS	091-3030T6	
25.4	6.0	UV FS	092-3030	
50.8	8.0	UV FS	095-3030	
76.2	12.7	UV FS	097-3030	
101.6	15.0	UV FS	098-3030	

Spherical Mirrors. Diameter, D = 12.7 mm. Thickness (edge for plano-concave, center for plano-convex), T = 6.0 mm

Radius, mm	Substrate type	Substrate material	Catalogue number	
-50	Plano-concave	BK7	091-0130R-50	
-75	Plano-concave	BK7	091-0130R-75	
-100	Plano-concave	BK7	091-0130R-100	
-150	Plano-concave	BK7	091-0130R-150	
-200	Plano-concave	BK7	091-0130R-200	
-250	Plano-concave	BK7	091-0130R-250	
-300	Plano-concave	BK7	091-0130R-300	
-400	Plano-concave	BK7	091-0130R-400	
-500	Plano-concave	BK7	091-0130R-500	
-1000	Plano-concave	BK7	091-0130R-1000	
-1500	Plano-concave	BK7	091-0130R-1500	
-2000	Plano-concave	BK7	091-0130R-2000	
-50	Plano-concave	UV FS	091-3130R-50	
-75	Plano-concave	UV FS	091-3130R-75	
-100	Plano-concave	UV FS	091-3130R-100	
-150	Plano-concave	UV FS	091-3130R-150	
-200	Plano-concave	UV FS	091-3130R-200	
-250	Plano-concave	UV FS	091-3130R-250	
-300	Plano-concave	UV FS	091-3130R-300	
-400	Plano-concave	UV FS	091-3130R-400	
-500	Plano-concave	UV FS	091-3130R-500	
-1000	Plano-concave	UV FS	091-3130R-1000	
-1500	Plano-concave	UV FS	091-3130R-1500	
-2000	Plano-concave	UV FS	091-3130R-2000	

Radius, mm	Substrate type	Substrate material	Catalogue number	
+50	Plano-convex	BK7	091-0230R+50	
+100	Plano-convex	BK7	091-0230R+100	
+150	Plano-convex	BK7	091-0230R+150	
+200	Plano-convex	BK7	091-0230R+200	
+300	Plano-convex	BK7	091-0230R+300	
+400	Plano-convex	BK7	091-0230R+400	
+500	Plano-convex	BK7	091-0230R+500	
+50	Plano-convex	UV FS	091-3230R+50	
+100	Plano-convex	UV FS	091-3230R+100	
+150	Plano-convex	UV FS	091-3230R+150	
+200	Plano-convex	UV FS	091-3230R+200	
+300	Plano-convex	UV FS	091-3230R+300	
+400	Plano-convex	UV FS	091-3230R+400	
+500	Plano-convex	UV FS	091-2230R+500	

Spherical Mirrors. Diameter, D = 25.4 mm. Thickness (edge for plano-concave, center for plano-convex), T = 6.0 mm

Radius, mm	Substrate type	Substrate material	Catalogue number
-50	Plano-concave	BK7	092-0130R-50
-75	Plano-concave	BK7	092-0130R-75
-100	Plano-concave	BK7	092-0130R-100
-150	Plano-concave	BK7	092-0130R-150
-200	Plano-concave	BK7	092-0130R-200
-250	Plano-concave	BK7	092-0130R-250
-300	Plano-concave	BK7	092-0130R-300
-400	Plano-concave	BK7	092-0130R-400
-500	Plano-concave	BK7	092-0130R-500
-600	Plano-concave	BK7	092-0130R-600
-750	Plano-concave	BK7	092-0130R-750
-800	Plano-concave	BK7	092-0130R-800
-1000	Plano-concave	BK7	092-0130R-1000
-1500	Plano-concave	BK7	092-0130R-1500
-2000	Plano-concave	BK7	092-0130R-2000
-2500	Plano-concave	BK7	092-0130R-2500
-3000	Plano-concave	BK7	092-0130R-3000
-4000	Plano-concave	BK7	092-0130R-4000
-5000	Plano-concave	BK7	092-0130R-5000
-6000	Plano-concave	BK7	092-0130R-6000
-8000	Plano-concave	BK7	092-0130R-8000
-50	Plano-concave	UV FS	092-3130R-50
-75	Plano-concave	UV FS	092-3130R-75
-100	Plano-concave	UV FS	092-3130R-100
-150	Plano-concave	UV FS	092-3130R-150
-200	Plano-concave	UV FS	092-3130R-200
-250	Plano-concave	UV FS	092-3130R-250
-300	Plano-concave	UV FS	092-3130R-300
-400	Plano-concave	UV FS	092-3130R-400
-500	Plano-concave	UV FS	092-3130R-500
-600	Plano-concave	UV FS	092-3130R-600
-750	Plano-concave	UV FS	092-3130R-750
-800	Plano-concave	UV FS	092-3130R-800
-1000	Plano-concave	UV FS	092-3130R-1000
-1500	Plano-concave	UV FS	092-3130R-1500

Radius, mm	Substrate type	Substrate material	Catalogue number
-2000	Plano-concave	UV FS	092-3130R-2000
-2500	Plano-concave	UV FS	092-3130R-2500
-3000	Plano-concave	UV FS	092-3130R-3000
-4000	Plano-concave	UV FS	092-3130R-4000
-5000	Plano-concave	UV FS	092-3130R-5000
-6000	Plano-concave	UV FS	092-3130R-6000
-8000	Plano-concave	UV FS	092-3130R-8000
+50	Plano-convex	BK7	092-0230R+50
+100	Plano-convex	BK7	092-0230R+100
+150	Plano-convex	BK7	092-0230R+150
+200	Plano-convex	BK7	092-0230R+200
+300	Plano-convex	BK7	092-0230R+300
+400	Plano-convex	BK7	092-0230R+400
+500	Plano-convex	BK7	092-0230R+500
+600	Plano-convex	BK7	092-0230R+600
+800	Plano-convex	BK7	092-0230R+800
+1000	Plano-convex	BK7	092-0230R+1000
+1500	Plano-convex	BK7	092-0230R+1500
+2000	Plano-convex	BK7	092-0230R+2000
+4000	Plano-convex	BK7	092-0230R+4000
+5000	Plano-convex	BK7	092-0230R+5000
+50	Plano-convex	UV FS	092-3230R+50
+100	Plano-convex	UV FS	092-3230R+100
+150	Plano-convex	UV FS	092-3230R+150
+200	Plano-convex	UV FS	092-3230R+200
+300	Plano-convex	UV FS	092-3230R+300
+400	Plano-convex	UV FS	092-3230R+400
+500	Plano-convex	UV FS	092-3230R+500
+600	Plano-convex	UV FS	092-3230R+600
+800	Plano-convex	UV FS	092-3230R+800
+1000	Plano-convex	UV FS	092-3230R+1000
+1500	Plano-convex	UV FS	092-3230R+1500
+2000	Plano-convex	UV FS	092-3230R+2000
+4000	Plano-convex	UV FS	092-3230R+4000
+5000	Plano-convex	UV FS	092-3230R+5000

Related Products

Curved Windows. See page 1.6

Kinematic Mirror Mount 840-0010

Find more at EksmaOptics.com

Adapter for Mirror at 45° 840-0115

Find more at EksmaOptics.com

Spherical Mirrors. Diameter, D = 50.8 mm. Thickness (edge for plano-concave, center for plano-convex), T = 10.0 mm

Radius, mm	Substrate type	Substrate material	Catalogue number	
-100	Plano-concave	BK7	095-0130R-100	
-150	Plano-concave	BK7	095-0130R-150	
-200	Plano-concave	BK7	095-0130R-200	
-250	Plano-concave	BK7	095-0130R-250	
-300	Plano-concave	BK7	095-0130R-300	
-400	Plano-concave	BK7	095-0130R-400	
-500	Plano-concave	BK7	095-0130R-500	
-600	Plano-concave	BK7	095-0130R-600	
-800	Plano-concave	BK7	095-0130R-800	
-1000	Plano-concave	BK7	095-0130R-1000	
-1500	Plano-concave	BK7	095-0130R-1500	
-2000	Plano-concave	BK7	095-0130R-2000	
-2500	Plano-concave	BK7	095-0130R-2500	
-3000	Plano-concave	BK7	095-0130R-3000	
-4000	Plano-concave	BK7	095-0130R-4000	
-5000	Plano-concave	BK7	095-0130R-5000	
-6000	Plano-concave	BK7	095-0130R-6000	
-8000	Plano-concave	BK7	095-0130R-8000	
-10000	Plano-concave	BK7	095-0130R-10000	
-100	Plano-concave	UV FS	095-3130R-100	
-150	Plano-concave	UV FS	095-3130R-150	
-200	Plano-concave	UV FS	095-3130R-200	
-250	Plano-concave	UV FS	095-3130R-250	
-300	Plano-concave	UV FS	095-3130R-300	
-400	Plano-concave	UV FS	095-3130R-400	
-500	Plano-concave	UV FS	095-3130R-500	
-600	Plano-concave	UV FS	095-3130R-600	
-800	Plano-concave	UV FS	095-3130R-800	
-1000	Plano-concave	UV FS	095-3130R-1000	
-1500	Plano-concave	UV FS	095-3130R-1500	
-2000	Plano-concave	UV FS	095-3130R-2000	
-2500	Plano-concave	UV FS	095-3130R-2500	
-3000	Plano-concave	UV FS	095-3130R-3000	
-4000	Plano-concave	UV FS	095-3130R-4000	
-5000	Plano-concave	UV FS	095-3130R-5000	
-6000	Plano-concave	UV FS	095-3130R-6000	
-8000	Plano-concave	UV FS	095-3130R-8000	
-10000	Plano-concave	UV FS	095-3130R-10000	

Radius, mm	Substrate type	Substrate material	Catalogue number	
+100	Plano-convex	BK7	095-0230R+100	
+150	Plano-convex	BK7	095-0230R+150	
+200	Plano-convex	BK7	095-0230R+200	
+300	Plano-convex	BK7	095-0230R+300	
+400	Plano-convex	BK7	095-0230R+400	
+500	Plano-convex	BK7	095-0230R+500	
+600	Plano-convex	BK7	095-0230R+600	
+800	Plano-convex	BK7	095-0230R+800	
+1000	Plano-convex	BK7	095-0230R+1000	
+1500	Plano-convex	BK7	095-0230R+1500	
+2000	Plano-convex	BK7	095-0230R+2000	
+100	Plano-convex	UV FS	095-3230R+100	
+150	Plano-convex	UV FS	095-3230R+150	
+200	Plano-convex	UV FS	095-3230R+200	
+300	Plano-convex	UV FS	095-3230R+300	
+400	Plano-convex	UV FS	095-3230R+400	
+500	Plano-convex	UV FS	095-3230R+500	
+600	Plano-convex	UV FS	095-3230R+600	
+800	Plano-convex	UV FS	095-3230R+800	
+1000	Plano-convex	UV FS	095-3230R+1000	
+1500	Plano-convex	UV FS	095-3230R+1500	
+2000	Plano-convex	UV FS	095-3230R+2000	

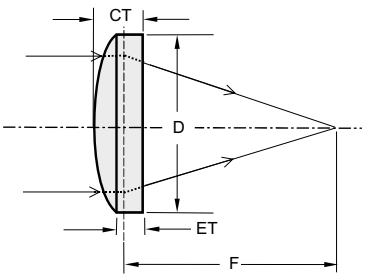
Most of Metal Coated mirrors are available for fast off-the-shelf delivery. Check the availability at **www.eksmaoptics.com**

Lenses
(UV FS, BK7, CaF_2)

PLANO-CONVEX LENSES

Features

- Positive focal length
- Converge incident light
- Form both real and virtual images
- Very close to the form minimising spherical aberration for infinite conjugate applications



These simplest form lenses have flat surface on one side and spherical surface on the other. They are widely used in telescopes, microscopes, collimators, optical transceivers, magnifiers, condenser systems and eyepieces.

Upon customer's request, lenses may be anti-reflection coated. For a required coating, please refer to the *Coatings Section*.

Standard lenses have a range of focal lengths – from 25 mm to 10000 mm, and diameters – from 12.7 mm to 50.8 mm.

Most of the Lenses are available for fast off-the-shelf delivery. Check the availability at **www.eksmaoptics.com**

Specifications

Material	BK7, UV FS, CaF_2	
Surface quality	40 – 20 scratch & dig (MIL-PRF-13830B)	
Clear aperture	90% of the diameter	
Diameter tolerance	+0.00 / -0.12 mm	
Thickness tolerance	±0.5 mm	
Surface irregularity	λ/8 @ 633 nm	
Surface irregularity for CaF_2	λ/4 @ 633 nm	
Concentricity	3 arcmin	
Paraxial focal length	BK7	±2% @ 546 nm
	UV FS	±2% @ 355 nm
	CaF_2	±2% @ 2940 nm

Please contact us if you can not find the lens that you need. We can provide a wide range of special focal lengths, diameters and coatings.

BK7 PLANO-CONVEX LENSES

Focal length F, mm	Diameter D, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Catalogue number
20.0	12.7	4.5	2.3	10.4	110-0104E
25.0	12.7	4.0	2.3	13.0	110-0105E
30.0	12.7	3.5	2.1	15.6	110-0106E
40.0	12.7	3.0	2.0	20.7	110-0107E
50.0	12.7	3.0	2.2	25.9	110-0109E
60.0	12.7	3.0	2.3	31.1	110-0111E
75.0	12.7	3.0	2.5	38.9	110-0115E
100.0	12.7	3.0	2.6	51.9	110-0117E
150.0	12.7	3.0	2.7	77.8	110-0121E
200.0	12.7	3.0	2.8	103.7	110-0123E
250.0	12.7	3.0	2.8	129.7	110-0125E
300.0	12.7	3.0	2.9	155.6	110-0126E
350.0	12.7	3.0	2.9	181.6	110-0127E
500.0	12.7	2.1	2.0	259.4	110-0129E

Focal length F, mm	Diameter D, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Catalogue number
1000.0	12.7	2.1	2.1	518.7	110-0135E
1500.0	12.7	2.1	2.1	778.1	110-0145E
30.0	25.4	8.5	1.9	15.6	110-0205E
40.0	25.4	6.1	1.8	20.7	110-0207E
50.0	25.4	5.0	1.7	25.9	110-0209E
60.0	25.4	4.4	1.7	31.1	110-0211E
75.0	25.4	4.0	1.9	38.9	110-0215E
90.0	25.4	3.8	2.0	46.7	110-0218E
100.0	25.4	3.5	1.9	51.9	110-0219E
125.0	25.4	3.2	1.9	64.8	110-0223E
150.0	25.4	3.0	2.0	77.8	110-0227E
175.0	25.4	3.0	2.1	90.8	110-0229E
200.0	25.4	3.0	2.2	103.7	110-0231E
250.0	25.4	3.0	2.4	129.7	110-0235E

Focal length F, mm	Diameter D, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Catalogue number	
300.0	25.4	3.0	2.5	155.6	110-0239E	18
350.0	25.4	3.0	2.6	181.6	110-0241E	18
400.0	25.4	3.0	2.6	207.5	110-0243E	
450.0	25.4	3.0	2.7	233.4	110-0245E	
500.0	25.4	3.0	2.7	259.4	110-0247E	
550.0	25.4	3.0	2.7	285.3	110-0248E	
600.0	25.4	3.0	2.7	311.2	110-0249E	
700.0	25.4	3.0	2.8	363.1	110-0251E	
800.0	25.4	3.0	2.8	415.0	110-0255E	
900.0	25.4	3.0	2.8	466.8	110-0257E	
1000.0	25.4	3.0	2.8	518.7	110-0259E	
1200.0	25.4	3.0	2.9	622.5	110-0263E	
1250.0	25.4	3.0	2.9	648.4	110-0264E	
1300.0	25.4	3.0	2.9	674.3	110-0265E	
1400.0	25.4	3.0	2.9	726.2	110-0266E	
1500.0	25.4	3.0	2.9	778.1	110-0267E	
1600.0	25.4	3.0	2.9	830.0	110-0268E	
1750.0	25.4	3.0	2.9	907.8	110-0269E	
1900.0	25.4	3.0	2.9	985.6	110-0270E	
2000.0	25.4	3.0	2.9	1037.4	110-0271E	
2500.0	25.4	3.0	2.9	1296.8	110-0275E	
3000.0	25.4	3.0	2.9	1556.2	110-0281E	
4000.0	25.4	3.0	3.0	2074.9	110-0285E	
5000.0	25.4	3.0	3.0	2593.6	110-0289E	
10000.0	25.4	3.0	3.0	5187.2	110-0295E	
50.0	38.1	12.0	3.7	25.9	110-0405E	
63.5	38.1	8.0	1.9	32.9	110-0406E	
75.0	38.1	7.3	2.3	38.9	110-0407E	
100.0	38.1	6.5	2.9	51.9	110-0409E	
150.0	38.1	5.1	2.7	77.8	110-0411E	
200.0	38.1	4.3	2.5	103.7	110-0415E	
250.0	38.1	4.0	2.6	129.7	110-0417E	
300.0	38.1	4.0	2.8	155.6	110-0419E	
350.0	38.1	4.0	3.0	181.6	110-0421E	

Focal length F, mm	Diameter D, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Catalogue number	
400.0	38.1	4.0	3.1	207.5	110-0423E	
500.0	38.1	4.0	3.3	259.4	110-0427E	
700.0	38.1	4.0	3.5	363.1	110-0435E	
1000.0	38.1	4.0	3.7	518.7	110-0445E	
2500.0	38.1	4.0	3.8	1296.8	110-0450E	
5000.0	38.1	4.0	3.9	2593.6	110-0455E	
75.0	50.8	12.3	2.9	38.9	110-0502E	
100.0	50.8	10.4	3.8	51.9	110-0505E	
150.0	50.8	7.2	2.9	77.8	110-0507E	
200.0	50.8	6.1	2.9	103.7	110-0509E	
250.0	50.8	5.4	2.9	129.7	110-0511E	
300.0	50.8	5.0	2.9	155.6	110-0515E	
350.0	50.8	4.7	2.9	181.6	110-0519E	
400.0	50.8	5.5	3.9	207.5	110-0523E	
500.0	50.8	5.2	4.0	259.4	110-0525E	
600.0	50.8	5.0	4.0	311.2	110-0527E	
650.0	50.8	5.0	4.0	337.2	110-0528E	
700.0	50.8	5.0	4.1	363.1	110-0529E	
800.0	50.8	5.0	4.2	415.0	110-0531E	
1000.0	50.8	5.0	4.4	518.7	110-0535E	
1500.0	50.8	5.0	4.6	778.1	110-0540E	
2000.0	50.8	5.0	4.7	1037.4	110-0545E	
5000.0	50.8	5.0	4.9	2593.6	110-0555E	
10000.0	50.8	5.0	4.9	5187.2	110-0565E	
250.0	76.2	12.7	7.0	129.7	110-0711E	
300.0	76.2	11.7	7.0	155.6	110-0715E	
400.0	76.2	10.5	7.0	207.5	110-0723E	
500.0	76.2	9.8	7.0	259.4	110-0725E	
750.0	76.2	8.9	7.0	389.0	110-0730E	
1000.0	76.2	8.4	7.0	518.7	110-0735E	
1500.0	76.2	7.9	7.0	778.1	110-0740E	
2000.0	76.2	7.7	7.0	1037.4	110-0745E	
3000.0	76.2	7.5	7.0	1556.2	110-0748E	

UV FS PLANO-CONVEX LENSES

Focal length F, mm	Diameter D, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Catalogue number	
25.0	12.7	4.0	2.2	11.9	110-1105E	
30.0	12.7	3.7	2.2	14.3	110-1106E	
40.0	12.7	2.5	1.1	19.0	110-1108E	
50.0	12.7	3.0	2.1	23.8	110-1109E	
75.0	12.7	3.0	2.4	35.7	110-1111E	
80.0	12.7	3.5	2.5	38.0	110-1112E	
90.0	12.7	3.5	3.0	42.8	110-1114E	
100.0	12.7	3.0	2.6	47.6	110-1115E	
125.0	12.7	3.0	2.7	59.4	110-1117E	
150.0	12.7	3.0	2.7	71.3	110-1119E	
175.0	12.7	3.0	2.8	83.2	110-1121E	
200.0	12.7	3.0	2.8	95.1	110-1123E	
250.0	12.7	3.0	2.8	118.9	110-1127E	
300.0	12.7	3.0	2.9	142.7	110-1129E	
350.0	12.7	3.0	2.9	166.4	110-1131E	
400.0	12.7	3.0	2.9	190.2	110-1133E	
750.0	12.7	3.0	2.9	357.1	110-1141E	
30.0	25.4	9.75	2.0	14.3	110-1203E	
40.0	25.4	7.0	2.1	19.0	110-1204E	
50.0	25.4	6.0	2.3	23.8	110-1205E	
60.0	25.4	5.0	2.0	28.5	110-1207E	
75.0	25.4	4.5	2.2	35.7	110-1209E	
80.0	25.4	4.6	2.4	38.0	110-1210E	

Focal length F, mm	Diameter D, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Catalogue number	
100.0	25.4	4.0	2.3	47.6	110-1211E	
125.0	25.4	4.0	2.6	59.4	110-1216E	
150.0	25.4	4.0	2.9	71.3	110-1217E	
175.0	25.4	4.0	3.0	83.2	110-1218E	
200.0	25.4	4.0	3.1	95.1	110-1219E	
250.0	25.4	4.0	3.3	118.9	110-1221E	
300.0	25.4	4.0	3.4	142.7	110-1223E	
350.0	25.4	4.0	3.5	166.4	110-1225E	
400.0	25.4	4.0	3.6	190.2	110-1227E	
500.0	25.4	4.0	3.7	237.8	110-1233E	
550.0	25.4	4.0	3.7	261.5	110-1234E	
600.0	25.4	4.0	3.7	285.3	110-1235E	
700.0	25.4	4.0	3.8	332.9	110-1238E	
750.0	25.4	4.0	3.8	356.6	110-1239E	
800.0	25.4	4.0	3.8	380.4	110-1240E	
1000.0	25.4	4.0	3.8	475.5	110-1245E	
1100.0	25.4	4.0	3.8	523.1	110-1246E	
1500.0	25.4	4.0	3.9	713.3	110-1255E	
2000.0	25.4	4.0	3.9	951.0	110-1265E	
5000.0	25.4	4.0	4.0	2377.5	110-1275E	
50.0	38.1	13.5	3.9	23.8	110-1405E	
75.0	38.1	8.6	3.1	35.7	110-1409E	
100.0	38.1	6.9	2.9	47.6	110-1411E	

Focal length F, mm	Diameter D, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Catalogue number
150.0	38.1	5.4	2.8	71.3	110-1415E
200.0	38.1	4.0	2.1	95.1	110-1419E
250.0	38.1	4.0	2.5	118.9	110-1423E
300.0	38.1	4.0	2.7	142.7	110-1427E
350.0	38.1	4.0	3.0	181.6	110-1421E
400.0	38.1	4.0	3.0	190.2	110-1431E
500.0	38.1	4.0	3.2	237.8	110-1435E
600.0	38.1	4.0	3.4	285.3	110-1439E
1000.0	38.1	4.0	3.6	475.5	110-1445E
1500.0	38.1	4.0	3.7	713.3	110-1455E
2500.0	38.1	4.0	3.8	1296.8	110-1450E
3000.0	38.1	4.0	3.9	1426.5	110-1465E
5000.0	38.1	4.0	3.9	2377.5	110-1475E
75.0	50.8	12.2	1.6	35.7	110-1505E
100.0	50.8	9.6	2.2	47.6	110-1509E
150.0	50.8	6.5	1.8	71.3	110-1511E
200.0	50.8	6.0	2.5	95.1	110-1515E
250.0	50.8	6.0	3.3	118.9	110-1517E
300.0	50.8	6.0	3.7	142.7	110-1519E
350.0	50.8	6.0	4.1	166.6	110-1521E
400.0	50.8	6.0	4.3	190.2	110-1523E
500.0	50.8	6.0	4.6	237.8	110-1527E
600.0	50.8	6.0	4.9	285.3	110-1531E
700.0	50.8	6.0	5.0	332.9	110-1533E
800.0	50.8	6.0	5.2	380.4	110-1535E
900.0	50.8	6.0	5.2	428.5	110-1540E
1000.0	50.8	6.0	5.3	475.5	110-1545E
1500.0	50.8	6.0	5.5	713.3	110-1550E
2000.0	50.8	6.0	5.7	951.0	110-1555E

Focal length F, mm	Diameter D, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Catalogue number
2500.0	50.8	6.0	5.7	1188.8	110-1565E
3000.0	50.8	6.0	5.8	1426.5	110-1564E
4000.0	50.8	6.0	5.8	1902.0	110-1566E
5000.0	50.8	5.0	4.9	2377.5	110-1567E
250.0	76.2	9.0	2.7	118.9	110-1717E
300.0	76.2	8.0	2.8	142.7	110-1719E
500.0	76.2	7.0	3.9	237.8	110-1727E
1000.0	76.2	6.0	4.5	475.5	110-1745E
1500.0	76.2	6.0	5.0	713.3	110-1750E
2000.0	76.2	6.0	5.2	951.0	110-1755E

We can supply custom cutting, edging, coating or complete fabrication if required.

Ordering of Coated Lenses

Please choose relevant coating from anti-reflection coatings section *(pages 1.5 - 1.6)*. The coating code and price should be added to the lens code and price.

Example:

BK7 pl/cx lens Ø12.7 mm, F=1500 mm, coated AR/AR@400-700 nm, AOI=0°

Code: **110-0145E** + **ARB550**,

Lens code | Coating code

CaF_2 PLANO-CONVEX LENSES

Focal length F, mm	Diameter D, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Catalogue number
25.0	12.7	4.1	2.0	10.5	110-5105E
50.0	12.7	3.0	2.0	20.9	110-5109E
75.0	12.7	2.6	2.0	31.4	110-5111E
100.0	12.7	2.5	2.0	41.8	110-5115E
150.0	12.7	2.3	2.0	62.7	110-5119E
200.0	12.7	2.2	2.0	83.6	110-5123E
250.0	12.7	2.2	2.0	104.6	110-5127E
500.0	12.7	2.1	2.0	209.1	110-5135E
1000.0	12.7	3.0	3.0	418.2	110-5145E
40.0	25.4	7.9	2.1	16.7	110-5204E
50.0	25.4	7.3	3.0	20.9	110-5205E
75.0	25.4	5.7	3.0	31.4	110-5209E
100.0	25.4	5.0	3.0	41.8	110-5211E
125.0	25.4	5.0	3.4	52.3	110-5213E
150.0	25.4	4.3	3.0	62.7	110-5217E
200.0	25.4	4.0	3.0	83.6	110-5219E
250.0	25.4	3.8	3.0	104.6	110-5221E
300.0	25.4	3.7	3.1	125.5	110-5222E
400.0	25.4	3.5	3.0	167.3	110-5228E
500.0	25.4	3.4	3.0	209.1	110-5223E
650.0	25.4	3.3	3.0	271.8	110-5229E
750.0	25.4	3.0	2.7	313.7	110-5225E
1000.0	25.4	3.2	3.0	418.2	110-5227E
1500.0	25.4	3.2	3.1	627.3	110-5235E

Focal length F, mm	Diameter D, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Catalogue number
2000.0	25.4	3.1	3.0	836.5	110-5240E
3000.0	25.4	3.1	3.0	1254.7	110-5245E
75.0	50.8	15.9	2.9	31.4	110-5509E
100.0	50.8	11.6	3.0	41.8	110-5511E
150.0	50.8	8.4	3.0	62.7	110-5517E
200.0	50.8	7.0	3.1	83.6	110-5519E
250.0	50.8	5.6	2.5	104.6	110-5520E
300.0	50.8	5.6	3.0	125.5	110-5522E
400.0	50.8	5.6	3.7	167.3	110-5524E
500.0	50.8	5.0	3.5	209.1	110-5523E
750.0	50.8	5.0	4.0	313.7	110-5528E
1000.0	50.8	5.0	4.2	418.2	110-5535E
1500.0	50.8	5.0	4.5	627.3	110-5545E
1700.0	50.8	5.0	4.5	711.0	110-5550E
2000.0	50.8	5.0	4.6	836.5	110-5555E

Housing accessories

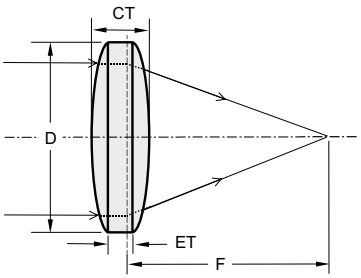
Self-Centering Lens Mounts 830-0010, 830-0020

Find more at EksmaOptics.com

BICONVEX LENSES

Features

- Have positive focal lengths
- Converge incident light
- Form both real and virtual images
- Minimise spherical aberration as well as cancel coma and distortion at a unit conjugate ratio



Biconvex lenses are all symmetrical, having equal radii on both sides. They are recommended for virtual imaging of real objects and for positive conjugate ratios from 0.2 up to 5. Outside this ratio range plano-convex lenses are usually more suitable. Biconvex lenses are used as magnifiers, objectives, some condensing systems.

Since both surfaces contribute to the power of biconvex lenses, they have shorter focal lengths than plano-convex lenses of equal diameter and surface radius.

Upon customer's request, lenses may be anti-reflection coated. For a required coating please refer to *Coatings Section*.

Specifications

Material	BK7, UV FS	
Surface quality	40 – 20 scratch & dig (MIL-PRF-13830B)	
Clear aperture	90% of the diameter	
Diameter tolerance	+0.00 / -0.12 mm	
Thickness tolerance	±0.5 mm	
Surface irregularity	λ/8 @ 633 nm	
Concentricity	3 arcmin	
Paraxial focal length	BK7	±2% @ 546 nm
	UV FS	±2% @ 355 nm

Please contact us if you can not find the lens that you need. We can provide a wide range of special focal lengths, diameters and coatings.

BK7 BICONVEX LENSES

Focal length F, mm	Diameter D, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Catalogue number	
12.7	12.7	4.8	1.3	12.3	111-0104E	
25.0	12.7	3.5	1.9	25.3	111-0108E	
40.0	12.7	2.5	1.5	41.1	111-0114E	
50.0	12.7	2.5	1.7	51.4	111-0116E	
60.0	12.7	2.5	1.8	61.8	111-0118E	
75.0	12.7	2.5	2.0	77.4	111-0120E	
100.0	12.7	2.0	1.6	103.4	111-0124E	
125.0	12.7	2.0	1.7	129.3	111-0128E	
150.0	12.7	2.0	1.7	155.3	111-0132E	
200.0	12.7	2.0	1.8	207.1	111-0136E	
250.0	12.7	2.0	1.8	259.0	111-0140E	
300.0	12.7	2.0	1.9	310.9	111-0144E	
400.0	12.7	2.0	1.9	414.6	111-0148E	
500.0	12.7	3.0	2.9	518.2	111-0152E	
25.0	25.4	9.0	1.8	24.3	111-0204E	
30.0	25.4	7.5	1.8	29.8	111-0206E	
40.0	25.4	6.0	1.9	40.4	111-0208E	
50.0	25.4	6.0	2.8	50.8	111-0210E	
60.0	25.4	4.0	1.4	61.6	111-0214E	
75.0	25.4	4.0	1.9	77.1	111-0216E	
100.0	25.4	4.0	2.4	103.1	111-0218E	
150.0	25.4	4.0	3.0	154.9	111-0222E	
200.0	25.4	4.0	3.2	206.8	111-0226E	
250.0	25.4	4.0	3.4	258.7	111-0228E	
300.0	25.4	4.0	3.5	310.5	111-0229E	
500.0	25.4	4.0	3.7	518.0	111-0234E	
700.0	25.4	4.0	3.8	725.5	111-0240E	
1000.0	25.4	4.0	3.8	1036.8	111-0250E	

Focal length F, mm	Diameter D, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Catalogue number	
50.0	38.1	10.5	3.0	50.0	111-0404E	
100.0	38.1	6.0	2.4	102.7	111-0410E	
150.0	38.1	5.0	2.6	154.8	111-0414E	
200.0	38.1	5.0	3.2	206.6	111-0418E	
250.0	38.1	5.0	3.6	258.5	111-0422E	
300.0	38.1	5.0	3.8	310.4	111-0426E	
400.0	38.1	5.0	4.1	414.1	111-0430E	
500.0	38.1	5.0	4.3	517.9	111-0434E	
700.0	38.1	5.0	4.5	725.4	111-0440E	
1000.0	38.1	5.0	4.6	1036.6	111-0450E	
50.0	50.8	15.6	1.4	49.1	111-0504E	
75.0	50.8	10.0	1.3	76.1	111-0508E	
100.0	50.8	8.5	2.1	102.3	111-0510E	
150.0	50.8	6.1	1.9	154.6	111-0512E	
200.0	50.8	5.0	1.9	206.6	111-0514E	
300.0	50.8	5.0	2.9	310.4	111-0518E	
400.0	50.8	5.0	3.4	414.1	111-0522E	
500.0	50.8	5.0	3.8	517.9	111-0526E	
750.0	50.8	5.0	4.2	777.2	111-0534E	
1000.0	50.8	5.0	4.4	1036.6	111-0544E	
1200.0	50.8	5.0	4.5	1244.1	111-0550E	
1500.0	50.8	5.0	4.6	1555.3	111-0555E	

Housing accessories

Self-Centering Lens Mounts 830-0010, 830-0020

Find more at EksmaOptics.com

UV FS BICONVEX LENSES

Focal length F, mm	Diameter D, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Catalogue number	
12.7	12.7	6.0	2.0	11.0	111-1104E	
25.0	12.7	3.5	1.7	23.2	111-1108E	
50.0	12.7	3.0	2.1	47.1	111-1114E	
75.0	12.7	2.5	1.9	70.9	111-1118E	
100.0	12.7	2.3	1.9	94.7	111-1122E	
150.0	12.7	2.2	1.9	142.3	111-1126E	
25.0	25.4	10.0	2.0	22.1	111-1204E	
40.0	25.4	7.1	2.6	36.9	111-1207E	
50.0	25.4	6.0	2.5	46.6	111-1210E	
75.0	25.4	4.0	1.7	70.8	111-1214E	
100.0	25.4	4.0	2.3	94.6	111-1218E	
150.0	25.4	3.2	2.1	142.3	111-1222E	
200.0	25.4	3.0	2.1	189.9	111-1226E	
250.0	25.4	3.0	2.3	237.6	111-1230E	
300.0	25.4	3.0	2.4	285.2	111-1234E	
400.0	25.4	3.0	2.6	380.4	111-1238E	
500.0	25.4	3.0	2.7	475.6	111-1240E	
750.0	25.4	3.0	2.8	713.6	111-1250E	
1000.0	25.4	3.0	2.8	951.7	111-1260E	

Focal length F, mm	Diameter D, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Catalogue number	
50.0	38.1	11.0	2.7	45.8	111-1404E	
100.0	38.1	5.4	1.5	94.3	111-1410E	
150.0	38.1	5.0	2.4	142.0	111-1414E	
200.0	38.1	5.0	3.1	189.6	111-1418E	
250.0	38.1	4.0	2.5	237.4	111-1422E	
300.0	38.1	5.0	3.7	284.8	111-1426E	
400.0	38.1	5.0	4.0	380.1	111-1430E	
500.0	38.1	5.0	4.2	475.3	111-1434E	
700.0	38.1	5.0	4.5	665.7	111-1440E	
1000.0	38.1	4.7	4.3	951.4	111-1460E	
50.0	50.8	17.3	1.4	44.6	111-1504E	
75.0	50.8	11.0	1.4	69.6	111-1508E	
100.0	50.8	10.0	3.0	93.6	111-1514E	
150.0	50.8	7.5	2.9	141.6	111-1517E	
175.0	50.8	6.6	2.7	165.6	111-1520E	
200.0	50.8	7.0	3.6	189.3	111-1522E	
250.0	50.8	6.0	3.3	237.1	111-1526E	
300.0	50.8	6.0	3.7	284.7	111-1530E	
500.0	50.8	6.0	4.6	474.1	111-1534E	
1000.0	50.8	6.0	5.3	951.2	111-1550E	

Ordering of Coated Lenses

Please choose relevant coating from anti-reflection coatings section *(pages 1.5 - 1.6)*. The coating code and price should be added to the lens code and price.

Example:

1) BK7 bi/cx lens Ø12.7 mm, F=400 mm, coated AR/AR@400-700 nm, AOI=0°

Code: **111-0148E** + **ARB550**,

Lens code | Coating code

2) BK7 bi/cx lens Ø38.1 mm, F=1000 mm, coated AR/AR@400-700 nm, AOI=0°

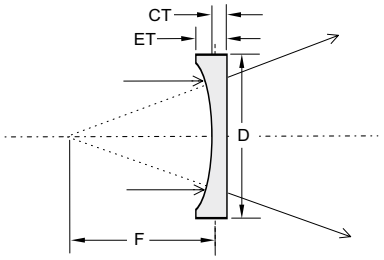
Code: **111-0450E** + **ARB550**,

Lens code | Coating code

PLANO-CONCAVE LENSES

Features

- Have negative focal lengths
- Diverge collimated incident light
- Form only virtual images which are seen through the lens
- Reduce spherical aberration, coma and distortion at negative-infinite or near-infinite conjugate ratios
- With the concave surface facing the longest conjugate distance



These lenses are thicker at the edge than in the centre and flat on one side. The plano- concave lenses are used to expand light beams or to increase focal lengths in optical systems. They are often employed for beam expansion of high peak power pulsed lasers. A beam incident on a concave surface will be focused to a point outside the instrument. Air heating and ionisation at the unwanted focal point are possible with corresponding mode disruption or material damage. To avoid this problem, the input lens should be reversed so that no concave surface faces a parallel beam.

A variety of anti-reflection coatings is available for these lenses. For an appropriate coating, please refer to the *Coatings Section*.

Most of the Lenses are available for fast off-the-shelf delivery. Check the availability at **www.eksmaoptics.com**

Specifications

Material	BK7, UV FS, CaF_2	
Surface quality	40 – 20 scratch & dig (MIL-PRF-13830B)	
Clear aperture	90% of the diameter	
Diameter tolerance	+0.00 / -0.12 mm	
Thickness tolerance	±0.5 mm	
Surface irregularity	λ/8 @ 633 nm	
Surface irregularity for CaF_2	λ/4 @ 546 nm	
Concentricity	3 arcmin	
Paraxial focal length	BK7	±2% @ 546 nm
	UV FS	±2% @ 355 nm
	CaF_2	±2% @ 2940 nm

Please contact us if you can not find the lens that you need. We can provide a wide range of special focal lengths, diameters and coatings.

BK7 PLANO-CONCAVE LENSES

Focal length F, mm	Diameter D, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Catalogue number
-25.0	12.7	1.9	3.5	-13.0	112-0105E
-50.0	12.7	2.7	3.5	-25.9	112-0109E
-60.0	12.7	2.4	3.1	-31.1	112-0112E
-75.0	12.7	2.9	3.4	-38.9	112-0115E
-100.0	12.7	3.0	3.4	-51.9	112-0117E
-125.0	12.7	3.1	3.4	-64.8	112-0119E
-150.0	12.7	3.2	3.5	-77.8	112-0121E
-200.0	12.7	3.3	3.5	-103.7	112-0123E
-250.0	12.7	3.3	3.5	-129.7	112-0125E
-300.0	12.7	2.9	3.0	-155.6	112-0127E
-30.0	25.4	1.4	7.9	-15.6	112-0205E
-40.0	25.4	1.7	6.0	-20.7	112-0207E
-50.0	25.4	2.7	6.0	-25.9	112-0209E
-75.0	25.4	2.9	5.0	-38.9	112-0215E
-100.0	25.4	3.1	4.7	-51.9	112-0219E
-125.0	25.4	3.0	4.3	-64.8	112-0223E
-150.0	25.4	2.7	3.7	-77.8	112-0227E
-200.0	25.4	3.0	3.8	-103.7	112-0231E
-250.0	25.4	3.1	3.7	-129.7	112-0235E
-300.0	25.4	3.1	3.6	-155.6	112-0239E

Focal length F, mm	Diameter D, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Catalogue number
-400.0	25.4	3.6	4.0	-207.5	112-0243E
-450.0	25.4	3.6	3.9	-233.4	112-0245E
-500.0	25.4	3.7	4.0	-259.4	112-0247E
-650.0	25.4	3.7	4.0	-337.2	112-0250E
-750.0	25.4	3.8	4.0	-389.0	112-0252E
-1000.0	25.4	3.8	4.0	-518.7	112-0259E
-1500.0	25.4	3.9	4.0	-778.1	112-0260E
-2000.0	25.4	3.9	4.0	-1037.4	112-0261E
-3000.0	25.4	3.9	4.0	-1556.2	112-0263E
-5000.0	25.4	4.0	4.0	-2593.6	112-0265E
-100.0	38.1	2.0	5.5	-51.9	112-0409E
-150.0	38.1	3.3	5.6	-77.8	112-0411E
-200.0	38.1	4.2	5.8	-103.7	112-0415E
-300.0	38.1	4.8	5.6	-155.6	112-0419E
-75.0	50.8	3.0	12.0	-38.9	112-0502E
-100.0	50.8	3.4	10.0	-51.9	112-0505E
-125.0	50.8	4.8	10.0	-64.8	112-0506E
-150.0	50.8	4.7	9.0	-77.8	112-0507E
-200.0	50.8	4.8	8.0	-103.7	112-0509E
-250.0	50.8	5.0	7.5	-129.7	112-0511E

UV FS PLANO-CONCAVE LENSES

Focal length F, mm	Diameter D, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Catalogue number	
-25.0	12.7	1.2	3.0	-11.9	112-1105E	
-50.0	12.7	2.1	3.0	-23.8	112-1109E	
-60.0	12.7	2.3	3.0	-28.5	112-1110E	
-75.0	12.7	2.4	3.0	-35.7	112-1111E	
-80.0	12.7	2.5	3.0	-38.1	112-1112E	
-90.0	12.7	2.5	3.0	-42.8	112-1114E	
-100.0	12.7	2.6	3.0	-47.6	112-1115E	
-125.0	12.7	2.7	3.0	-59.4	112-1117E	
-150.0	12.7	2.7	3.0	-71.3	112-1119E	
-175.0	12.7	2.8	3.0	-83.3	112-1121E	
-200.0	12.7	2.8	3.0	-95.2	112-1123E	
-250.0	12.7	2.8	3.0	-118.9	112-1127E	
-30.0	25.4	1.6	9.3	-14.3	112-1203E	
-50.0	25.4	1.9	5.5	-23.8	112-1205E	
-75.0	25.4	3.1	5.4	-35.7	112-1209E	
-100.0	25.4	3.0	4.7	-47.6	112-1211E	
-125.0	25.4	3.0	4.4	-59.5	112-1215E	
-150.0	25.4	3.1	4.2	-71.3	112-1217E	
-200.0	25.4	3.1	4.0	-95.2	112-1219E	

Focal length F, mm	Diameter D, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Catalogue number	
-250.0	25.4	3.3	4.0	-118.9	112-1221E	
-300.0	25.4	3.4	4.0	-142.8	112-1223E	
-400.0	25.4	3.6	4.0	-190.4	112-1227E	
-500.0	25.4	3.7	4.0	-237.8	112-1233E	
-750.0	25.4	3.8	4.0	-357.1	112-1239E	
-1000.0	25.4	3.8	4.0	-475.5	112-1245E	
-2000.0	25.4	3.9	4.0	-952.4	112-1250E	
-5000.0	25.4	2.0	2.0	-2380.0	112-1255E	
-100.0	38.1	2.4	6.4	-47.6	112-1411E	
-150.0	38.1	3.0	5.5	-71.4	112-1415E	
-200.0	38.1	3.0	4.9	-95.1	112-1419E	
-300.0	38.1	4.3	5.6	-142.7	112-1427E	
-100.0	50.8	5.0	11.9	-47.6	112-1509E	
-150.0	50.8	3.2	7.9	-71.4	112-1512E	
-250.0	50.8	3.1	5.7	-118.9	112-1517E	
-300.0	50.8	3.5	5.8	-142.8	112-1519E	
-500.0	50.8	4.7	6.0	-237.8	112-1527E	
-2000.0	50.8	5.8	6.0	-951.0	112-1540E	

CaF_2 PLANO-CONCAVE LENSES

Focal length F, mm	Diameter D, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Catalogue number	
-25.0	12.7	1.9	4.0	-10.5	112-5105E	
-50.0	12.7	2.0	3.0	-20.9	112-5109E	
-75.0	12.7	2.4	3.0	-31.4	112-5111E	
-100.0	12.7	2.5	3.0	-41.8	112-5115E	
-150.0	12.7	2.7	3.0	-62.7	112-5120E	
-200.0	12.7	1.8	2.0	-83.6	112-5125E	
-250.0	12.7	1.8	2.0	-104.6	112-5130E	
-500.0	12.7	1.9	2.0	-209.1	112-5135E	
-40.0	25.4	2.5	8.3	-16.7	112-5204E	
-50.0	25.4	2.7	7.0	-20.9	112-5205E	
-75.0	25.4	2.8	5.5	-31.4	112-5209E	
-100.0	25.4	3.0	5.0	-41.8	112-5211E	
-150.0	25.4	2.7	4.0	-62.7	112-5217E	
-200.0	25.4	3.0	4.0	-83.6	112-5219E	
-250.0	25.4	3.2	4.0	-104.6	112-5223E	
-300.0	25.4	3.4	4.0	-125.5	112-5225E	
-400.0	25.4	3.5	4.0	-167.3	112-5228E	
-500.0	25.4	2.6	3.0	-209.1	112-5230E	
-1000.0	25.4	2.8	3.0	-418.2	112-5235E	
-200.0	50.8	3.6	7.5	-83.6	112-5519E	
-300.0	50.8	3.0	5.6	-125.5	112-5525E	
-500.0	50.8	4.0	5.5	-209.1	112-5530E	

We can supply custom cutting, edging, coating or complete fabrication if required. If you do not find what you need in our catalogue, please send your specification or drawings for a custom quotation.

Housing accessories

Adjustable Lens Mounts 830-0030

Find more at EksmaOptics.com

Ordering of Coated Lenses

Please choose relevant coating from anti-reflection coatings section *(pages 1.5 - 1.6)*. The coating code and price should be added to the lens code and price.

Example:

BK7 pl/cv lens Ø12.7 mm, F=-250 mm, coated AR/AR@400-700 nm, AOI=0°

Code: **112-0125E** + **ARB550**,

Lens code | Coating code

BICONCAVE LENSES

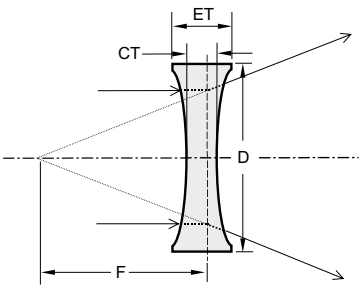
Features

- Have negative focal lengths, diverge collimated incident light
- Form only virtual images which are seen through the lens
- Minimise spherical aberration, coma and distortion at unit conjugate ratio

These lenses are symmetrical, having equal radii on both sides. Biconcave lenses are often used to expand light beams or to increase focal lengths in optical systems, and are normally used in combination with other lenses. Among the many devices utilising biconcave lenses are laser beam expanders, optical character readers, viewers and projection systems.

A variety of anti-reflection coatings is available for these lenses. For appropriate coating, please refer to the *Coatings Section*.

Most of the Lenses are available for fast off-the-shelf delivery. Check the availability at **www.eksmaoptics.com**



Specifications

Material	BK7, UV FS	
Surface quality	40 – 20 scratch & dig (MIL-PRF-13830B)	
Clear aperture	90% of the diameter	
Diameter tolerance	+0.00 / -0.12 mm	
Thickness tolerance	±0.5 mm	
Surface irregularity	λ/8 @ 633 nm	
Concentricity	3 arcmin	
Paraxial focal length	BK7	±2% @ 546 nm
	UV FS	±2% @ 355 nm

Please contact us if you can not find the lens that you need. We can provide a wide range of special focal lengths, diameters and coatings.

BK7 BICONCAVE LENSES

Focal length F, mm	Diameter D, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Catalogue number	
-12.7	12.7	3.2	5.5	-13.7	114-0104E	
-25.0	12.7	2.2	3.2	-26.3	114-0106E	
-40.0	12.7	2.4	3.1	-41.9	114-0108E	
-50.0	12.7	2.6	3.1	-52.3	114-0110E	
-60.0	12.7	2.6	3.0	-62.7	114-0112E	
-75.0	12.7	2.7	3.0	-78.3	114-0114E	
-100.0	12.7	2.8	3.0	-104.2	114-0118E	
-125.0	12.7	1.7	2.0	-130.0	114-0120E	
-150.0	12.7	1.8	2.0	-155.9	114-0124E	
-200.0	12.7	1.8	2.0	-207.8	114-0128E	
-250.0	12.7	1.8	2.0	-259.7	114-0132E	

Focal length F, mm	Diameter D, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Catalogue number	
-25.0	25.4	4.8	10.2	-26.7	114-0204E	
-40.0	25.4	2.7	6.2	-42.0	114-0206E	
-50.0	25.4	4.5	7.5	-52.6	114-0208E	
-60.0	25.4	2.6	5.2	-62.7	114-0210E	
-75.0	25.4	3.7	5.5	-78.4	114-0212E	
-100.0	25.4	3.2	4.6	-104.3	114-0214E	
-125.0	25.4	3.1	4.3	-130.2	114-0218E	
-150.0	25.4	3.0	4.0	-156.1	114-0220E	
-200.0	25.4	2.8	3.6	-208.0	114-0224E	
-250.0	25.4	2.9	3.5	-259.9	114-0228E	
-400.0	25.4	3.2	3.6	-415.5	114-0234E	
-500.0	25.4	3.2	3.5	-519.3	114-0238E	

Housing accessories

Variable Lens Holder 830-0040

Find more at EksmaOptics.com

Ordering of Coated Lenses

Please choose relevant coating from anti-reflection coatings section *(pages 1.5 - 1.6)*. The coating code and price should be added to the lens code and price.

Example:

BK7 bi/cv lens Ø12.7 mm, F=-250 mm, coated AR/AR@400-700 nm, AOI=0°

Code: **114-0132E** + **ARB550**,

Lens code | Coating code

UV FS BICONCAVE LENSES

Focal length F, mm	Diameter D, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Catalogue number	
-12.7	12.7	3.7	6.7	-12.6	114-1104E	
-25.0	12.7	2.8	4.0	-24.2	114-1108E	
-30.0	12.7	3.0	4.0	-29.0	114-1110E	
-50.0	12.7	2.6	3.2	-48.0	114-1114E	
-75.0	12.7	2.7	3.1	-71.8	114-1118E	
-100.0	12.7	2.8	3.0	-95.5	114-1122E	
-25.0	25.4	5.3	12.0	-24.6	114-1204E	
-30.0	25.4	3.0	7.5	-29.0	114-1205E	
-50.0	25.4	2.6	6.0	-48.0	114-1208E	
-75.0	25.4	3.8	6.1	-71.9	114-1212E	
-100.0	25.4	3.6	5.3	-95.7	114-1216E	
-150.0	25.4	4.4	5.3	-143.4	114-1220E	
-200.0	25.4	3.0	3.8	-190.7	114-1224E	

Please contact us for other size, focus or precision requirements.

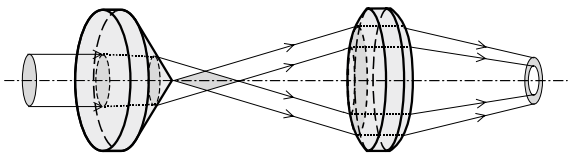
CONICAL LENSES (AXICONS)

Features

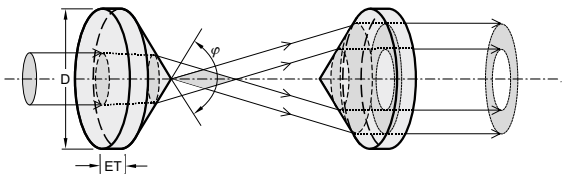
- Precision and standard grade axicons
- Can be made from most optical materials
- Can be supplied with AR and BBAR coatings

We can supply custom cutting, edging, coating or complete fabrication if required. If you cannot find your axicons needed, please send your specification or drawings for a custom quotation.

An axicon with a spherical lens produces an annular focus.



Two axicons together produce a thick-walled hollow "pipe" of light.



PRECISION GRADE PLANO-CONVEX AXICONS

Apex angle φ, deg	Diameter D, mm	Edge thickness ET, mm	Centre thickness CT, mm	Catalogue number	
90	25.4	3.5	16.2	131-1290	
130	25.4	3.5	9.4	131-1230	
140	25.4	3.5	8.1	131-1240	
160	25.4	3.5	5.7	131-1260	
165	25.4	3.5	5.2	131-1265	
170	25.4	3.5	4.6	131-1270	
175	25.4	3.5	4.1	131-1275	
176	25.4	3.5	3.9	131-1276	
177	25.4	3.5	3.8	131-1277	
178	25.4	3.5	3.7	131-1278	
179	25.4	3.5	3.6	131-1279	
160	50.8	5	9.4	131-1560	
170	50.8	5	7.2	131-1570	
176	50.8	5	5.9	131-1576	
178	50.8	5	5.4	131-1578	
179	50.8	5	5.2	131-1579	

Specifications

Material	UVFS
Surface quality	40 – 20 scratch & dig (MIL-PRF-13830B)
Clear aperture	90% of the diameter
Diameter tolerance	+0.00 / -0.1 mm
Angle tolerance	±0.05° (±3 arcmin)
Surface irregularity	S1 (conical): ±0.5μm S2 (flat): λ/4 @ 633 nm
Apex rounding	< Ø1 mm

Housing accessories

Universal Adjustable Lens/Optics Mount 830-0035

Find more at EksmaOptics.com

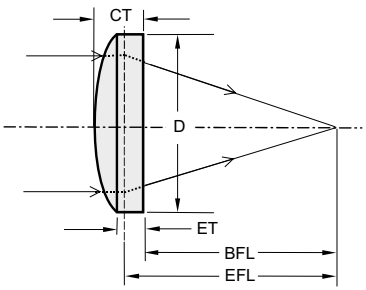
STANDARD PLANO-CONVEX AXICONS

Apex angle φ, deg	Diameter D, mm	Edge thickness ET, mm	Centre thickness CT, mm	BK7		UV FS	
				Catalogue number		Catalogue number	
140	25.4	8	12.6	130-0240		130-1240	
160	25.4	8	10.2	130-0260		130-1260	
165	25.4	8	9.7	130-0265		130-1265	
170	25.4	8	9.1	130-0270		130-1270	
175	25.4	8	8.6	130-0275		130-1275	
178	25.4	8	8.2	130-0278		130-1278	

Specifications

Material	BK7, UV FS
Surface quality	60 – 40 scratch & dig (MIL-PRF-13830B)
Clear aperture	90% of the diameter
Diameter tolerance	+0.00 / -0.12 mm
Angle tolerance	±0.5°
Surface irregularity	S1 (conical): ±2.5 µm S2 (flat): λ @ 633 nm

PRECISION ASPHERICAL LENSES



Aspherical lenses are designed to reduce spherical aberration. Complex multi-lens systems designed for compensation of spherical aberration can often be replaced with a single aspheric lens. We can produce aspherical lenses of custom design using your drawings or specifications in our CNC lens polishing facility.

Specifications

Standard material [Refractive index]	N-BK7 [1.517] S-LAH64 [1.788] UVFS [1.453]
Design wavelength	780 nm
Surface quality	40 – 20 scratch & dig (uncoated)
Clear aperture	>90% of diameter
Diameter tolerance	+0.0 / -0.05 mm
Bevel	0.3 mm max @ 45°
Center thickness tolerance	≤0.05 mm
EFL tolerance	≤0.1%
Asphere figure error P-V	±1 µm
Surface form deviation RMS	≤0.5 µm

Aspheric lenses with surface figure error P-V <0.6 µm are available on request.

Substrate	D, mm	EFL, mm	BFL, mm	CT, mm	CA, mm	NA	Catalogue number	
S-LAH64	12.5	10	7.6	4.3	11.3	0.544	116-1210	
UVFS	12.7	20	17	4.4	11.4	0.275	117-1220	
UVFS	12.7	25	22	3.8	11.4	0.223	117-1225	
N-BK7	12.5	25	22.4	4.0	11.3	0.227	115-1225	
UVFS	12.7	15	11.4	5.3	11.4	0.356	117-1215	
UVFS	12.7	30	27.6	3.5	11.4	0.187	117-1230	
UVFS	12.7	40	36.2	5.5	11.4	0.144	117-1240	
S-LAH64	25	20	15.7	7.6	22.5	0.543	116-2520	
N-BK7	25	50	46	6.0	22.5	0.232	115-2550	
N-BK7	25	32	27.4	7.0	22.5	0.359	115-2532	
UVFS	25.4	20	9.9	14.7	22.9	0.496	117-2520	
UVFS	25.4	25	17.8	10.5	22.9	0.416	117-2525	
UVFS	25.4	30	24.5	8.0	22.9	0.398	117-2530	
UVFS	25.4	40	35.9	6.0	22.9	0.292	117-2540	
UVFS	25.4	50	46.6	5.0	22.9	0.232	117-2550	
UVFS	25.4	60	56.6	5.0	22.9	0.192	117-2560	
S-LAH64	50	40	31.3	15.5	45.0	0.554	116-5040	
N-BK7	50	100	93.4	10.0	45.0	0.237	115-5100	
UVFS	50.8	50	37.0	18.9	45.7	0.416	117-5050	
UVFS	50.8	60	49.5	15.2	45.7	0.356	117-5060	
UVFS	50.8	75	66.7	12.1	45.7	0.292	117-5075	
UVFS	50.8	100	93.6	9.4	45.7	0.223	117-5100	

PLANO-CYLINDRICAL LENSES

Features

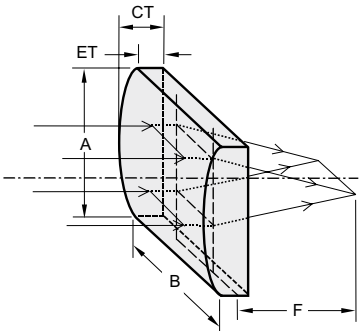
- Condense or expand light in one dimension only
- Ideal for producing line images, for scanning and projection

We offer a selection of cylindrical lenses that are either plano-convex or plano-concave in form and rectangular in shape. These lenses are used to focus light to a thin line in laser scanners, spectroscopy, dye lasers, acousto-optics, optical processors and other similar applications. They are the best for circularisation of diode laser outputs, energy collection for linear detectors or for coupling to a slit input.

Earlier remarks made about plano-convex and plano-concave spherical lenses with regard to aberrations and conjugate ratios are also applicable to cylindrical lenses.

A variety of anti-reflection coatings is available for these lenses. For an appropriate coating, please refer to the *Coatings Section*.

Please contact us for other size, focus or precision requirements. We can supply custom cutting, edging, coating or complete fabrication if required.



Specifications

Material	BK7, UV FS	
Surface quality	40 – 20 scratch & dig (MIL-PRF-13830B)	
Clear aperture	90% of the diameter	
Size tolerance	±0.5 mm	
Thickness tolerance	±0.5 mm	
Surface irregularity	λ/4 @ 633 nm	
Paraxial focal length	BK7	±2% @ 546 nm
	UV FS	±2% @ 355 nm

BK7 PLANO-CONVEX CYLINDRICAL LENSES

Focal length F, mm	Dimensions A, mm	Dimensions B, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Catalogue number	
15	12.7	12.7	4.8	1.5	7.8	120-0105E	
25	19.1	25.4	6.1	2.0	13.0	120-0110E	
25	25.4	25.4	14	2.5	13.0	120-0202E	
30	25.4	25.4	8.5	2.0	15.6	120-0201E	
40	25.4	25.4	6.4	2.0	20.7	120-0203E	
50	25.4	25.4	5.2	2.0	25.9	120-0204E	
50	25.4	50.8	5.2	2.0	25.9	120-0205E	
75	25.4	25.4	4.1	2.0	38.9	120-0209E	
75	25.4	50.8	4.1	2.0	38.9	120-0210E	
100	25.4	25.4	3.5	2.0	51.9	120-0214E	
100	25.4	50.8	3.5	2.0	51.9	120-0215E	
150	25.4	25.4	3.0	2.0	77.8	120-0219E	
150	25.4	50.8	3.0	2.0	77.8	120-0220E	
200	25.4	25.4	2.8	2.0	103.7	120-0224E	
200	25.4	50.8	2.8	2.0	103.7	120-0225E	
300	25.4	25.4	2.5	2.0	155.6	120-0229E	
300	25.4	50.8	2.5	2.0	155.6	120-0230E	
500	25.4	25.4	2.4	2.0	259.4	120-0234E	
500	25.4	50.8	2.4	2.0	259.4	120-0235E	
1000	25.4	25.4	2.3	2.0	518.7	120-0239E	
1000	25.4	50.8	2.3	2.0	518.7	120-0240E	
1500	25.4	25.4	2.2	2.0	778.1	120-0244E	
1500	25.4	50.8	2.2	2.0	778.1	120-0245E	

UV FS PLANO-CONVEX CYLINDRICAL LENSES

Focal length F, mm	Dimensions		Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Catalogue number	
	A, mm	B, mm					
15	12.7	12.7	4.9	2.0	7.1	120-1104E	
25	19.1	25.4	8.0	3.0	11.9	120-1105E	
30	25.4	25.4	10.0	2.5	14.3	120-1201E	
40	25.4	25.4	8.0	3.1	19.0	120-1203E	
50	25.4	25.4	7.1	3.5	23.8	120-1204E	
50	25.4	50.8	7.1	3.5	23.8	120-1205E	
75	25.4	25.4	5.6	3.3	35.7	120-1209E	
75	25.4	50.8	5.6	3.3	35.7	120-1210E	
100	25.4	25.4	4.7	3.0	47.6	120-1214E	
100	25.4	50.8	4.7	3.0	47.6	120-1215E	
125	25.4	25.4	4.4	3.0	59.4	120-1217E	
150	25.4	25.4	4.1	3.0	71.3	120-1219E	
150	25.4	50.8	4.1	3.0	71.3	120-1220E	
200	25.4	25.4	4.3	3.5	95.1	120-1224E	
200	25.4	50.8	4.3	3.5	95.1	120-1225E	
250	25.4	25.4	4.2	3.5	118.9	120-1226E	
250	25.4	50.8	4.2	3.5	118.9	120-1227E	
300	25.4	25.4	4.1	3.5	142.7	120-1229E	
300	25.4	50.8	4.1	3.5	142.7	120-1230E	
500	25.4	25.4	3.8	3.5	237.8	120-1234E	
500	25.4	50.8	3.8	3.5	237.8	120-1235E	
1000	25.4	25.4	2.5	2.3	475.5	120-1239E	
1000	25.4	50.8	2.5	2.3	475.5	120-1240E	
1500	25.4	25.4	2.2	2.0	713.3	120-1244E	
1500	25.4	50.8	2.2	2.0	713.3	120-1245E	

BK7 PLANO-CONCAVE CYLINDRICAL LENSES

Focal length F, mm	Dimensions		Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Catalogue number	
	A, mm	B, mm					
-15	12.7	12.7	1.4	3.7	-7.8	122-0105E	
-25	19.1	25.4	2.0	6.0	-13.0	122-0110E	
-50	25.4	25.4	2.0	5.2	-25.9	122-0204E	
-50	25.4	50.8	2.0	5.2	-25.9	122-0205E	
-75	25.4	25.4	2.0	4.1	-38.9	122-0209E	
-75	25.4	50.8	2.0	4.1	-38.9	122-0210E	
-100	25.4	25.4	2.0	3.5	-51.9	122-0214E	
-100	25.4	50.8	2.0	3.5	-51.9	122-0215E	
-150	25.4	25.4	2.0	3.0	-77.8	122-0219E	
-150	25.4	50.8	2.0	3.0	-77.8	122-0220E	
-200	25.4	25.4	2.0	2.8	-103.7	122-0224E	
-200	25.4	50.8	2.0	2.8	-103.7	122-0225E	
-250	25.4	25.4	2.0	2.7	-129.7	122-0226E	
-250	25.4	50.8	2.0	2.7	-129.7	122-0227E	
-300	25.4	25.4	2.0	2.5	-155.6	122-0229E	
-300	25.4	50.8	2.0	2.5	-155.6	122-0230E	
-500	25.4	25.4	2.0	2.4	-259.4	122-0234E	
-500	25.4	50.8	2.0	2.4	-259.4	122-0235E	

UV FS PLANO-CONCAVE CYLINDRICAL LENSES

Focal length F, mm	Dimensions A, mm	Dimensions B, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Catalogue number	
-15	12.7	12.7	2.0	4.9	-7.1	122-1104E	
-25	19.1	25.4	3.0	8.0	-11.9	122-1105E	
-30	25.4	25.4	2.5	10.0	-14.3	122-1201E	
-50	25.4	25.4	3.5	7.1	-23.8	122-1204E	
-50	25.4	50.8	3.5	7.1	-23.8	122-1205E	
-75	25.4	25.4	3.3	5.6	-35.7	122-1209E	
-75	25.4	50.8	3.3	5.6	-35.7	122-1210E	
-100	25.4	25.4	3.0	4.7	-47.6	122-1214E	
-100	25.4	50.8	3.0	4.7	-47.6	122-1215E	
-150	25.4	25.4	3.0	4.1	-71.3	122-1219E	
-150	25.4	50.8	3.0	4.1	-71.3	122-1220E	
-200	25.4	25.4	3.8	4.6	-95.1	122-1224E	
-200	25.4	50.8	3.8	4.6	-95.1	122-1225E	
-300	25.4	25.4	3.5	4.1	-142.7	122-1229E	
-300	25.4	50.8	3.5	4.1	-142.7	122-1230E	
-500	25.4	25.4	3.5	3.8	-237.8	122-1234E	
-500	25.4	50.8	3.5	3.8	-237.8	122-1235E	

Ordering of Coated Lenses

Please choose relevant coating from anti-reflection coatings section *(pages 1.5 - 1.6)*. The coating code and price should be added to the lens code and price.

Example:

BK7 pl/cx cylindrical lens, dimensions: 10×10 mm, F = 15 mm, coated AR/AR @ 400-700 nm, AOI=0°

Code: **120-0105 E + ARB550**,

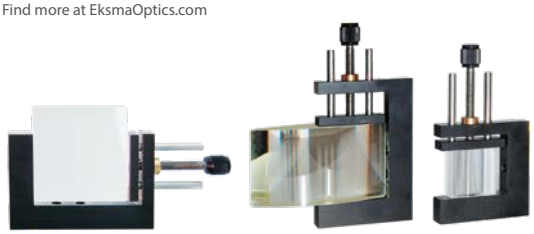
Lens code | Coating code

English or Metric Dimensions. *Can be omitted if not important*

Housing accessories

Rectangular Optics Holders 830-0100, 830-0110

Find more at EksmaOptics.com



For applications where fine adjusment is required, use Prism Holders 840-0160 , 840-0170

Find more at EksmaOptics.com

LENS KITS

Lens kits contain different types (plano-convex, biconvex, plano-concave, biconcave) of Ø25.4 mm lenses with various focal lengths. Kits are packed into foam lined plastic the new plastic boxes for safe handling and storage.

Large lens kit consists of 40 lenses and small lens kit consists of 15 lenses made either of N-BK7 glass or UVFS. Kits are available uncoated, as well as BBAR coated or with AR coatings for particular laser wavelengths.

SPHERICAL N-BK7 LENS KITS

Small Lens Kit

Please refer to Nd:YAG Laser Line *(see page 3.13)* or Femtoline *(see page 4.20)* section for lens kits with AR coated lenses for particular laser applications.

Small kit of 15 pcs. N-BK7 lenses

Coating	Catalogue number	
uncoated	140-0215	
BBAR @ 400 – 700 nm, R<0.9%	140-0215-AR400-700	
BBAR @ 650 – 1100 nm, R<1.0%	140-0215-AR650-1100	
BBAR @ 1050 – 1700 nm, R<1.0%	140-0215-AR1050-1700	
AR @ 532 + 1064 nm, R<0.5%	140-0215-AR532+1064	
AR @ 1064 nm, R<0.25%	140-0215-AR1064	
AR @ 532 nm, R<0.25%	140-0215-AR532	

Small BK7 Lens Kit

Type	Dia, mm	F, mm	Catalogue nr.
pl/cx	25.4	30	110-0205E
pl/cx	25.4	40	110-0207E
pl/cx	25.4	50	110-0209E
pl/cx	25.4	60	110-0211E
pl/cx	25.4	75	110-0215E
pl/cx	25.4	100	110-0219E
pl/cx	25.4	150	110-0227E
pl/cx	25.4	200	110-0231E

Type	Dia, mm	F, mm	Catalogue nr.
pl/cx	25.4	500	110-0247E
pl/cx	25.4	1000	110-0259E
pl/cv	25.4	-40	112-0207E
pl/cv	25.4	-50	112-0209E
pl/cv	25.4	-75	112-0215E
pl/cv	25.4	-100	112-0219E
pl/cv	25.4	-150	112-0227E

Large kit of 40 pcs. N-BK7 lenses

Coating	Catalogue number	
uncoated	140-0240	
BBAR @ 400 – 700 nm, R<0.9%	140-0240-AR400-700	
BBAR @ 650 – 1100 nm, R<1.0%	140-0240-AR650-1100	
BBAR @ 1050 – 1700 nm, R<1.0%	140-0240-AR1050-1700	
AR @ 532 + 1064 nm, R<0.5%	140-0240-AR532+1064	
AR @ 1064 nm, R<0.25%	140-0240-AR1064	
AR @ 532 nm, R<0.25%	140-0240-AR532	

Large BK7 Lens Kit

Type	Dia, mm	F, mm	Catalogue nr.
pl/cx	25.4	30	110-0205E
pl/cx	25.4	40	110-0207E
pl/cx	25.4	50	110-0209E
pl/cx	25.4	60	110-0211E
pl/cx	25.4	75	110-0215E
pl/cx	25.4	100	110-0219E
pl/cx	25.4	125	110-0223E
pl/cx	25.4	150	110-0227E
pl/cx	25.4	200	110-0231E
pl/cx	25.4	250	110-0235E
pl/cx	25.4	300	110-0239E
pl/cx	25.4	350	110-0241E
pl/cx	25.4	400	110-0243E
pl/cx	25.4	500	110-0247E

Type	Dia, mm	F, mm	Catalogue nr.
pl/cx	25.4	700	110-0251E
pl/cx	25.4	1000	110-0259E
bi/cx	25.4	25	111-0204E
bi/cx	25.4	30	111-0206E
bi/cx	25.4	40	111-0208E
bi/cx	25.4	50	111-0210E
bi/cx	25.4	60	111-0214E
bi/cx	25.4	75	111-0216E
bi/cx	25.4	100	111-0218E
bi/cx	25.4	150	111-0222E
bi/cx	25.4	200	111-0226E
bi/cx	25.4	250	111-0228E
bi/cx	25.4	500	111-0234E
bi/cx	25.4	1000	111-0250E

Type	Dia, mm	F, mm	Catalogue nr.
pl/cv	25.4	-40	112-0207E
pl/cv	25.4	-50	112-0209E
pl/cv	25.4	-75	112-0215E
pl/cv	25.4	-100	112-0219E
pl/cv	25.4	-150	112-0227E
pl/cv	25.4	-200	112-0231E
bi/cv	25.4	-25	114-0204E
bi/cv	25.4	-50	114-0208E
bi/cv	25.4	-75	114-0212E
bi/cv	25.4	-100	114-0214E
bi/cv	25.4	-150	114-0220E
bi/cv	25.4	-200	114-0224E

SPHERICAL UV FS LENS KITS

Large Lens Kit

Related products

Tweezers/Forceps for Optical Components
260-1050

See page A.4

Small kit of 15 pcs. UV FS lenses

Coating	Catalogue number	
uncoated	140-1215	
BBAR @ 210 – 400 nm, R<2%	140-1215-AR210-400	
BBAR @ 350 – 900 nm, R<1.5%	140-1215-AR350-900	
BBAR @ 760 – 840 nm, R<0.4%	140-1215-AR760-840	
BBAR @ 700 – 900 nm, R<0.8%	140-1215-AR700-900	
BBAR @ 650 – 1100 nm, R<1%	140-1215-AR650-1100	
AR @ 532 + 1064 nm, R<0.5%	140-1215-AR532+1064	
AR @ 1064 nm, R<0.25%	140-1215-AR1064	
AR @ 532 nm, R<0.25%	140-1215-AR532	
AR @ 355 nm, R<0.25%	140-1215-AR355	
AR @ 266 nm, R<0.4%	140-1215-AR266	
AR @ 1030 nm, R<0.25%	140-1215-AR1030	
AR @ 515 nm, R<0.25%	140-1215-AR515	
AR @ 343 nm, R<0.3%	140-1215-AR343	
AR @ 258 nm, R<0.4%	140-1215-AR258	

Small UV FS Lens Kit

Type	Dia, mm	F, mm	Catalogue nr.
pl/cx	25.4	30	110-1203E
pl/cx	25.4	50	110-1205E
pl/cx	25.4	75	110-1209E
pl/cx	25.4	100	110-1211E
pl/cx	25.4	125	110-1216E
pl/cx	25.4	150	110-1217E
pl/cx	25.4	200	110-1219E
pl/cx	25.4	300	110-1223E

Type	Dia, mm	F, mm	Catalogue nr.
pl/cx	25.4	500	110-1233E
pl/cx	25.4	1000	110-1245E
pl/cv	25.4	-50	112-1205E
pl/cv	25.4	-75	112-1209E
pl/cv	25.4	-100	112-1211E
pl/cv	25.4	-125	112-1215E
pl/cv	25.4	-150	112-1217E

Large kit of 40 pcs. UV FS lenses

Coating	Catalogue number	
uncoated	140-1240	
BBAR @ 210 – 400 nm, R<2%	140-1240-AR210-400	
BBAR @ 350 – 900 nm, R<1.5%	140-1240-AR350-900	
BBAR @ 760 – 840 nm, R<0.4%	140-1240-AR760-840	
BBAR @ 700 – 900 nm, R<0.8%	140-1240-AR700-900	
BBAR @ 650 – 1100 nm, R<1%	140-1240-AR650-1100	
AR @ 532 + 1064 nm, R<0.5%	140-1240-AR532+1064	
AR @ 1064 nm, R<0.25%	140-1240-AR1064	
AR @ 532 nm, R<0.25%	140-1240-AR532	
AR @ 355 nm, R<0.25%	140-1240-AR355	
AR @ 266 nm, R<0.4%	140-1240-AR266	
AR @ 1030 nm, R<0.25%	140-1240-AR1030	
AR @ 515 nm, R<0.25%	140-1240-AR515	
AR @ 343 nm, R<0.3%	140-1240-AR343	
AR @ 258 nm, R<0.4%	140-1240-AR258	

Large UV FS Lens Kit

Type	Dia, mm	F, mm	Catalogue nr.
pl/cx	25.4	30	110-1203E
pl/cx	25.4	50	110-1205E
pl/cx	25.4	75	110-1209E
pl/cx	25.4	80	110-1210E
pl/cx	25.4	100	110-1211E
pl/cx	25.4	125	110-1216E
pl/cx	25.4	150	110-1217E
pl/cx	25.4	200	110-1219E
pl/cx	25.4	250	110-1221E
pl/cx	25.4	300	110-1223E
pl/cx	25.4	350	110-1225E

Type	Dia, mm	F, mm	Catalogue nr.
pl/cx	25.4	400	110-1227E
pl/cx	25.4	500	110-1233E
pl/cx	25.4	600	110-1235E
pl/cx	25.4	750	110-1239E
pl/cx	25.4	1000	110-1245E
bi/cx	25.4	25	111-1204E
bi/cx	25.4	40	111-1207E
bi/cx	25.4	50	111-1210E
bi/cx	25.4	75	111-1214E
bi/cx	25.4	100	111-1218E
bi/cx	25.4	150	111-1222E

Type	Dia, mm	F, mm	Catalogue nr.
bi/cx	25.4	200	111-1226E
bi/cx	25.4	250	111-1230E
bi/cx	25.4	300	111-1234E
bi/cx	25.4	400	111-1238E
bi/cx	25.4	500	111-1240E
bi/cx	25.4	1000	111-1260E
pl/cv	25.4	-50	112-1205E
pl/cv	25.4	-75	112-1209E
pl/cv	25.4	-100	112-1211E

Type	Dia, mm	F, mm	Catalogue nr.
pl/cv	25.4	-150	112-1217E
pl/cv	25.4	-200	112-1219E
pl/cv	25.4	-300	112-1223E
bi/cv	25.4	-25	114-1204E
bi/cv	25.4	-50	114-1208E
bi/cv	25.4	-75	114-1212E
bi/cv	25.4	-100	114-1216E
bi/cv	25.4	-150	114-1220E
bi/cv	25.4	-200	114-1224E

CYLINDRICAL N-BK7 LENS KIT

Cylindrical Lens Kit of 12 pcs. N-BK7 lenses

Coating	Catalogue number	
uncoated	140-0212	
BBAR @ 400 – 700 nm, R<0.9%	140-0212-AR400-700	
BBAR @ 650 – 1100 nm, R<0.7%	140-0212-AR650-1100	
BBAR @ 1050 – 1700 nm, R<0.7%	140-0212-AR1050-1700	
AR @ 1064 nm, R<0.25%	140-0212-AR1064	
AR @ 532 + 1064 nm, R<0.5%	140-0212-ARD1064	

Cylindrical N-BK7 lens kit

Type	Size, mm	F, mm	Catalogue nr.
pl/cx	25.4 x 50.8	50	120-0205E
pl/cx	25.4 x 50.8	75	120-0210E
pl/cx	25.4 x 50.8	100	120-0215E
pl/cx	25.4 x 50.8	150	120-0220E
pl/cx	25.4 x 50.8	200	120-0225E
pl/cx	25.4 x 50.8	300	120-0230E
pl/cx	25.4 x 50.8	500	120-0235E

Type	Size, mm	F, mm	Catalogue nr.
pl/cx	25.4 x 50.8	1000	120-0240E
pl/cv	25.4 x 50.8	-50	122-0205E
pl/cv	25.4 x 50.8	-75	122-0210E
pl/cv	25.4 x 50.8	-100	122-0215E
pl/cv	25.4 x 50.8	-150	122-0220E

CYLINDRICAL UV FS LENS KIT

Cylindrical Lens Kit of 12 pcs. UV FS lenses

Coating	Catalogue number	
uncoated	140-1212	
BBAR @ 210 – 400 nm, R<2%	140-0212-ARB300	
BBAR @ 350 – 900 nm, R<1.5%	140-0212-ARB625	
BBAR @ 700 – 900 nm, R<0.5%	140-0212-ARB800	
BBAR @ 700 – 900 nm, R<0.1%	140-0212-ARB800HT	
BBAR @ 650 – 1100 nm, R<0.7%	140-0212-ARB825	
BBAR @ 900 – 1100 nm, R<0.1%	140-0212-ARB1000HT	
AR @ 515 + 1030 nm, R<0.5%	140-0212-ARD1030	
AR @ 515 + 1030 nm, R<0.1%	140-0212-ARD1030HT	
AR @ 1000 – 1060 nm, R<0.3%	140-0212-AR1030	

Cylindrical UV FS lens kit

Type	Size, mm	F, mm	Catalogue nr.
pl/cx	25.4 x 50.8	50	120-1205E
pl/cx	25.4 x 50.8	75	120-1210E
pl/cx	25.4 x 50.8	100	120-1215E
pl/cx	25.4 x 50.8	150	120-1220E
pl/cx	25.4 x 50.8	200	120-1225E
pl/cx	25.4 x 50.8	300	120-1230E
pl/cx	25.4 x 50.8	500	120-1235E

Type	Size, mm	F, mm	Catalogue nr.
pl/cx	25.4 x 50.8	1000	120-1240E
pl/cv	25.4 x 50.8	-50	122-1205E
pl/cv	25.4 x 50.8	-75	122-1210E
pl/cv	25.4 x 50.8	-100	122-1215E
pl/cv	25.4 x 50.8	-150	122-1220E

Prisms

WEDGE PRISMS

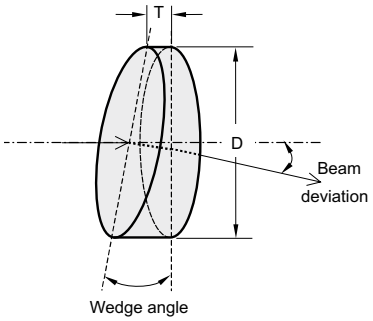
Features

- Steer beams in optical systems
- Can be used in pairs for continuous angular adjustment

Having selected an appropriate wedge, it is easy to create a precise beam deviation without affecting other beam parameters. If two wedges are used together with the sloping surfaces in close proximity, it is possible to produce a continuous variation of beam deviation by counter – rotating the wedges.

Wedge prisms are made from alternative materials, such as UV grade fused silica, and different shapes and sizes or with various anti-reflection coatings.

Contact us for other types of prisms
e.g. trapezoidal, various isosceles, Dove, Amici, Penta, etc.



Specifications

Material	BK7, UV FS
Clear aperture	90% of the diameter
Diameter tolerance	+0.00 / -0.12 mm
Wedge tolerance	±3 arcmin

STANDARD WEDGE PRISMS

Surface quality: 40 – 20 scratch & dig (MIL-PRF-13830B). Surface flatness: λ/4 @ 633 nm.

Material: BK7

Wedge, deg	Beam Deviation, deg		Ø12.7 × 3 mm	Ø25.4 × 3 mm
	@ 1064	@ 532	Catalogue number	Catalogue number
0.5	0.25	0.26	310-0100E	310-0200E
1	0.51	0.52	310-0101E	310-0201E
2	1.01	1.04	310-0102E	310-0202E
3	1.52	1.56	310-0103E	310-0203E
5	2.54	2.60	310-0105E	310-0205E

Material: UV FS

Wedge, deg	Beam Deviation, deg			Ø12.7 × 3 mm	Ø25.4 × 3 mm
	@ 1064	@ 532	@ 355	Catalogue number	Catalogue number
0.5	0.22	0.23	0.24	310-1100E	310-1200E
1	0.45	0.46	0.48	310-1101E	310-1201E
2	0.90	0.92	0.95	310-1102E	310-1202E
3	1.35	1.38	1.43	310-1103E	310-1203E
5	2.26	2.31	2.39	310-1105E	310-1205E

Most of the Prisms are available for fast off-the-shelf delivery. Check the availability at **www.eksmaoptics.com**

PRECISION WEDGE PRISMS

Surface quality: 20 – 10 scratch & dig (MIL-PRF-13830B). Surface flatness: λ/10 @ 633 nm.

Housing accessories

Stable Steel Mirror/Beamsplitter Mount 840-0036

Find more at EksmaOptics.com

Material: BK7

Wedge, deg	Beam Deviation, deg		Ø12.7 × 6 mm		Ø25.4 × 6 mm	
	@ 1064	@ 532	Catalogue number		Catalogue number	
0.5	0.25	0.26	311-0100E		311-0200E	
1	0.51	0.52	311-0101E		311-0201E	
2	1.01	1.04	311-0102E		311-0202E	
3	1.52	1.56	311-0103E		311-0203E	
5	2.54	2.60	311-0105E		311-0205E	

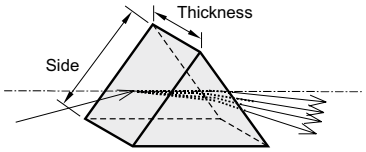
Material: UV FS

Wedge, deg	Beam Deviation, deg			Ø12.7 × 6 mm		Ø25.4 × 6 mm	
	@ 1064	@ 532	@ 355	Catalogue number		Catalogue number	
0.5	0.22	0.23	0.24	311-1100E		311-1200E	
1	0.45	0.46	0.48	311-1101E		311-1201E	
2	0.90	0.92	0.95	311-1102E		311-1202E	
3	1.35	1.38	1.43	311-1103E		311-1203E	
5	2.26	2.31	2.39	311-1105E		311-1205E	

LASER DISPERSING PRISMS

Features

- Separate light by wavelength
- Are made so that entrance and exit beams pass through at the Brewster angle



Like Brewster angle windows, laser dispersing prisms can be used inside the cavity of a laser operating on very low gain laser transitions, where even slight reflection losses may be intolerable.

Contact us for other types of prisms e.g. trapezoidal, various isosceles, Dove, Amici, Penta, etc.

Custom fabrication also available: coating, cutting, edging, drilling according to your specification.

Specifications

Material	BK7, UV FS, SF11
Surface quality	40 – 20 scratch & dig (MIL-PRF-13830B)
Surface flatness	λ/4 @ 633 nm
Apex angle tolerance	±2 arcmin
Design wavelength	800 nm

Most of the Prisms are available for fast off-the-shelf delivery. Check the availability at **www.eksmaoptics.com**

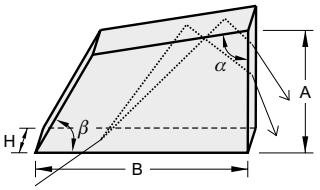
Material	Maximum input beam diameter, mm	Side length, mm	Thickness, mm	Apex angle	Catalogue number	
BK7	6.0	15	10	67°	320-0110	
UV FS	6.0	15	10	69°	320-1110	
SF11	6.0	15	10	59°	320-8110	
BK7	12.0	25	18	67°	320-0218	
UV FS	12.0	25	18	69°	320-1218	
SF11	12.0	25	18	59°	320-8218	
BK7	22.0	50	25	67°	320-0525	
UV FS	22.0	50	25	69°	320-1525	
SF11	22.0	50	25	59°	320-8525	

PELLIN-BROCA PRISMS

Features

- Extremely small loss of a p-polarized beam
- Light separated by wavelength is conveniently turned at an 90° angle with minimum deviation
- UV FS prisms provide 1.26° separation between 532 nm and 1064 nm

In a Pellin-Broca prism, an ordinary dispersing prism is split in half along the bisector of the apex angle. Using a right angle prism, the two halves are joined to create a dispersing prism with an internal right angle bend obtained by total internal reflection. The entrance beam is deviated at an 90° angle to its initial direction.



Specifications

Material	BK7, UV FS
Surface quality	20 – 10 scratch & dig (MIL-PRF-13830B)
Surface flatness	λ/10 @ 633 nm
Angles	α = 79.5° ± 0.5°, β = 60° ± 1°
Design wavelength	546.1 nm
Dimensions	± 0.2 mm
Clear aperture	> 80% of dimensions

Material	A, mm	B, mm	H, mm	Catalogue number	
BK7	11.0	20.0	6.4	325-0206	
	23.5	40.0	12.7	325-0412	
UV FS	11.0	20.0	6.4	325-1206	
	15.0	26.0	15.0	325-1215	
	23.5	40.0	12.7	325-1412	

Housing accessories

Tilt/Rotation Stage 860-0110

Find more at EksmaOptics.com

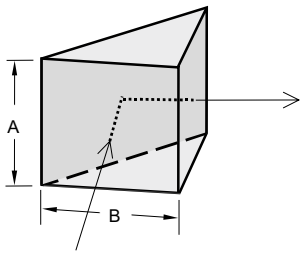
RIGHT ANGLE PRISMS

Features

- 45–45–90 degree prisms
- Can be used as internal or external reflectors or as retro-reflectors

These prisms are used to direct beams at 90 degrees by using a hypotenuse face in total internal reflection (TIR). Right angle prisms are often preferable to an inclined mirror in applications involving severe acoustic or inertial loads, because they are easier to mount and deform much less than a mirror in response to external mechanical stress. As long as acceptance angle limitations for TIR from the roof faces are not exceeded, right angle prisms can serve as a retro reflector, turning beams back to the original direction.

For various HR or AR coatings, please refer to the Coatings section.



Specifications

Material	BK7, UV FS
Surface quality	40 – 20 scratch & dig (MIL-PRF-13830B)
Surface flatness	λ/4 @ 633 nm
Clear aperture	80% of the face size
90° angle tolerance	±2 arcmin or ±5 arcsec
Pyramidal tolerance	±1 arcmin or ±30 arcsec
Dimensions	±0.25 mm

Size of face, A × B mm	90° angle tolerance	Pyramidal tolerance	BK7		UV FS	
			Catalogue number		Catalogue number	
5.0 × 5.0	2 arcmin	1 arcmin	330-0052		330-1052	
10.0 × 10.0	2 arcmin	1 arcmin	330-0102		330-1102	
12.5 × 12.5	2 arcmin	1 arcmin	330-0122		330-1122	
15.0 × 15.0	2 arcmin	1 arcmin	330-0152		330-1152	
20.0 × 20.0	2 arcmin	1 arcmin	330-0202		330-1202	
25.0 × 25.0	2 arcmin	1 arcmin	330-0252		330-1252	
10.0 × 10.0	5 arcsec	30 arcsec	330-0105		330-1105	
12.5 × 12.5	5 arcsec	30 arcsec	330-0125		330-1125	
15.0 × 15.0	5 arcsec	30 arcsec	330-0155		330-1155	
20.0 × 20.0	5 arcsec	30 arcsec	330-0205		330-1205	
25.0 × 25.0	5 arcsec	30 arcsec	330-0255		330-1255	

Custom fabrication also available: coating, cutting, edging, drilling according to your specification.

Housing accessories

Prism Holders 840-0160, 840-0170

Find more at EksmaOptics.com

Contact us for other types of prisms
e.g. trapezoidal, various isosceles, Dove, Amici, Penta, etc.

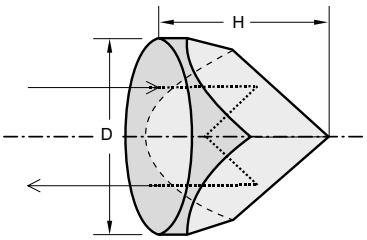
CORNER CUBES

Features

- Incident light deviates by 180 degrees independently of the angle of incidence

These prisms have 3 mirror surfaces making angles of 90° to each other, juxtaposed to form the corner of a cube with the entrance face perpendicular to the cube diagonal. Respective of an incident direction, all beams are reflected back to the original direction. Solid corner cubes are used in high precision applications or with lasers over very long distances. These "angle insensitive" mirrors therefore find frequent applications in situations where orientation is difficult or impossible to control and where a mirror would therefore be unsatisfactory.

Contact us for other types of prisms e.g. trapezoidal, various isosceles, Dove, Amici, Penta, etc.



Specifications

Material	BK7, UV FS
Surface quality	60 – 40 scratch & dig (MIL-PRF-13830B)
Surface flatness	λ/4 at 633 nm
Angle tolerances	±5 arcsec
Beam deviation	180°±30 sec
Diameter tolerance	+0.0 / -0.3mm
Clear aperture	>80%
Coating	uncoated

Material	Diameter D, mm	Height H, mm	Catalogue number	
BK7	22.0	17.5	**340-0217**	
	25.4	17.5	**340-0217M**	
	25.4	19.0	**340-0219**	
	38.1	28.5	**340-0329**	
	50.8	38.0	**340-0538**	
	63.5	48.0	**340-0648**	
UV FS	22.0	17.5	**340-1217**	
	25.4	17.5	**340-1217M**	

Models **340-0217M** and **340-1217M** are mounted into black anodized aluminium ring Ø25.4 mm and clear aperture Ø17 mm.

Mounting Suggestion

Housing accessories

Kinematic Mirror and Beamsplitter Mount 840-0020

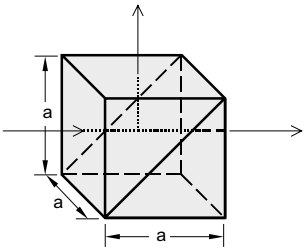
Find more at EksmaOptics.com

Most of the Coner Cubes are available for fast off-the-shelf delivery. Check the availability at **www.eksmaoptics.com**

NON-POLARIZING BROADBAND CUBE BEAMSPLITTERS

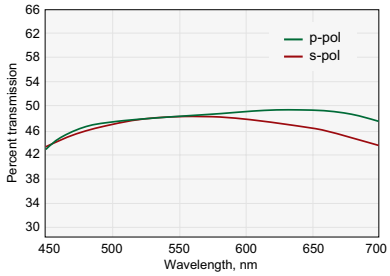
Features

- Cemented for low power applications
- Typical damage threshold: >0.1 J/cm², 10 ns, 10 Hz at 1064 nm
- Four sides broadband antireflection coated: R < 1% @ 450 – 700 nm or R < 1% @ 750 – 1100 nm



Specifications

Material	BK7
Size tolerance	±0.25 mm
Surface quality	40 – 20 scratch & dig
Surface flatness	λ/4 at 633 nm
Beam deviation	<5 arcmin
Clear aperture	>80% of size
Absorption	<10%
Reflection/Transmission ratio	50/50 ± 5%
Transmission	$T_p = T_s = 45 \pm 5\%$



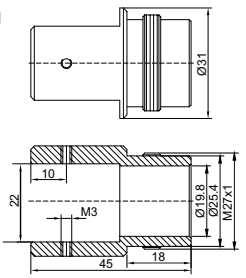
Typical transmission curve @ 450 – 700 nm

Operating wavelength, nm	Size, mm	Unmounted		Mounted	
		Catalogue number		Catalogue number	
450 – 700	10 × 10	351-0107		351-0107-M2Ps	
450 – 700	15 × 15	351-0157		351-0157-M2Ps	
450 – 700	20 × 20	351-0207		351-0207-M2P	
450 – 700	25 × 25	351-0257		351-0257-M2P	
750 – 1100	10 × 10	351-0108		351-0108-M2Ps	
750 – 1100	15 × 15	351-0158		351-0158-M2Ps	
750 – 1100	20 × 20	351-0208		351-0208-M2P	
750 – 1100	25 × 25	351-0258		351-0258-M2P	

Mounting Suggestion

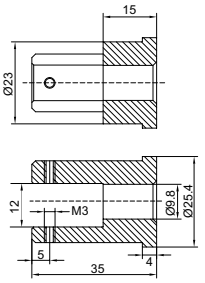
Mounting

Example of **M2P** mount for Cube Polarizing Beamsplitters of 20×20 mm standard dimensions.



M2P mount can be used with 840-0180, 840-0195, 840-0020.

Example of **M2Ps** mount for Cube Polarizing Beamsplitters of 10×10 mm dimensions.



M2Ps mount can be used with 840-0180, 840-0020.

Drawings of M2P and M2Ps for prisms of other dimensions are available on request.

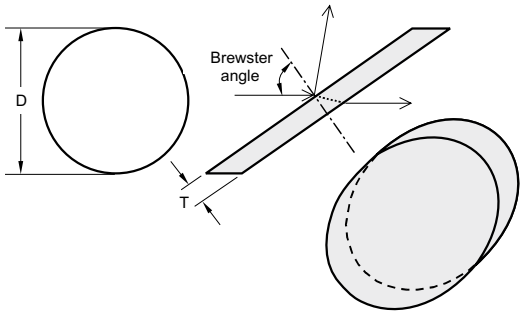
BREWSTER WINDOWS

Features

- Transmit 100% p-polarization components
- Reflect 20% s-polarization components

Brewster windows are intended for high energy laser beams intra cavity usage.

Please contact us for other Brewster windows size or precision requirements.



Specifications

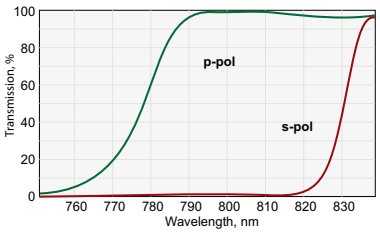
Material	BK7, UV FS
Surface quality	20 – 10 scratch & dig (MIL-PRF-13830B)
Wavefront distortion	λ/10 @ 633 nm
Clear aperture	90% of diameter
Parallelism	< 10 arcsec
Axis tolerance	+0.00 / -0.12 mm
Thickness tolerance	±0.2 mm

Minor axis D, mm	Thickness T, mm	BK7		UV FS	
		Catalogue number		Catalogue number	
8.0	2.0	410-0082		410-1082	
12.5	3.0	410-0123		410-1123	
25.0	5.0	410-0255		410-1255	
40.0	8.0	410-0408		410-1408	
50.0	8.0	410-0508		410-1508	

THIN FILM LASER POLARIZERS (56° Angle of Incidence)

Features

- Provide the achievement of strictly linear polarization of laser radiaton
- Utilise the polarization wich occurs on reflection from a plane surface



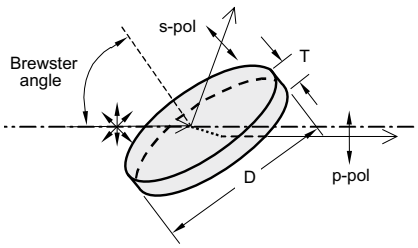
420-0126.
Transmission @ 800 nm, Rs/Tp > 99.5/95.0 %

Thin Film Polarizers are designed for use in the most demanding lasers. Due to a high laser damage threshold reaching 10 J/cm² @ 1064 nm 8 ns, they are used as an alternative to Glan laser polarizing prisms or cube polarizing beamsplitters.

Typical applications are intracavity Q-switch hold-off polarizers or extracavity attenuators for Nd:YAG lasers.

Thin Film Polarizers can be used at an > 40° angle of incidence, but polarization is most efficient and appears in a broad wavelength range at 56° AOI (Brewster angle). Typical polarization ratio T_P/T_S is 200:1.

Standard size is up to Ø50 mm (2"), while max. available dimensions are 100×200 mm. For optimal transmission a Thin Film Polarizer should be mounted in an appropriate holder for angular adjustment.



Specifications

Material	BK7, UV FS
Surface quality	20 – 10 scratch & dig (MIL-PRF-13830B)
Transmitted wavefront distortion	λ/10 @ 633 nm
Parallelism	<30 arcsec
Clear aperture	>90%
Angle of incidence (AOI)	56 ± 2°
Diameter tolerance	+0.0 / -0.12 mm
Thickness tolerance	±0.2 mm
Transmission efficiency	Tp > 95%
Extinction ratio Tp/Ts	>200:1
Laser damage threshold	10 J/cm² 10 nsec pulse at 1064 nm typical

BK7 ROUND THIN FILM POLARIZERS

Rs / Tp > 99.5 / 95.0%. Extinction ratio for transmitted light Tp/Ts >200:1

Wavelength, nm	Diameter D, mm	Thickness T, mm	Catalogue number	
515	12.7	3.0	420-0114E	
532	12.7	3.0	420-0124E	
633	12.7	3.0	420-0125E	
775	12.7	3.0	420-0127E	
800	12.7	3.0	420-0126E	
780 – 820	12.7	3.0	420-0136E	
1030	12.7	3.0	420-0118E	
1010 – 1050	12.7	3.0	420-0138E	
1064	12.7	3.0	420-0128E	
515	25.4	3.0	420-0244E	
532	25.4	3.0	420-0254E	
633	25.4	3.0	420-0255E	
775	25.4	3.0	420-0257E	
800	25.4	3.0	420-0256E	
780 – 820	25.4	3.0	420-0266E	
1030	25.4	3.0	420-0248E	
1010 – 1050	25.4	3.0	420-0268E	
1064	25.4	3.0	420-0258E	
1550	25.4	3.0	420-0259E	
515	50.8	6.0	420-0514E	
532	50.8	6.0	420-0504E	
633	50.8	6.0	420-0505E	
775	50.8	6.0	420-0507E	
800	50.8	6.0	420-0506E	
780 – 820	50.8	6.0	420-0526E	
1030	50.8	6.0	420-0518E	
1010 – 1050	50.8	6.0	420-0528E	
1064	50.8	6.0	420-0508E	

BK7 RECTANGULAR THIN FILM LASER POLARIZERS

Rs / Tp > 99.5 / 95.0%. Extinction ratio for transmitted light Tp/Ts >200:1

Wavelength, nm	Rectangular dimensions		Thickness T, mm	Catalogue number	
	Length, mm	Width, mm			
515	28.6	14.3	3.0	420-0274	
532	28.6	14.3	3.0	420-0284	
633	28.6	14.3	3.0	420-0285	
775	28.6	14.3	3.0	420-0287	
800	28.6	14.3	3.0	420-0286	
780-820	28.6	14.3	3.0	420-0296	
1030	28.6	14.3	3.0	420-0278	
1010-1050	28.6	14.3	3.0	420-0298	
1064	28.6	14.3	3.0	420-0288	

Housing accessories

Adapters for Polarizer at 56° 840-0117, 840-0118

Find more at EksmaOptics.com

Variable Attenuators for Linearly Polarized Laser Beam 990-0070, -0071

See page 5.9

UV FS ROUND THIN FILM LASER POLARIZERS

Rs / Tp > 99.5 / 95.0%. Extinction ratio for transmitted light Tp/Ts >200:1

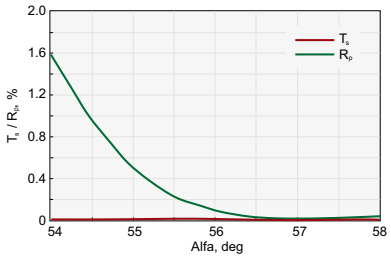
Wavelength, nm	Diameter D, mm	Thickness T, mm	Catalogue number	
266	12.7	3.0	420-1110E	
343	12.7	3.0	420-1112E	
355	12.7	3.0	420-1122E	
400	12.7	3.0	420-1123E	
515	12.7	3.0	420-1114E	
532	12.7	3.0	420-1124E	
800	12.7	3.0	420-1126E	
780 – 820	12.7	3.0	420-1136E	
1030	12.7	3.0	420-1118E	
1010 – 1050	12.7	3.0	420-1138E	
1064	12.7	3.0	420-1128E	
266	25.4	3.0	420-1240E	
343	25.4	3.0	420-1242E	
355	25.4	3.0	420-1252E	
390 – 410	25.4	3.0	420-1253B	
400	25.4	3.0	420-1253E	
515	25.4	3.0	420-1244E	
532	25.4	3.0	420-1254E	
800	25.4	3.0	420-1256E	
780 – 820	25.4	3.0	420-1266E	
1030	25.4	3.0	420-1248E	
1010 – 1050	25.4	3.0	420-1268E	
1064	25.4	3.0	420-1258E	
1530 – 1570	25.4	3.0	420-1269E	
266	50.8	6.0	420-1510E	
343	50.8	6.0	420-1512E	
355	50.8	6.0	420-1502E	
390 – 410	50.8	6.0	420-1503B	
400	50.8	6.0	420-1503E	
515	50.8	6.0	420-1514E	
532	50.8	6.0	420-1504E	
800	50.8	6.0	420-1506E	
780 – 820	50.8	6.0	420-1526E	
1030	50.8	6.0	420-1518E	
1010 – 1050	50.8	6.0	420-1528E	
1064	50.8	6.0	420-1508E	

UV FS RECTANGULAR THIN FILM LASER POLARIZERS

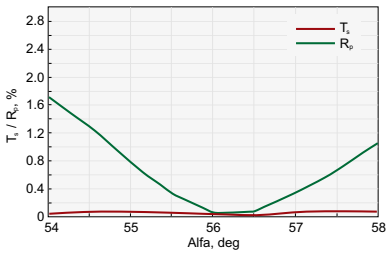
Rs / Tp > 99.5 / 95.0%. Extinction ratio for transmitted light Tp/Ts >200:1

Wavelength, nm	Rectangular dimensions		Thickness T, mm	Catalogue number	
	Length, mm	Width, mm			
266	28.6	14.3	3.0	420-1270	
343	28.6	14.3	3.0	420-1272	
355	28.6	14.3	3.0	420-1282	
390 – 410	35.0	20.0	3.0	240-1383B	
400	28.6	14.3	3.0	420-1283	
515	28.6	14.3	3.0	420-1274	
532	28.6	14.3	3.0	420-1284	
800	28.6	14.3	3.0	420-1286	
780 – 820	28.6	14.3	3.0	420-1296	
1030	28.6	14.3	3.0	420-1278	
1010 – 1050	28.6	14.3	3.0	420-1298	
1064	28.6	14.3	3.0	420-1288	
266	35.0	20.0	3.0	420-1370	
343	35.0	20.0	3.0	420-1372	
355	35.0	20.0	3.0	420-1382	
400	35.0	20.0	3.0	420-1383	
515	35.0	20.0	3.0	420-1374	
532	35.0	20.0	3.0	420-1384	
800	35.0	20.0	3.0	420-1386	
780 – 820	35.0	20.0	3.0	420-1396	
1030	35.0	20.0	3.0	420-1378	
1010 – 1050	35.0	20.0	3.0	420-1398	
1064	35.0	20.0	3.0	420-1388	
1530 – 1570	35.0	20.0	3.0	420-1399	

ULTRA HIGH TRANSMISSION THIN FILM POLARIZERS



420-1254UHT.
Ultra High Transmission @ 532 nm,
Ts<0.2%, Rp<0.2%, AOI = 56°

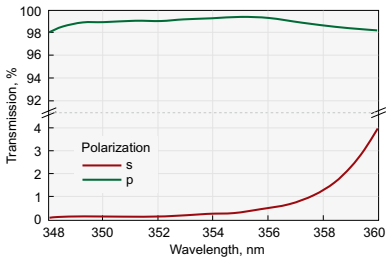


420-1258UHT.
Ultra High Transmission @ 1064 nm,
Ts<0.2%, Rp<0.2%, AOI = 56°

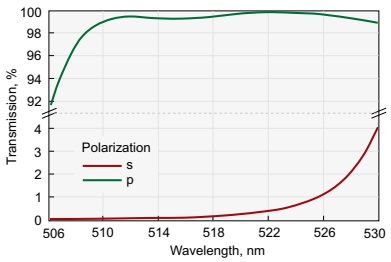
Round Polarizers. Material – UV FS. Ts < 0.2%, Rp < 0.2%. Extinction ratio for transmitted light Tp/Ts >500:1

Wavelength, nm	Diameter D, mm	Thickness T, mm	Catalogue number	
532	25.4	3	**420-1254UHT**	
800	25.4	3	**420-1256UHT**	
1030	25.4	3	**420-1248UHT**	
1064	25.4	3	**420-1258UHT**	

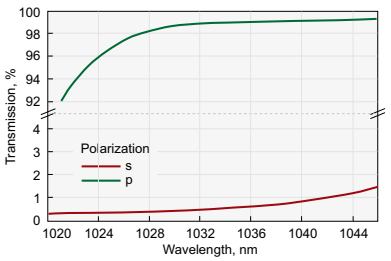
HIGH TRANSMISSION THIN FILM POLARIZERS



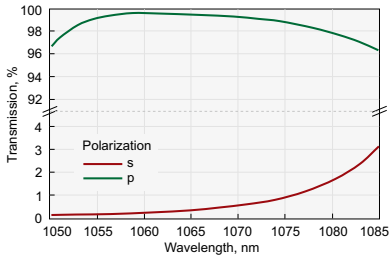
420-1252HT.
High Transmission @ 355 nm,
Rs/Tp > 99.5/99.0%



420-1244HT.
High Transmission @ 515 nm,
Rs/Tp > 99.5/99.0%



420-1248HT.
High Transmission @ 1030 nm,
Rs/Tp > 99.5/99.0%



420-1258HT.
High Transmission @ 1064 nm,
Rs/Tp > 99.5/99.0%.

Round Polarizers. Material – UV FS. Rs / Tp > 99.5 / 99.0%. Extinction ratio for transmitted light Tp/Ts >200:1

Wavelength, nm	Diameter D, mm	Thickness T, mm	Catalogue number	
343	25.4	3	**420-1242HT**	
355	25.4	3	**420-1252HT**	
515	25.4	3	**420-1244HT**	
532	25.4	3	**420-1254HT**	
800	25.4	3	**420-1256HT**	
1030	25.4	3	**420-1248HT**	
1064	25.4	3	**420-1258HT**	

Rectangular Polarizers.
Material – UV FS. Rs / Tp > 99.5 / 99.0%. Extinction ratio for transmitted light Tp/Ts >200:1

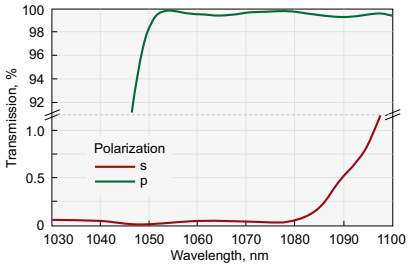
Wavelength, nm	Rectangular dimensions		Thickness T, mm	Catalogue number	
	Length, mm	Width, mm			
1030	28.6	14.3	3	**420-1278HT**	
1064	28.6	14.3	3	**420-1288HT**	

Related Products

Glan Laser Polarizing Prims
See page 1.62

Wollaston Prisms
See page 1.64

THIN FILM POLARIZERS WITH HIGH EXTINCTION RATIO



420-1258HE.
Tp > 98%, Ts < 0.1%

Round Polarizers. Material – UV FS. Rs / Tp > 99.5 / 99.0%. Extinction ratio for transmitted light Tp/Ts >200:1

Wavelength, nm	Diameter D, mm	Thickness T, mm	Catalogue number	
343	25.4	3	420-1242HE	
355	25.4	3	420-1252HE	
515	25.4	3	420-1244HE	
532	25.4	3	420-1254HE	
780 – 820	25.4	3	420-1266HE	
800	25.4	3	420-1256HE	
1030	25.4	3	420-1248HE	
1064	25.4	3	420-1258HE	

Rectangular Polarizers.
Material – UV FS. Rs / Tp > 99.5 / 99.0%. Extinction ratio for transmitted light Tp/Ts >200:1

Wavelength, nm	Rectangular dimensions		Thickness T, mm	Catalogue number	
	Length, mm	Width, mm			
532	20	15	6	420-1484HE	
532	30	20	6	420-1584HE	
1030	20	15	6	420-1478HE	
1030	30	20	6	420-1578HE	
1064	20	15	6	420-1488HE	
1064	30	20	6	420-1588HE	

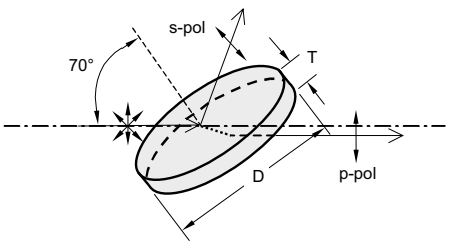
Housing accessories

Adapters
for Polarizer at 56°
840-0117, 840-0118
Find more at
EksmaOptics.com

Variable Attenuators
for Linearly Polarized
Laser Beam
990-0070, -0071
See page 5.9

THIN FILM POLARIZERS (70° Angle of Incidence)

Broadband thin film polarizers separate the s- and p-polarization components in broad region at 70° angle of incidence (AOI). These polarizers are designed to be used in high energy laser systems, typically as extracavity attenuators for femtosecond lasers. Polarizers are made form UV fused silica and feature a high laser damage threshold – up to 50 mJ/cm².



Specifications

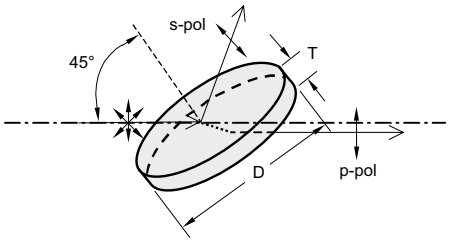
Substrate material	UV FS
Surface quality	20 – 10 scratch & dig (MIL-PRF-13830B)
Transmitted wavefront distortion	λ/10 @ 633 nm
Clear aperture	>90% of diameter
Angle of incidence (AOI)	70 ± 2°
Parallelism	<30 arcsec

Rectangular Polarizers. Material – UV FS. Rs / Tp > 99.5 / 95.0%. Extinction ratio for transmitted light Tp/Ts >200:1

Operating wavelength region, nm	Centre wavelength, nm	Rectangular dimensions		Thickness T, mm	Catalogue number	
		Length, mm	Width, mm			
750 – 850	800	60.0	20.0	4.0	420-1696BBi70	
980 – 1080	1030	60.0	20.0	4.0	420-1698BBi70	

THIN FILM POLARIZERS (45° Angle of Incidence)

These thin film polarizers separate or combine the s- and p-polarization components at 45° angle of incidence. They are designed for use in high energy lasers. Polarizers are made from UV FS and feature high laser damage threshold reaching 10 J/cm² at 1064 nm.



Specifications

Substrate material	UV FS
Surface quality	20 – 10 scratch & dig (MIL-PRF-13830B)
Clear aperture	>90% of diameter
Angle of incidence (AOI)	45 ± 2°
Parallelism	<30 arcsec

THIN FILM POLARIZERS WITH HIGH EXTINCTION RATIO

Round Polarizers.
Material – UV FS. Tp > 98%, Ts < 0.1%; Extinction ratio for transmitted light Tp/Ts: >1000:1

Wavelength, nm	Diameter D, mm	Thickness T, mm	Catalogue number	
343	25.4	3.0	420-1242i45HE	
355	25.4	3.0	420-1252i45HE	
515	25.4	3.0	420-1244i45HE	
532	25.4	3.0	420-1254i45HE	
800	25.4	3.0	420-1256i45HE	
1030	25.4	3.0	420-1248i45HE	
1053	25.4	3.0	420-1238i45HE	
1064	25.4	3.0	420-1258i45HE	
343	50.8	6.0	420-1512i45HE	
355	50.8	6.0	420-1502i45HE	
515	50.8	6.0	420-1514i45HE	
532	50.8	6.0	420-1504i45HE	
800	50.8	6.0	420-1506i45HE	
1030	50.8	6.0	420-1518i45HE	
1053	50.8	6.0	420-1538i45HE	
1064	50.8	6.0	420-1508i45HE	

STANDARD THIN FILM POLARIZERS

Round Polarizers.
Material – UV FS. Rs / Tp > 99.5 / 95.0%. Extinction ratio for transmitted light Tp/Ts >200:1

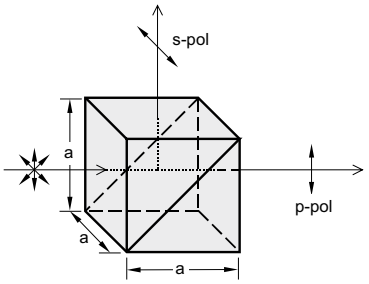
Wavelength, nm	Diameter D, mm	Thickness T, mm	Catalogue number	
343	25.4	3.0	420-1242i45	
355	25.4	3.0	420-1252i45	
515	25.4	3.0	420-1244i45	
532	25.4	3.0	420-1254i45	
1030	25.4	3.0	420-1248i45	
1053	25.4	3.0	420-1238i45	
1064	25.4	3.0	420-1258i45	
343	50.8	6.0	420-1512i45	
355	50.8	6.0	420-1502i45	
515	50.8	6.0	420-1514i45	
532	50.8	6.0	420-1504i45	
1030	50.8	6.0	420-1518i45	
1053	50.8	6.0	420-1538i45	
1064	50.8	6.0	420-1508i45	

CUBE POLARIZING BEAMSPLITTERS

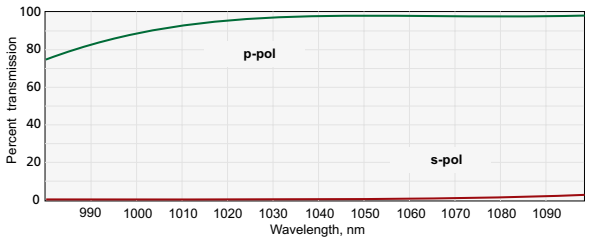
Features

- Durable and convenient
- Optimised for popular laser wavelengths

Polarizing film is coated on the internal face of a cube beamsplitter. Thin film polarizers utilize the polarization which occurs on reflection deviated by 90° angle. Cube polarizing beamsplitters can be optimized for a particular wavelength to give superior performance for laser application can be optimised for a particular wavelength to give superior performance for laser applications.



The four outer faces are all anti-reflection coated.



Typical transmission curve @ 1064 nm

Specifications

Material	BK7, UV FS
Surface quality	40 – 20 scratch & dig (MIL-PRF-13830B)
Surface flatness	λ/4 @ 633 nm
Clear aperture	90% of the face size
Beam deviation	<3 arcmin
Dimension tolerance	±0.3 mm
Laser damage threshold	0.3 J/cm² 10 ns pulses at 1064 nm

Please contact us for polarizing cubes with an extinction ratio of up to Tp/Ts>500:1

BK7 GLASS, Tp/Ts >200:1

Wavelength range, nm	Reflection s-pol, %	Transmission p-pol, %	Side a×a, mm	Unmounted		Mounted	
				Catalogue number		Catalogue number	
532	Rs>99.5	Tp>95	10 × 10	430-0101		430-0101-M2Ps	
532	Rs>99.5	Tp>95	15 × 15	430-0151		430-0151-M2P	
532	Rs>99.5	Tp>95	20 × 20	430-0201		430-0201-M2P	
532	Rs>99.5	Tp>95	25 × 25	430-0251		430-0251-M2P	
633	Rs>99.5	Tp>95	10 × 10	430-0104		430-0104-M2Ps	
633	Rs>99.5	Tp>95	15 × 15	430-0154		430-0154-M2P	
633	Rs>99.5	Tp>95	20 × 20	430-0204		430-0204-M2P	
633	Rs>99.5	Tp>95	25 × 25	430-0254		430-0254-M2P	
780	Rs>99.5	Tp>95	10 × 10	430-0102		430-0102-M2Ps	
780	Rs>99.5	Tp>95	15 × 15	430-0152		430-0152-M2P	
780	Rs>99.5	Tp>95	20 × 20	430-0202		430-0202-M2P	
780	Rs>99.5	Tp>95	25 × 25	430-0252		430-0252-M2P	
1064	Rs>99.5	Tp>95	10 × 10	430-0103		430-0103-M2Ps	
1064	Rs>99.5	Tp>95	15 × 15	430-0153		430-0153-M2P	
1064	Rs>99.5	Tp>95	20 × 20	430-0203		430-0203-M2P	
1064	Rs>99.5	Tp>95	25 × 25	430-0253		430-0253-M2P	

UV FS, Tp/Ts >100:1

Wavelength range, nm	Reflection s-pol, %	Transmission p-pol, %	Side a×a, mm	Unmounted		Mounted	
				Catalogue number		Catalogue number	
308	Rs>99	Tp>90	10 × 10	430-1105		430-1105-M2Ps	
308	Rs>99	Tp>90	15 × 15	430-1155		430-1155-M2P	
308	Rs>99	Tp>90	20 × 20	430-1205		430-1205-M2P	
355	Rs>99	Tp>90	10 × 10	430-1107		430-1107-M2Ps	
355	Rs>99	Tp>90	15 × 15	430-1157		430-1157-M2P	
355	Rs>99	Tp>90	20 × 20	430-1207		430-1207-M2P	

Please contact us if you need polarizing beamsplitters of other wavelengths, other sizes or other configurations.

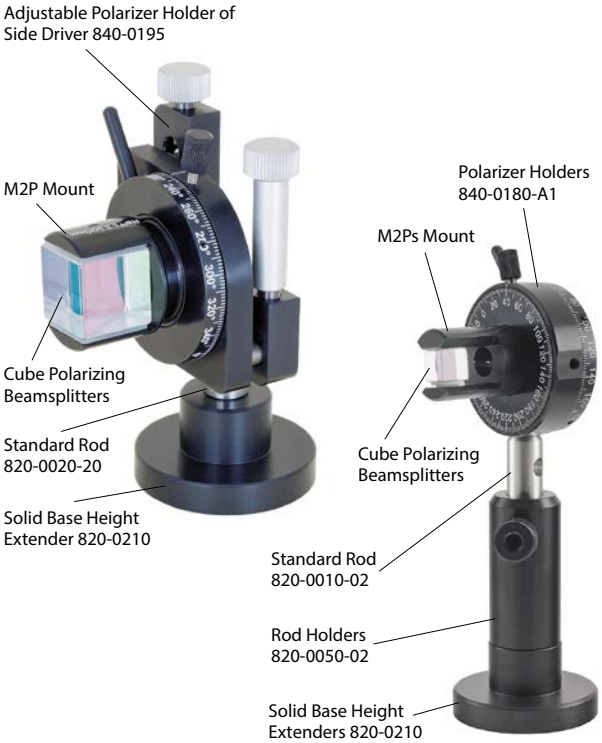
Housing accessories

for unmounted cube polarizing beamsplitters

Prism Holders
840-0160, 840-0170

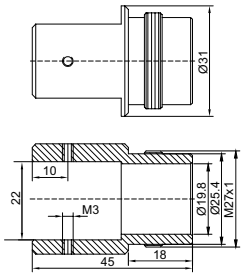
Find more at EksmaOptics.com

Mounting Suggestion



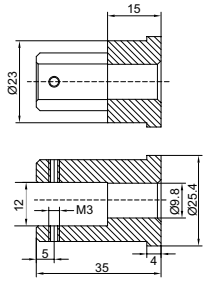
Mounting

Example of **M2P** mount for Cube Polarizing Beamsplitters of 20×20 mm standard dimensions.



M2P mount can be used with 840-0180, 840-0195, 840-0020.

Example of **M2Ps** mount for Cube Polarizing Beamsplitters of 10×10 mm dimensions.



M2Ps mount can be used with 840-0180, 840-0020.

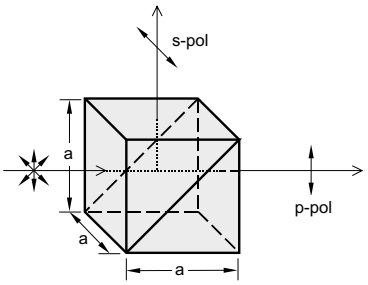
Drawings of M2P and M2Ps for prisms of other dimensions are available on request.

HIGH ENERGY POLARIZING CUBE BEAMSPLITTERS

Features

- Optically contacted for high power applications
- Typical damage threshold: >15 J/cm², 10 ns, 10 Hz at 1064 nm
- Precision surface quality
- High extinction ratio

The four outer faces are all anti-reflection coated.



Specifications

Material	UV FS (laser line) N-SF2 (broadband) N-SF15 (dual wavelength)
Size tolerance	±0.2mm
Extinction ratio	>1:500
Surface quality	20 – 10 scratch & dig (MIL-PRF-13830B)
Wavefront distortion	λ/10 at 633 nm
Beam deviation	<3 arcmin
Clear aperture	>85% of size
Reflection s-polarization	>99.5%
Transmission p-polarization	>97% for laser line
	>90% for broadband

Housing accessories

for unmounted cube polarizing beamsplitters

Prism Holders 840-0160, 840-0170

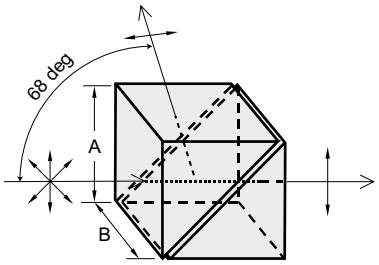
Find more at EksmaOptics.com

Operating wavelength, nm	Material	Laser Damage threshold, 10 ns, 10 Hz	Side a × a, mm	Unmounted Catalogue number	Mounted Catalogue number
343	UV FS	>3 J/cm² at 343 nm	12.7 × 12.7	435-1128	435-1128-M2Ps
355	UV FS	>3 J/cm² at 355 nm	12.7 × 12.7	435-1127	435-1127-M2Ps
515	UV FS	>6 J/cm² at 515 nm	12.7 × 12.7	435-1128	435-1128-M2Ps
532	UV FS	>6 J/cm² at 532 nm	12.7 × 12.7	435-1121	435-1121-M2Ps
800	UV FS	>8 J/cm² at 800 nm	12.7 × 12.7	435-1122	435-1122-M2Ps
800	UV FS	>8 J/cm² at 800 nm	25.4 × 25.4	435-1222	435-1222-M2P
1030	UV FS	>15 J/cm² at 1030 nm	12.7 × 12.7	435-1124	435-1124-M2Ps
515 + 1030	N-SF15	>10 J/cm² at 1030 nm	25.4 × 25.4	435-1224D	435-1224D-M2P
1064	UV FS	>15 J/cm² at 1064 nm	12.7 × 12.7	435-1123	435-1123-M2Ps
420 – 680	N-SF2	>1 J/cm² at 532 nm	12.7 × 12.7	436-1121	436-1121-M2Ps
700 – 1080	N-SF2	>2 J/cm² at 1064 nm	12.7 × 12.7	436-1123	436-1123-M2Ps

GLAN LASER POLARIZING PRISMS

Features

- Transmit a linearly polarized extraordinary beam without deviation from its initial direction
- Reflect an ordinary ray out of the prism into either the black glass or the escape port
- Air-spaced prisms
- Available with two, one or no escape ports in mounts for extra power capacity



Glan laser polarizers are manufactured from the finest optical grade natural calcite or α-BBO. They are useful in applications requiring a high degree of polarization purity, high total transmission and low, medium or high power requirements.

We also provide Glan Thompson, Beamsplitting Thompson prisms, Beam Displacers, Laser Polarizing Beamsplitters, etc.
Please contact us for more information.

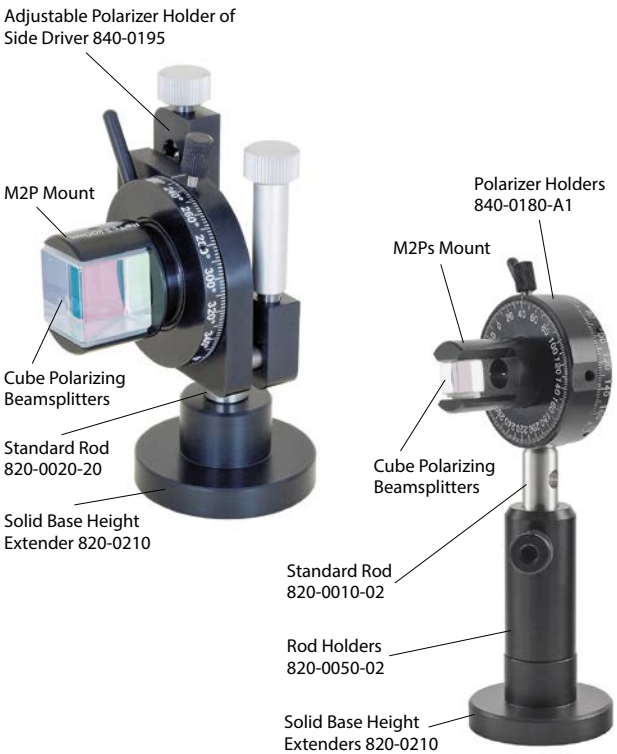
NATURAL CALCITE GLAN LASER PRISMS

Specifications

Material	Natural calcite
Surface quality	40 – 20 scratch & dig (MIL-PRF-13830B)
Wavefront distortion	λ/4 at 633 nm
Beam deviation	<3 arcmin
Wavelength range	350 – 2100 nm
Extinction ratio	1 : 100 000
Laser damage threshold	>5 J/cm², 10 ns pulses, 1064 nm

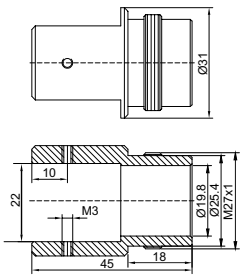
Standard dimensions A × B, mm	Unmounted		Mounted	
	Catalogue number		Catalogue number	
10 × 10	440-2010		440-2010-M2Ps	
12 × 12	440-2012		440-2012-M2Ps	
14 × 14	440-2014		440-2014-M2Ps	
20 × 20	440-2020		440-2020-M2P	

Mounting Suggestion



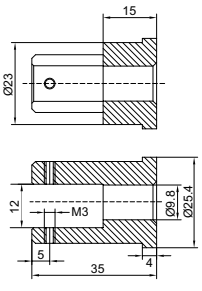
Mounting

Example of **M2P** mount for Cube Polarizing Beamsplitters of 20×20 mm standard dimensions.



M2P mount can be used with 840-0180, 840-0195, 840-0020.

Example of **M2Ps** mount for Cube Polarizing Beamsplitters of 10×10 mm dimensions.



M2Ps mount can be used with 840-0180, 840-0020.

Drawings of M2P and M2Ps for prisms of other dimensions are available on request.

α-BBO GLAN LASER PRISMS

Specifications

Material	α-BBO
Transmittance wavelength range	200–3500 nm
Extinction ratio	1 : 100 000
Surface quality	20 – 10 scratch & dig (MIL-PRF-13830B)
Wavefront distortion	λ/4 at 633 nm
Beam deviation	<3 arcmin
Angular field	>6 deg
Coating	Single layer MgF_2
Mount	Black anodized aluminium

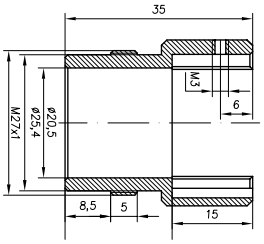
Operating wavelength range, nm	Clear aperture CA, mm	Outer mount OD, mm	Mounted, without adapter		Mounted, with adapter	
			Catalogue number		Catalogue number	
200–270	Ø8	Ø25.4	**441-2108**		**441-2108-M2Pd**	
200–270	Ø10	Ø25.4	**441-2110**		**441-2110-M2Pd**	
200–270	Ø15	Ø30	**441-2115**		**441-2115-M2PD**	
260–300	Ø8	Ø25.4	**441-2208**		**441-2208-M2Pd**	
260–300	Ø10	Ø25.4	**441-2210**		**441-2210-M2Pd**	
260–300	Ø15	Ø30	**441-2215**		**441-2215-M2PD**	
300–400	Ø8	Ø25.4	**441-2308**		**441-2308-M2Pd**	
300–400	Ø10	Ø25.4	**441-2310**		**441-2310-M2Pd**	
300–400	Ø15	Ø30	**441-2315**		**441-2315-M2PD**	

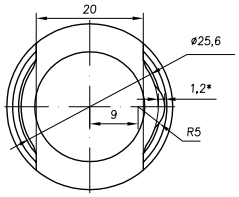
Mounting Suggestion

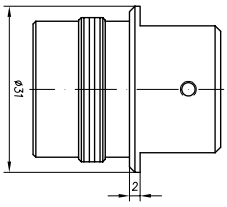
Polarizer Holders **840-0180-A1** for prisms with outer diameter of 25.4 mm and **840-0180-A2** for prisms with outer diameter of 30 mm.

Mounting

Example of **M2Pd** mount with adapter for α-BBO Glan Laser Prisms with outer diameter mount of 25.4 mm.







Housing accessories

Polarizer Holders 840-0180

Find more at EksmaOptics.com

WOLLASTON PRISMS

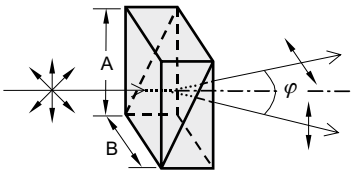
Features

- Split a beam into two orthogonaly polarized divergent beams
- Made from the finest optical grade natural calcite

Wollaston prism polarizers consist of two equal calcite prisms. Both output beams are almost equaly deviated. Angular separation of output beams depends on wavelength. The use of highest grade calcite provides useful transmission covering the 300–2200 nm range.

Prisms mounted in black aluminium mounts M2P or M2Ps are available.

For mount's drawing and mounting suggestion, see page 1.62.



Specifications

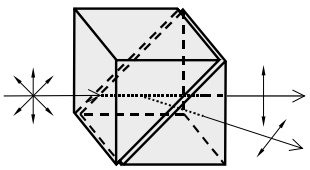
Material	Natural calcite
Surface quality	40 – 20 scratch & dig (MIL-PRF-13830B)
Wavelength range	300–2200 nm
Extinction ratio	1 : 100 000
Separation angle	10 or 20 deg
Dimension tolerance	±0.25 mm

Standard dimensions A × B, mm	Beam separation φ, deg	Unmounted		Mounted	
		Catalogue number		Catalogue number	
10 × 10	10	450-2101		450-2101-M2Ps	
12 × 12	10	450-2121		450-2121-M2Ps	
14 × 14	10	450-2141		450-2141-M2P	
10 × 10	20	450-2102		450-2102-M2Ps	
12 × 12	20	450-2122		450-2122-M2Ps	
14 × 14	20	450-2142		450-2142-M2P	

Other sizes, better quality, different spectral ranges or AR coatings are available on request.

ROCHON POLARIZING PRISMS

Rochon polarizer is made of two α-BBO prisms cemented together. The first prism, cut parallel to the optic axis, receives the light; the second, with the optic axis at right angles, transmits the ordinary ray without deviation but the extraordinary ray is deflected. A Rochon prism can be used to produce plane-polarized light and it can also be used with ultraviolet light. Any separation angle can be designed for specific wavelength upon request.



Specifications

Material	α-BBO
Wavelength range	200–3500 nm
Extinction ratio	1 : 100 000
Surface quality	20 – 10 scratch & dig (MIL-PRF-13830B)
Wavefront distortion	λ/4 at 633 nm
Beam deviation	<3 arcmin
Separation angle	8–14 deg (8 deg @ 1064 nm)
Clear aperture	90%
Coating	Single layer MgF_2
Mount	Black anodized aluminium

Side a × a, mm	Outer mount Ø, mm	Catalogue number	
8 × 8	25.4	455-2108	
10 × 10	25.4	455-2110	
15 × 15	30.0	455-2115	

RETARDATION PLATES

Features

- Made from high quality optical grade crystalline quartz
- Quarter wave and half wave retardation versions available
- Multiple-order, low-order or zero-order plates
- Suitable for high and low power laser applications

They rotate the direction of polarization (λ/2) or convert linear into circular polarization or vice versa (λ/4).

ZERO ORDER OPTICALLY CONTACTED WAVEPLATES

Features

- Easily aligned
- Temperature insensitive
- Moderately insensitive to wavelength

These are formed from two thin sections which are polished to different thicknesses to have a retardation difference exactly equal to the required. These component plates have orthogonal optic axis directions, so that the roles of the ordinary and extraordinary rays are interchanged in passing from one plate to the other. Retardation error versus wavelength is reduced, therefore they are suitable for fs lasers or laser diode applications.

Most of the Retardation Plates are available for fast off-the-shelf delivery. Check the availability at **www.eksmaoptics.com**

Specifications

Material	Single crystal quartz
Optical axis	normal to facet on circumference of retarder
Nominal thickness of waveplate	1.5–2.5 mm
Wavefront distortion	λ/10 @ 633 nm
Surface quality	20 – 10 scratch & dig (MIL-PRF-13830B)
Retardation tolerance	<λ/300 over wavelength range
Parallelism	< 10 arcsec
AR coating	R < 0.4%
Laser damage threshold	> 0.5 J/cm², 10 nsec pulse, 1064 nm typical

Ø12.7 mm waveplates. Clear aperture Ø11 mm, unmounted

Wavelength, nm	Retardation λ/2		Retardation λ/4	
	Catalogue number		Catalogue number	
1550	460-4201D12		460-4401D12	
1064	460-4205D12		460-4405D12	
1030	460-4208D12		460-4408D12	
852	460-4213D12		460-4413D12	
800	460-4215D12		460-4415D12	
780	460-4220D12		460-4420D12	
633	460-4225D12		460-4425D12	
532	460-4230D12		460-4430D12	
515	460-4232D12		460-4432D12	
488	460-4233D12		460-4433D12	
400	460-4235D12		460-4435D12	
355	460-4240D12		460-4440D12	
343	460-4241D12		460-4441D12	
266	460-4245D12		460-4445D12	
257	460-4246D12		460-4446D12	

Please contact us for other wavelength, size or precision requirements.

Housing accessories

Adjustable Polarizer Holder of Side Drive 840-0195

Find more at EksmaOptics.com

Polarizer Holders 840-0180

Find more at EksmaOptics.com

Ø20 mm waveplates. Clear aperture Ø17 mm, mounted into Ø25.4 mm ring holder

Wavelength, nm	Retardation λ/2		Retardation λ/4	
	Catalogue number		Catalogue number	
1550	460-4201		460-4401	
1064	460-4205		460-4405	
1053	460-4206		460-4406	
1030	460-4208		460-4408	
950	460-4210		460-4410	
852	460-4213		460-4413	
800	460-4215		460-4415	
780	460-4220		460-4420	
770	460-4221		460-4421	
633	460-4225		460-4425	
589	460-4228		460-4428	
532	460-4230		460-4430	
527	460-4231		460-4431	
515	460-4232		460-4432	
488	460-4233		460-4433	
400	460-4235		460-4435	
355	460-4240		460-4440	
343	460-4241		460-4441	
266	460-4245		460-4445	
257	460-4246		460-4446	
244	460-4248		460-4448	

Please contact us for other wavelength, size or precision requirements.

ZERO ORDER AIR-SPACED WAVEPLATES

Features

- For high power laser application

Most of the Retardation Plates are available for fast off-the-shelf delivery. Check the availability at **www.eksmaoptics.com**

Housing accessories

Polarizer Holders 840-0180

Find more at EksmaOptics.com

Specifications

Material	Single crystal quartz
Optical axis	Normal to facet on circumference of retarder
Wavefront distortion	λ/10 @ 633 nm
Surface quality	20 – 10 scratch & dig (MIL-PRF-13830B)
Retardation tolerance	<λ/300 over wavelength range
Parallelism	< 10 arcsec
AR coating	R < 0.5%
Laser damage threshold	10 J/cm², 10 nsec pulse, 1064 nm

Ø20 mm waveplates. Clear aperture Ø17 mm, mounted into Ø25.4 mm ring holder.

Center wavelength, nm	Retardation λ/2		Retardation λ/4	
	Catalogue nr.		Catalogue nr.	
1550	464-4201		464-4404	
1064	464-4205		464-4405	
1030	464-4208		464-4408	
800	464-4215		464-4415	
780	464-4220		464-4420	
532	464-4230		464-4430	
515	464-4232		464-4432	
400	464-4235		464-4435	
355	464-4240		464-4440	
343	464-4241		464-4441	
266	464-4245		464-4445	
257	464-4246		464-4446	

Ø20 mm waveplates. Clear aperture Ø40 mm, mounted into Ø50.8 mm ring holder.

Center wavelength, nm	Retardation λ/2		Retardation λ/4	
	Catalogue nr.		Catalogue nr.	
800	464-4215D50		464-4415D50	

ACHROMATIC AIR-SPACED WAVEPLATES

Achromatic waveplates are made from two different materials: crystal quartz and magnesium fluoride with highly efficient broadband antireflection coatings in an air spaced design.

Retardation tolerance of our achromatic waveplates is better than λ/100 over the entire wavelength range. The flat response of these waveplates is ideal for use with tunable lasers,multiple laser-line systems and other broad spectrum sources.

Our achromatic waveplates are available for four wavelength ranges: VIS (450 – 680 nm), NIR (700 – 1000 nm), 950 – 1300 nm, 1200 – 1650 nm. The waveplates are provided in a black anodized aluminum housing.

Specifications

Material	Single crystal quartz and MgF_2
Clear aperture	Ø12.7 mm
Ring mount outer diameter	25.4 +0.0 / -0.12 mm
Ring mount thickness	8.0 ± 0.2 mm
Retardation tolerance	<λ/100 over wavelength range
Surface quality	40 – 20 scratch & dig (MIL-PRF-13830B)
Wavefront distortion	<λ/8 @ 632 nm
Parallelism	< 1 arcmin
AR coating	R < 0.8%
Laser damage threshold	>3 J/cm^2 , 10 nsec, 1064 nm typical

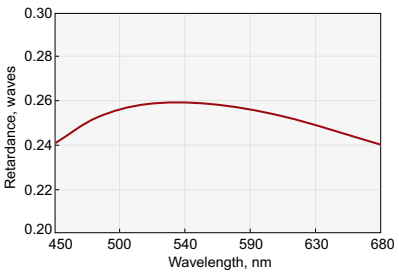
Operating wavelength, nm	Retardation λ/2		Retardation λ/4	
	Catalogue nr.		Catalogue nr.	
450 – 680	**467-4205**		**467-4405**	
700 – 1000	**467-4210**		**467-4410**	
950 – 1300	**467-4215**		**467-4415**	
1200 – 1650	**467-4220**		**467-4420**	

Housing accessories

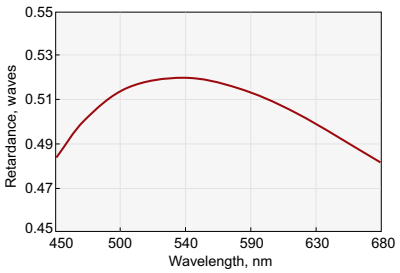
High Precision Rotation Polarizer, Waveplate Mount 840-0186

Find more at EksmaOptics.com

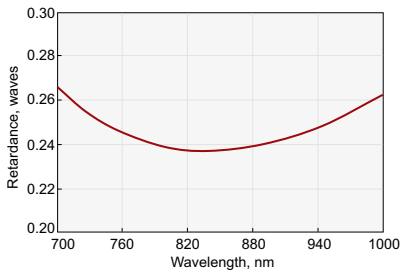
RETARDATION CURVE SAMPLES



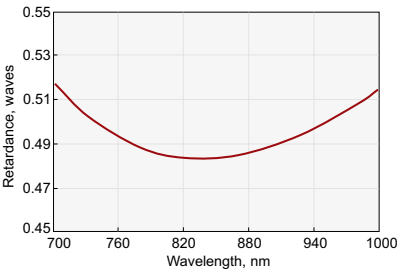
λ/4 @ 450-680 nm



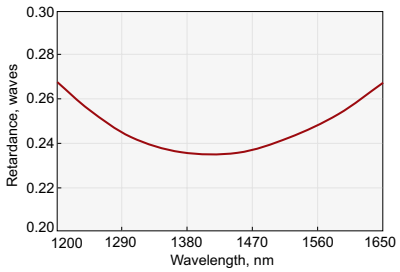
λ/2 @ 450-680 nm



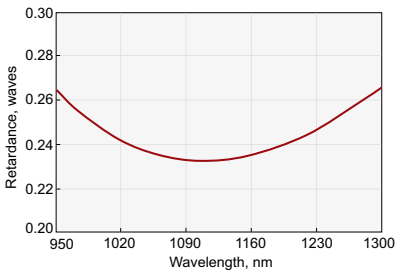
λ/4 @ 700-1000 nm



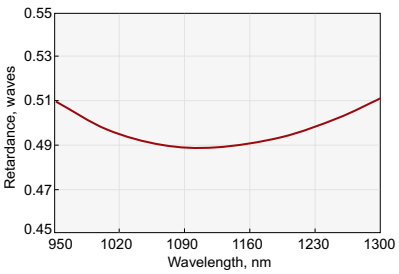
λ/2 @ 700-1000 nm



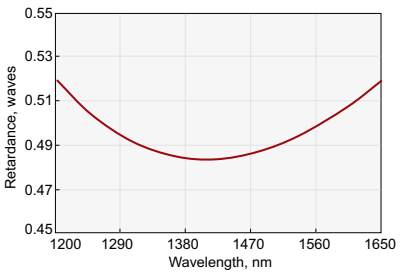
λ/4 @ 1200-1650 nm



λ/4 @ 950-1300 nm



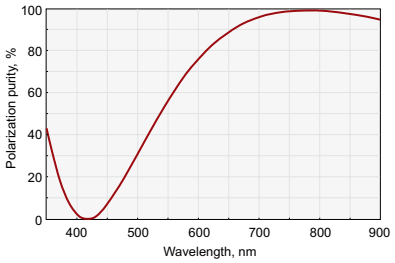
λ/2 @ 950-1300 nm



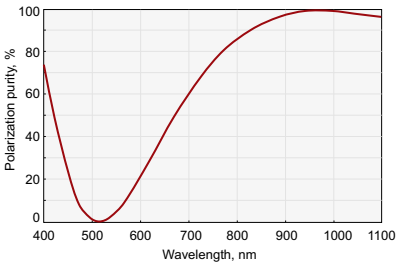
λ/2 @ 1200-1650 nm

ZERO ORDER DUAL WAVELENGTH WAVEPLATES

When optical axis is turned by 45 degrees to input polarization, the waveplate rotates polarization of Ti:Sapphire laser fundamental (800 nm) by 90 degrees and the polarization of Ti:Sapphire second harmonic (400 nm) remains the same.



Polarization purity of zero order dual waveplate. λ/2@800 nm + λ/400 nm



Polarization purity of zero order dual waveplate. λ/2@1030 nm + λ/515 nm

Specifications

Material	Single crystal quartz
Optical axis	normal to facet on circumference of retarder
Clear aperture	Ø17 mm
Ring mount outer diameter	25.4 +0.0 / -0.12 mm
Surface quality	20 – 10 scratch & dig (MIL-PRF-13830B)
Retardation tolerance	<λ/100 over wavelength range
Wavefront distortion	λ/10 @ 633 nm
Parallelism	<10 arcsec
AR coating	R<0.5%
Laser damage threshold:	
Optically contacted (465-4211, 465-4212)	>10 mJ/cm², 50 fsec pulse, 800 nm typical
Air-spaced (466-4211, 466-4212)	100 mJ/cm², 50 fsec pulse, 800 nm typical

Description	AR coated	Catalogue number	
Optically contacted; λ/2@800 nm + λ@400 nm	800+400 nm	**465-4211**	
Optically contacted; λ/2@1030 nm + λ@515 nm	1030+515 nm	**465-4212**	
Air-spaced; λ/2@800 nm + λ@400 nm	800+400 nm	**466-4211**	
Air-spaced; λ/2@1030 nm + λ@515 nm	1030+515 nm	**466-4212**	

Housing accessories

Polarizer Holders 840-0180

Find more at EksmaOptics.com

LOW ORDER WAVEPLATES

Features

- Thinner than multiple order
- Less than 8 order
- Less temperature and wavelength dependent than multiple order

Specifications

Material	Single crystal quartz
Optical axis	normal to facet on circumference of retarder
Nominal thickness of waveplate	0.15–0.35 mm
Surface quality	20 – 10 scratch & dig (MIL-PRF-13830B)
Retardation tolerance	<λ/300 over wavelength range
Wavefront distortion	λ/10 @ 633 nm
Parallelism	< 10 arcsec
AR coating	R < 0.4%
Laser damage threshold	10 J/cm², 10 nsec pulse, 1064 nm typical

Ø12.7 mm waveplates. Clear aperture Ø11 mm, unmounted

Wavelength, nm	Retardation λ/2		Retardation λ/4	
	Catalogue number		Catalogue number	
1550	**461-4201D12**		**461-4401D12**	
1064	**461-4205D12**		**461-4405D12**	
1053	**461-4206D12**		**461-4406D12**	
1030	**461-4208D12**		**461-4408D12**	
800	**461-4215D12**		**461-4415D12**	
780	**461-4220D12**		**461-4420D12**	
633	**461-4225D12**		**461-4425D12**	
532	**461-4230D12**		**461-4430D12**	
515	**461-4232D12**		**461-4432D12**	
355	**461-4240D12**		**461-4440D12**	

Please contact us for other wavelength, size or precision requirements.

Ø20 mm waveplates. Clear aperture Ø17 mm, mounted into Ø25.4 mm ring holder

Wavelength, nm	Retardation λ/2		Retardation λ/4	
	Catalogue number		Catalogue number	
1550	461-4201		461-4401	
1064	461-4205		461-4405	
1053	461-4206		461-4406	
1030	461-4208		461-4408	
950	461-4210		461-4410	
852	461-4213		461-4413	
800	461-4215		461-4415	
780	461-4220		461-4420	
770	461-4221		461-4421	
633	461-4225		461-4425	
589	461-4228		461-4428	
532	461-4230		461-4430	
527	461-4231		461-4431	
515	461-4232		461-4432	
488	461-4233		461-4433	
400	461-4235		461-4435	
355	461-4240		461-4440	
343	461-4241		461-4441	

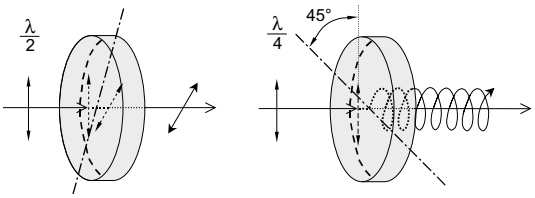
Please contact us for other wavelength, size or precision requirements.

MULTIPLE ORDER WAVEPLATES

Features

- Made from a single crystalline plate
- Polished to 1–1.5 mm thickness

Their retardation is only slightly more temperature dependent compared with the zero order ones.



Specifications

Material	Single crystal quartz
Optical axis	normal to facet on circumference of retarder
Nominal thickness of waveplate	1–1.5 mm
Surface quality	20 – 10 scratch & dig (MIL-PRF-13830B)
Retardation tolerance	<λ/300 over wavelength range
Wavefront distortion	λ/10 @ 633 nm
Parallelism	< 10 arcsec
AR coating	R < 0.4%
Laser damage threshold	10 J/cm^2, 10 nsec pulse, 1064 nm typical

Ø12.7 mm waveplates. Clear aperture Ø11 mm, unmounted

Wavelength, nm	Retardation λ/2		Retardation λ/4	
	Catalogue number		Catalogue number	
1550	462-4201D12		462-4401D12	
1064	462-4205D12		462-4405D12	
1053	462-4206D12		462-4406D12	
1030	462-4208D12		462-4408D12	
800	462-4215D12		462-4415D12	
780	462-4220D12		462-4420D12	
633	462-4225D12		462-4425D12	
532	462-4230D12		462-4430D12	
515	462-4232D12		462-4432D12	
355	462-4240D12		462-4440D12	

Please contact us for other wavelength, size or precision requirements.

Housing accessories

High Precision Rotation Polarizer, Waveplate Mount 840-0186

Find more at EksmaOptics.com

Polarizer Holders 840-0180

Find more at EksmaOptics.com

Ø20 mm waveplates. Clear aperture Ø17 mm, mounted into Ø25.4 mm ring holder

Wavelength, nm	Retardation λ/2		Retardation λ/4	
	Catalogue number		Catalogue number	
1550	462-4201		462-4401	
1064	462-4205		462-4405	
1053	462-4206		462-4406	
1030	462-4208		462-4408	
950	462-4210		462-4410	
852	462-4213		462-4413	
800	462-4215		462-4415	
780	462-4220		462-4420	
770	462-4221		462-4421	
633	462-4225		462-4425	
589	462-4228		462-4428	
532	462-4230		462-4430	
527	462-4231		462-4431	
515	462-4232		462-4432	
448	462-4233		462-4433	
400	462-4235		462-4435	
355	462-4240		462-4440	
343	462-4241		462-4441	
266	462-4245		462-4445	
257	462-4246		462-4446	

Please contact us for other wavelength, size or precision requirements.

MULTIPLE ORDER DUAL WAVELENGTH WAVEPLATES

Features

- Operate at both first and second Nd:YAG laser harmonics
- Retardation tolerance < λ/300

Specifications

Material	Single crystal quartz
Optical axis	normal to facet on circumference of retarder
Wavefront distortion	λ/10 @ 633 nm
Clear aperture	Ø17 mm
Ring mount outer diameter	25.4 +0.0 / -0.12 mm
Surface quality	20 – 10 scratch & dig (MIL-PRF-13830B)
Retardation tolerance	<λ/200 over wavelength range
Parallelism	< 10 arcsec
AR coating	R < 0.5%
Nominal thickness of waveplate	0.2-1.2 mm
Laser damage threshold	5 J/cm², 10 nsec pulse, 1064 nm typical

Housing accessories

High Precision Rotation Polarizer, Waveplate Mount 840-0186

Find more at EksmaOptics.com

Polarizer Holders 840-0180

Find more at EksmaOptics.com

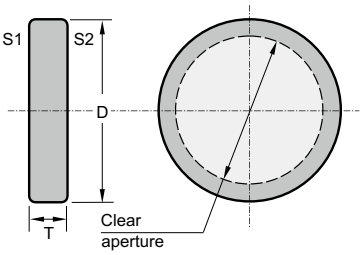
Retardation and Wavelength	Catalogue number	
λ @ 1064nm + λ/2 @ 532 nm	463-4120	
λ @ 1064nm + λ/4 @ 532 nm	463-4140	
λ/2 @ 1064nm + λ@ 532 nm	463-4210	
λ/2 @ 1064nm + λ/2 @ 532 nm	463-4220	
λ/2 @ 1064nm + λ/4 @ 532 nm	463-4240	
λ/4 @ 1064nm + λ @ 532 nm	463-4410	
λ/4 @ 1064nm + λ/2 @ 532 nm	463-4420	
λ/4 @ 1064nm + λ/4 @ 532 nm	463-4440	
λ @ 800nm + λ/2 @ 400nm	463-4121	
λ @ 800nm + λ/4 @ 400nm	463-4141	
λ/2 @ 800nm + λ @ 400nm	463-4211	
λ/2 @ 800nm + λ/2 @ 400nm	463-4221	
λ/2 @ 800nm + λ/4 @ 400nm	463-4241	
λ/4 @ 800nm + λ @ 400nm	463-4411	
λ/4 @ 800nm + λ/2 @ 400nm	463-4421	
λ/4 @ 800nm + λ/4 @ 400nm	463-4441	

POLARIZATION PLANE ROTATORS

Features

- Made of crystalline quartz
- Intended to rotate a beam polarization plane strictly to an appropriate angle using the circular birefringent effect

As compared to a waveplate, a rotator has an intrinsic advantage, being independent of rotation around its own optical axis. It needs no adjustment, only to be installed normal to incident radiation. A polarization plane rotator is normally used for the specific wavelength. It is only slightly dependent on ambient temperature.



Polarization plane rotators for any wavelength from 200 to 2300 nm are available.

Specifications

Material	Single crystal quartz
Optical axis	Normal to faces S1, S2 of rotator
Clear aperture	Ø17 mm
Ring mount outer diameter	D = 25.4 +0.0 / -0.12 mm
Mount thickness	T = 6–20 mm (depending on wavelength and rotation angle)
Surface quality	20 – 10 scratch & dig (MIL-PRF-13830B)
Wavefront distortion	λ/10
Parallelism	< 10 arcsec
AR coating	R < 0.2% both sides
Laser damage threshold	5 J/cm^2, 10 nsec pulse, 1064 nm typical

Center wavelength, nm	Rotation angle of polarization plane, deg	Catalogue number	
1064	45	470-4644	
1064	90	470-4649	
1030	45	470-4904	
1030	90	470-4909	
800	45	470-4804	
800	90	470-4809	
780	45	470-4784	
780	90	470-4789	
633	45	470-4634	
633	90	470-4639	
532	45	470-4534	
532	90	470-4539	
515	45	470-4514	
515	90	470-4519	
413	45	470-4414	
413	90	470-4419	
400	45	470-4044	
400	90	470-4049	
355	45	470-4354	
355	90	470-4359	
343	45	470-4344	
343	90	470-4349	
266	45	470-4264	
266	90	470-4269	
257	45	470-4254	
257	90	470-4259	
244	45	470-4244	
244	90	470-4249	

Please contact us for other size or wavelengths requirements.

Housing accessories

Kinematic Mirror and Beamsplitter Mount 840-0020

Find more at EksmaOptics.com

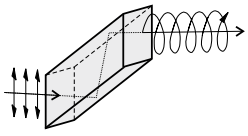
Kinematic Positioning Mount 840-0193

Find more at EksmaOptics.com

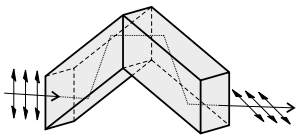
FRESNEL RHOMBS

Features

- Rotate polarization, operates over a wide wavelength range
- λ/2 rhomb is two optically contacted λ/4 rhombs

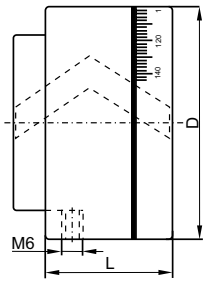


λ/4 Fresnel rhomb



λ/2 Fresnel rhomb

Due to unequal phase shifts arising in orthogonally polarized components of an incident wave at total internal reflection, Fresnel Rhombs are used to alter the polarization type of radiation. They are designed so that two full internal reflections inside a rhomb provide π/2 phase difference between the orthogonally polarized components of radiation. Hence, if there is a 45° angle between the polarization of the linearly polarized incident plane, the emerging beam is circularly polarized, i. e. the rhomb effect is similar to that of a quarter-waveplate. Therefore, two identical Fresnel rhombs, installed in series, will provide π/2 phase difference similar to that of a half-waveplate, i. e. the device can rotate the beam polarization plane by 90°, leaving the beam direction invariable.



λ/2 rhomb with mount

Due to the low dispersion of the refractive index of the materials being used Fresnel rhombs are achromatic over a wide spectral range.

Air-Spaced Fresnel Rhombs are available on request for high power applications.

Specifications

Material	BK7, UV FS
Operating spectral range	BK7: 400–2000 nm
	UV FS: 210–400 nm
Surface quality	20 – 10 scratch & dig (MIL-PRF-13830B)
Surface flatness	λ/10 @ 633 nm (all polished surfaces)
Retardation tolerance	±2°
Broad band AR coating	R < 1%
Laser damage threshold	> 0.5 J/cm², 10 nsec pulse, 1064 typical

Mounting Suggestion

Unmounted

Material	Wavelength range, nm	Retardation	Clear aperture, mm	Catalogue number	
BK7	600–900	λ/2	10	481-0210	
		λ/4	10	481-0410	
	400–700	λ/2	10	481-0212	
		λ/4	10	481-0414	
UV FS	210–400	λ/2	10	481-1210	
		λ/4	10	481-1410	

Fresnel rhombs with other dimensions and parameters or coatings as well as unmounted rhombs are available upon request.

Mounted

Material	Wavelength range, nm	Retardation	Clear aperture, mm	Holder diameter D, mm	Holder lenght L, mm	Catalogue number	
BK7	600–900	λ/2	10	73	55	480-0210	
		λ/4	10	65	25	480-0410	
	400–700	λ/2	10	73	55	480-0212	
		λ/4	10	65	25	480-0414	
UV FS	210–400	λ/2	10	73	55	480-1210	
		λ/4	10	65	25	480-1410	

Fresnel rhombs with other dimensions and parameters or coatings as well as unmounted rhombs are available upon request.

LITHIUM FLUORIDE (LiF) COMPONENTS

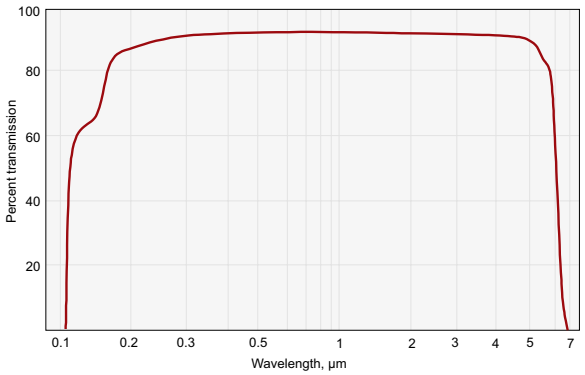
Features

- Optically isotropic, medium hard, hygroscopic, insoluble in water
- Wide transmission range from 150 nm to 6000 nm

Lithium fluoride crystals are well-suited for manufacturing of optical elements (mirrors, windows, lenses) for UV, visible and IR applications.

LiF is very useful for x-ray monochromators and for the study of fundamental properties and defects in crystals.

LiF lenses, Brewster windows, prisms are available upon request.



External transmission of LiF window of 10 mm thickness

Physical properties

Crystal type	cubic
Lattice constant, Å	a = 4.026
Density, g/cm^3	2.64
Melting point, °C	870
Refractive index @ 1.0 µm	n = 1.387
Transmission range, µm	0.12 – 6

Specifications for LiF windows

Material	optical quality LiF crystal ($\Delta n/cm < 0.5\times10^{-5}$)
Spectral range	UV, VIS, IR
Surface quality	60 – 40 scratch & dig (MIL-PRF-13830B)
Clear aperture	90% of the diameter
Diameter tolerance	+0.0 / -0.1 mm
Thickness tolerance	±0.2 mm
Surface flatness	λ/4 @ 633 nm
Parallelism	< 3 arcmin

Housing accessories

Optical Component Mount 830-0037

Find more at EksmaOptics.com

Diameter, mm	Thickness, mm	Substrate	Catalogue number	
25.4	3.0	UV grade LiF	**510-5253**	
38.1	4.0	UV grade LiF	**510-5384**	
50.8	6.0	UV grade LiF	**510-5506**	

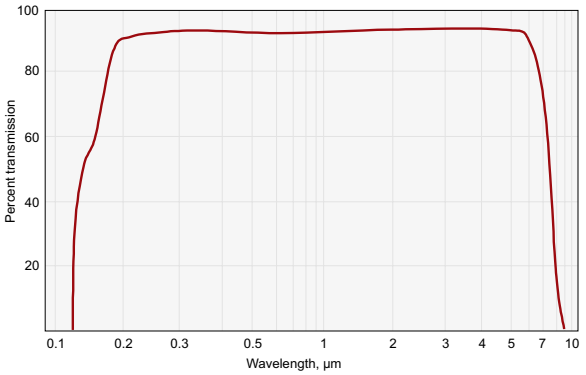
Please contact us for other size, shape or precision requirements.

MAGNESIUM FLUORIDE (MgF_2) COMPONENTS

Features

- Very hard and rugged
- Resistant to mechanical and thermal shock
- The only optical material combining a wide spectral transmission band with the birefringence phenomenon

Magnesium fluoride is a proven material for high energy lasers, and in particular for lasers operating in the UV range.



External transmission of MgF_2 window of 10 mm thickness

Generally all optical elements are manufactured with the working surface perpendicular to the c-axis of MgF_2 crystal.

MgF_2 lenses, windows, mirrors, prisms are available upon request.

Physical properties

Crystal type	tetragonal
Lattice constant, Å	a = 4.60, c = 3.06
Density, g/cm³	3.177
Melting point, °C	1255
Refractive index @ 1.0 µm	$n_o = 1.3796$, $n_e = 1.3852$
Transmission range, µm	0.12 – 7

Specifications

Material	optical quality MgF_2 crystal ($\Delta n/cm < 0.5\times10^{-5}$)
Spectral range	UV, IR
Surface quality	40 – 20 scratch & dig (MIL-PRF-13830B)
Clear aperture	90% of the diameter
Diameter tolerance	+0.0 / -0.1 mm
Thickness tolerance	±0.2 mm
Surface flatness	λ/4 @ 633 nm
Parallelism	< 3 arcmin
Maximum available size of optical components	up to 50 mm

Diameter, mm	Thickness, mm	Substrate	Catalogue number	
25.4	3.0	UV grade MgF_2	**520-5253**	
38.1	5.0	UV grade MgF_2	**520-5385**	
50.8	6.0	UV grade MgF_2	**520-5506**	
25.4	3.0	IR grade MgF_2	**520-6253**	
38.1	5.0	IR grade MgF_2	**520-6385**	
50.8	6.0	IR grade MgF_2	**520-6506**	

Please contact us for other size, shape or precision requirements.

Housing accessories

Kinematic Mirror / Beamsplitter Mounts 840-0032, 840-0033

Find more at EksmaOptics.com

CALCIUM FLUORIDE (CaF_2) COMPONENTS

Features

- Useful transmission over the spectral range from 0.2 to 8.0 microns
- Low solubility

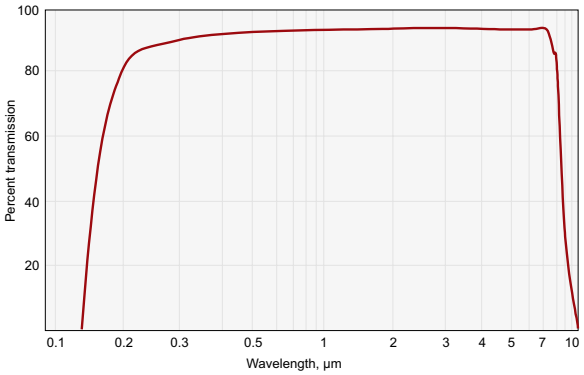
Two grades of materials are available: one for UV and the other for IR applications. Low solubility and a wide transmission range makes it useful for many applications, including:

– mirror substrate for UV laser systems;

– substrate for manufacturing windows, lenses for UV, IR applications.

Due to its composition CaF_2 has a much longer useful life than most materials when used in a fluorine environment.

CaF_2 lenses, windows, mirrors, prisms, beamsplitters and beamselectors are available upon request.



External transmission of CaF_2 window of 10 mm thickness

Physical properties

Crystal type	cubic
Lattice constant, Å	a = 5.462
Density, g/cm^3	3.18
Melting point, °C	1360
Refractive index @ 1.0 µm	n = 1.4289
Transmission range, µm	0.13 – 10

CaF_2 WINDOWS

Specifications

Material	optical quality CaF_2 crystal ($\Delta n/cm < 0.5\times10^{-5}$)
Spectral range	UV, VIS, IR
Surface quality	40 – 20 scratch & dig (MIL-PRF-13830B)
Clear aperture	90% of the diameter
Diameter tolerance	+0.0 / -0.13 mm
Thickness tolerance	±0.2 mm
Surface flatness	λ/4 @ 633 nm
Parallelism	3 arcmin
Maximum available size of optical components up to dia	120 × 20 mm

Diameter, mm	Thickness, mm	Substrate	Catalogue number	
25.4	1.0	UV grade CaF_2	530-6251	
25.4	2.0	UV grade CaF_2	530-6252	
25.4	3.0	UV grade CaF_2	530-5253	
38.1	5.0	UV grade CaF_2	530-5385	
50.8	6.0	UV grade CaF_2	530-5506	
25.4	3.0	IR grade CaF_2	530-6253	
38.1	5.0	IR grade CaF_2	530-6385	
50.8	6.0	IR grade CaF_2	530-6506	
70.0	10.0	IR grade CaF_2	530-6710	
75.0	6.0	IR grade CaF_2	530-6756	

Please contact us for other size, shape or precision requirements.

IR GRADE CaF_2 PROTECTIVE WINDOWS FOR SPECTROSCOPY APPLICATION (optically polished)

Specifications

Material	optical quality CaF_2 crystal ($\Delta n/cm < 0.5\times10^{-5}$)
Surface quality	80 – 50 scratch & dig (MIL-PRF-13830B)
Clear aperture	90% of the diameter
Diameter tolerance	+0.0 / -0.13 mm
Thickness tolerance	±0.2 mm
Surface flatness	optically polished
Parallelism	<10 arcmin

Diameter, mm	Thickness, mm	Substrate	Catalogue number	
12.0	1	IR grade CaF_2	530-6121	
25.4	1.5	IR grade CaF_2	530-6131	
50.8	2.0	IR grade CaF_2	530-6151	

Housing accessories

Flipping Mirror / Beamsplitter Mounts 840-0155

Find more at EksmaOptics.com

BARIUM FLUORIDE (BaF_2) COMPONENTS

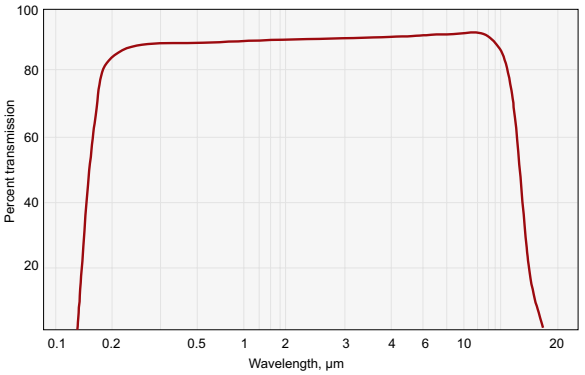
Features

- Useful transmission range covers 0.265 – 10 µm
- Most resistant to high energy radiation among fluorides listed in this catalogue

Barium fluoride is used for optical windows, prisms and lenses transmitting from ultraviolet into infrared, it can be used as an infrared laser window or lens. BaF_2 is recommended for use as a vacuum ultraviolet window where high radiation resistance is required.

BaF_2 is less soluble than LiF, but relatively more soluble than MgF_2 and CaF_2.

BaF_2 lenses, Brewster windows, mirrors, prisms are available on request.



External transmission of BaF_2 window of 10 mm thickness

Physical properties

Crystal type	cubic
Density, g/cm³	4.89
Melting point, °C	1386
Refractive index	@ 0.265 µm, n = 1.51217 @ 10.3 µm, n = 1.39636
Transmission range, µm	0.15 – 12

BaF_2 WINDOWS

Specifications

Material	BaF_2
Surface quality	60 – 40 scratch & dig (MIL-PRF-13830B)
Clear aperture	90% of the diameter
Diameter tolerance	+0.0 / -0.25 mm
Thickness tolerance	± 0.2 mm
Surface flatness	1λ per inch @ 633 nm
Parallelism	3 arcmin

Diameter, mm	Thickness, mm	Catalogue number	
25.4	2	540-7252	
25.4	3	540-7251	
44.6	3.5	540-7445	
50.8	3	540-7503	

Please contact us for other size, shape, precision or coating requirements.

BaF_2 LENSES

Specifications

Material	BaF_2
Surface quality	60 – 40 scratch & dig (MIL-PRF-13830B)
Clear aperture	90% of the diameter
Diameter tolerance	+0.0 / -0.5 mm
Focal length	± 2% @ 3 µm
Surface irregularity	λ/4 @ 633 nm
Centration	3 arcmin
Maximum available size of optical components	up to Ø100 mm

Diameter, mm	Focal length, mm	Type	Catalogue number	
12.7	25	plano-convex	541-7105	
25.4	40	plano-convex	541-7204	
25.4	50	plano-convex	541-7205	
25.4	75	plano-convex	541-7207	
25.4	100	plano-convex	541-7210	
25.4	125	plano-convex	541-7212	
25.4	150	plano-convex	541-7213	
25.4	200	plano-convex	541-7214	
25.4	250	plano-convex	541-7225	
25.4	300	plano-convex	541-7230	
25.4	750	plano-convex	541-7275	
25.4	1000	plano-convex	541-7250	
12.7	-25	plano-concave	542-7105	
25.4	-50	plano-concave	542-7205	
25.4	-75	plano-concave	542-7207	
25.4	-100	plano-concave	542-7210	
25.4	-250	plano-concave	542-7225	
25.4	-1000	plano-concave	542-7250	
25.4	-2000	plano-concave	542-7270	

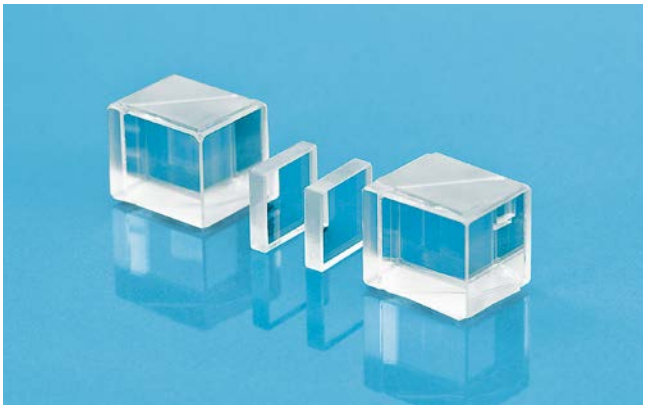
Please contact us for other size, shape or precision requirements.

Housing accessories

Self-Centring Lens Mounts 830-0010

Find more at EksmaOptics.com

BaF_2 OPTICAL CRYSTALS FOR CROSS POLARIZED WAVE GENERATION



Cross-Polarized Wave (XPW) generation is a nonlinear third order process during which fundamental and generated waves have the same frequency; however, generated wave is perpendicularly polarized to pump wave polarization. Phase matching occurs over large bandwidth in XPW generation process. This means the same phase and group velocities for fundamental wave and XPW.

Cross-polarized wave (XPW) generation process is driven by the third order nonlinearity of the crystal, $\chi^{(3)}_{xxxx}$ and the anisotropy $\sigma = (\chi^{(3)}_{xxxx} - 3\chi^{(3)}_{xxyy}) / \chi^{(3)}_{xxxx}$ of the $\chi^{(3)}$ sensor.

The typical optical material used for cross-polarized wave (XPW) generation is Barium Fluoride (BaF_2) crystal with z ([001]) or holographic ([011]) crystallographic orientation. Theory predicts a maximum XPW energy conversion efficiency around 35% when using [011]-cut BaF_2 crystal with a concomitant pulse shortening factor of √3 corresponding to a pure third-order nonlinear process [1].

EKSMA OPTICS offers [011] orientation BaF_2 optical crystals (XPW crystals) for Cross-Polarized Wave (XPW) generation. BaF_2 optical crystals with orientation [001] as well CaF_2 optical crystals are available on request.

Physical properties

Crystal type	cubic
Density, g/cm³	5.27
Melting point, °C	1525
Refractive index	@ 0.265 µm, n = 1.51217 @ 10.3 µm, n = 1.39636
Transmission range, µm	0.135 – 15

Specifications

Material	BaF_2
Surface quality	60 – 40 scratch & dig (MIL-PRF-13830B)
Clear aperture	90% of the diameter
Diameter tolerance	+0.0 / -0.25 mm
Thickness tolerance	± 0.2 mm
Surface flatness	λ/2 @ 633 nm
Parallelism	3 arcmin

Characteristics of the different Cross Polarized Wave (XPW) crystals at 2.1 µm [2]

	BaF_2	CaF_2	CVD-Diamond
Orientation	h-cut [011]	h-cut [011]	z-cut [001]
Length, mm	2	2	1.2
n	1.464	1.426	2.383
$\chi^{(3)}_{xxxx}$, 10^{-22} m²/V²	1.53	0.94	11
σ	-1.2	-0.6	-1.8
GVD, fs²/mm	-6	-27	63

[1] L. Canova, S. Kourtev, N. Minkovski, A. Jullien, R. Lopez-Martens, O. albert, and S.M. Saltiel, Appl. Phys. Lett. 92, 231102 (2008)

[2] Ricci, A., Silva, F., Julline, A., Cousin, S. L., Austin, D. R., Biegert, J., Lopez-Martens, R. Generation of High-Fidelity few-cycle pulses at 2.1 µm via cross-polarized wave generation. Optics Express 9711, 2013.04.22. Vol. 21, No. 8. DOI:10.1364/OE.21.009711

UNMOUNTED

Size, mm	Thickness, mm	Orientation	Catalogue number	
10x10	0.5	[011]	**540-7105**	
10x10	1.0	[011]	**540-7110**	
10x10	1.5	[011]	**540-7115**	
10x10	2.0	[011]	**540-7120**	
10x10	2.5	[011]	**540-7125**	
10x10	3.0	[011]	**540-7130**	

MOUNTED INTO OPEN RING HOLDER

Size, mm	Thickness, mm	Orientation	Catalogue number	
10x10	0.5	[011]	**540-7105M**	
10x10	1.0	[011]	**540-7110M**	
10x10	1.5	[011]	**540-7115M**	
10x10	2.0	[011]	**540-7120M**	
10x10	2.5	[011]	**540-7125M**	
10x10	3.0	[011]	**540-7130M**	

SAPPHIRE (Al_2O_3) COMPONENTS

Features

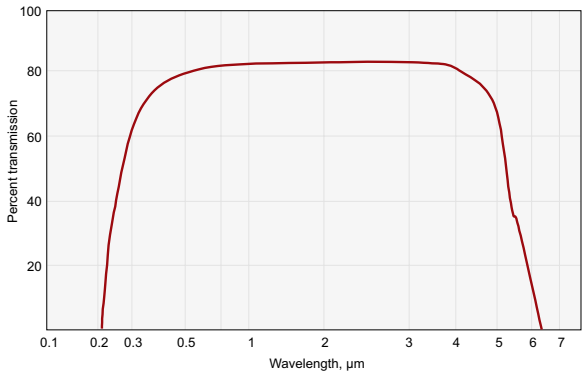
- The hardest of the oxide crystals
- Excellent transparency and thermal properties
- Chemically inert and insoluble
- Can be safely made much thinner than windows from glass or other crystals

Single crystal sapphire combines excellent optical, physical and chemical properties. Chemically inert and almost insoluble, sapphire in many ways is a superior material for windows. It is transparent from 150 nm up to 6 µm in the middle infrared.

Sapphire exhibits anisotropy in many optical and physical properties. Difference in the index of refraction in orthogonal directions is 0.008.

The high index of sapphire makes magnesium fluoride almost an ideal single layer anti-reflection coating.

Exact parameters depend on the orientation of optical axis or c-axis relative to the surface.



External transmission of Al_2O_3 window of 1 mm thickness

Physical properties

Crystal type	Hexagonal
Density, g/cm^3	3.97
Melting point, °C	2040
Refractive index	@ 0.3 µm, n = 1.814 @ 5 µm, n = 1.623
Transmission range, µm	0.17 – 5.5

Specifications for Sapphire windows

Material	Al_2O_3
Surface quality	60 – 40 scratch & dig (MIL-PRF-13830B)
Clear aperture	80% of the diameter
Diameter tolerance	+0.0 / -0.13 mm
Thickness tolerance	±0.2 mm
Surface flatness	1 λ per inch @ 633 nm
Parallelism	3 arcmin
Orientation	C-cut

Diameter, mm	Thickness, mm	Catalogue number	
12.7	0.5	550-7120	
12.7	1	550-7121	
12.7	2	550-7122	
12.7	3	550-7123	
12.7	4	550-7124	
12.7	6	550-7126	
20.0	0.5	550-7200	
20.0	1	550-7201	
20.0	2	550-7202	
25.4	0.5	550-7250	
25.4	1	550-7251	
25.4	2	550-7252	
25.4	3	550-7253	
25.4	4	550-7254	
25.4	5	550-7255	
38.1	2	550-7382	
50.0	2	550-7502	
50.0	3	550-7503	

Please contact us for other size, shape or precision requirements. Coatings are available upon request.

Housing accessories

Mirror / Beamsplitter Mount 840-0036

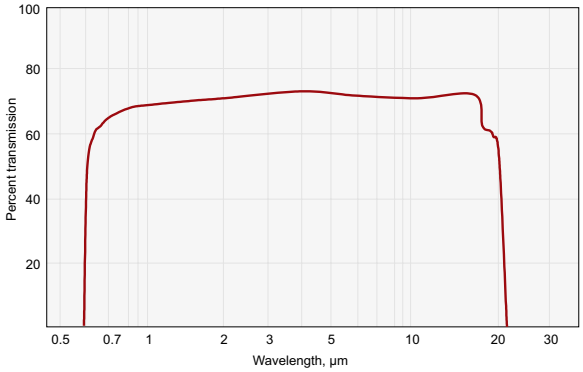
Find more at EksmaOptics.com

ZINC SELENIDE (ZnSe) COMPONENTS

Features

- Low absorption in the red end of the visible spectrum
- Not hygroscopic
- Quite stable in the laboratory environment

Zinc selenide is the most popular material for infrared applications. Due to a very wide transmission range covering 0.6–22 µm chemical vapor deposition grown ZnSe as a high optical quality material is used to manufacture optical components (windows, mirrors, lenses) for high power IR lasers.



External transmission of ZnSe window of 10 mm thickness

Because of a high refractive index, single and double layer antireflection coatings can be unusually effective.

ZnSe Brewster windows, mirrors, prisms, beamsplitters and beamselectors are available upon request.

Physical properties

Crystal type	cubic	
Density, g/cm^3	5.27	
Melting point, °C	1525	
Refractive index	@ 8 – 13 µm	n = 2.417–2.385
	@ 10.6 µm	n = 2.403
Transmission range, µm	0.6 – 21	
Bulk absorption coefficient, cm^{-1}	@ 10.6 µm	0.6 – 1.0×10^{-3}
Coefficient of linear thermal expansion, °C^{-1}	8.56×10^{-6}	

ZnSe WINDOWS

Specifications

Material	ZnSe
Surface quality	40 – 20 scratch & dig (MIL-PRF-13830B)
Clear aperture	90% of the diameter
Diameter tolerance	+0.0 / -0.13 mm
Thickness tolerance	± 0.1 mm @ 10.6 µm
Surface flatness	λ/40 per inch @ 10.6 µm over clear aperture
Parallelism	3 arcmin
Coating	both surfaces AR coated @ 10.6 µm, R≤0.5% per surface

Uncoated

Diameter, mm	Thickness, mm	Catalogue number	
12.7	2.0	**560-6120**	
12.7	3.0	**560-6121**	
25.4	2.0	**560-6250**	
25.4	3.0	**560-6251**	
38.1	3.0	**560-6381**	
50.8	3.0	**560-6501**	
50.8	5.0	**560-6503**	

Coated AR/AR @ 10.6 µm, AOI=0°

Diameter, mm	Thickness, mm	Catalogue number	
12.7	2.0	**560-6122**	
25.4	3.0	**560-6253**	
38.1	3.0	**560-6383**	
50.8	5.0	**560-6505**	
76.2	6.4	**560-6766**	

Please contact us for other size, shape, precision or coating requirements.

ZnSe PLANO-CONVEX LENSES

Specifications

Material	ZnSe
Surface quality	40 – 20 scratch & dig (MIL-PRF-13830B)
Focal length tolerance	±2%
Diameter tolerance	+0.0 / -0.13 mm
Thickness tolerance	±0.1 mm
Coating	both surfaces AR coated @ 10.6 µm, R≤0.5% per surface

Diameter, mm	Focal length, mm	Catalogue number	
12.7	25.4	561-6122	
19.1	38.1	561-6192	
19.1	50.8	561-6193	
25.4	50.8	561-6251	
25.4	63.5	561-6252	
25.4	76.2	561-6253	
25.4	101.6	561-6254	
25.4	127	561-6255	

Diameter, mm	Focal length, mm	Catalogue number	
25.4	150	561-6256	
25.4	200	561-6257	
25.4	254	561-6258	
38.1	63.5	561-6382	
38.1	127	561-6385	
38.1	190.5	561-6388	
50.8	127	561-6502	
76.2	254	561-6765	

Please contact us for other size, shape, precision or coating requirements.

ZnSe MENISCUS LENSES

Specifications

Material	ZnSe
Surface quality	40-20 scratch & dig (MIL-PRF-13830B)
Focal length tolerance	±2%
Diameter tolerance	+0.0 -0.13 mm
Thickness tolerance	±0.1 mm
Clear Aperture	90% of the diameter
Coating	both surfaces AR coated @ 10.6 µm, R≤0.5% per surface

Housing accessories

Variable Lens Holder 830-0040

Find more at EksmaOptics.com

Diameter, mm	Focal length, mm	Catalogue number	
12.7	38.1	565-6122	
25.4	25.4	565-6251	
25.4	38.1	565-6252	
25.4	50	565-6253	
25.4	63.5	565-6255	
25.4	75	565-6256	
25.4	100	565-6257	
25.4	127	565-6258	
38.1	63.5	565-6382	
38.1	127	565-6385	
38.1	254	565-6388	
50.8	127	565-6502	
76.2	254	565-6765	

Please contact us for other size, shape, precision or coatings requirements.

SILICON (Si) COMPONENTS

Coated silicon substrates are most common used as mirrors for CO_2 lasers. Its advantages are good durability, thermal stability and relatively low cost.

The total reflectors are used as rear reflectors and fold mirrors and externally as beam benders in beam delivery systems.

Specifications

Material	Si
Density, g/cm^3	2.33
Operation wavelength	10.6 µm
Surface quality	40 – 20 scratch & dig (MIL-PRF-13830B)
Surface flatness	λ/4 @ 633 nm
Clear aperture	>80% of diameter
Diameter tolerance	+0.0 / -0.2 mm
Thickness tolerance	±0.25 mm

SILICON (Si) MIRRORS

Specifications

Coating	protected gold
Reflectivity for unpolarised radiation	> 99%

Diameter, mm	Thickness, mm	Catalogue number	
25.4	3	575-6250	
38.1	4	575-6380	
50.8	5	575-6500	

SILICON (Si) WINDOWS

Specifications

Coating	uncoated
Parallelism	3 arcmin

Diameter, mm	Thickness, mm	Catalogue number	
25.4	3	575-6250U	
50.8	3	575-6500U	

GERMANIUM (Ge) COMPONENTS

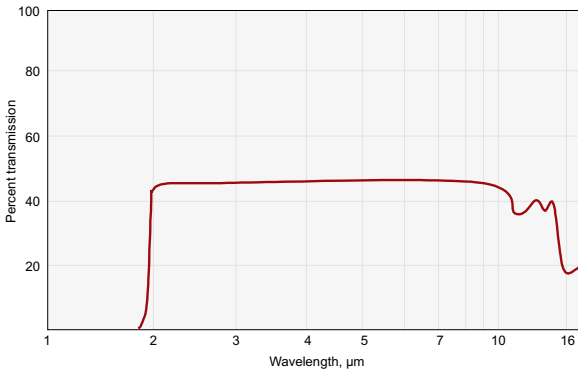
Features

- Wide IR transmission range covering 1.8 – 16 µm
- Opaque in the visible range

Ge based optical components are widely used for IR applications. Ge is well suited for manufacturing windows and lenses for IR applications in lasers and optical systems. Ge components are used with AR coatings because of high surface reflectivity of substrate.

The high refractive index ensures an exceptional single wavelength performance for a "best form" singlet constructed from germanium.

Ge lenses, Brewster windows, mirrors and beamsplitters are available upon request.



External transmission for Ge window of 10 mm thickness

Physical properties

Crystal type	cubic
Lattice constant, Å	a = 5.657
Density, g/cm³	5.33
Melting point, °C	936
Refractive index @ 10.6 µm	n = 4.0034
Transmission band, µm	1.8 – 17

Specifications

Material	optical quality Ge crystal ($\Delta n/cm < 0.5\times10^{-5}$)
Surface quality	60 – 40 scratch & dig (MIL-PRF-13830B)
Clear aperture	80% of the diameter
Diameter tolerance	+0.0 / -0.1 mm
Thickness tolerance	±0.2 mm
Surface flatness	< 1.5 λ per inch @ 633 nm
Parallelism	< 3 arcmin

Coating	Diameter, mm	Thickness, mm	Catalogue number	
uncoated	25.4	3.0	**580-6023**	
	38.1	4.0	**580-6034**	
	50.8	5.0	**580-6055**	
AR/AR @ 10.6 µm	25.4	3.0	**580-6123**	
	38.1	4.0	**580-6134**	
	50.8	5.0	**580-6155**	

Please contact us for other sizes or required specifications of coating.

Housing accessories

Kinematic Mirror and Beamsplitter Mount 840-0020

Find more at EksmaOptics.com

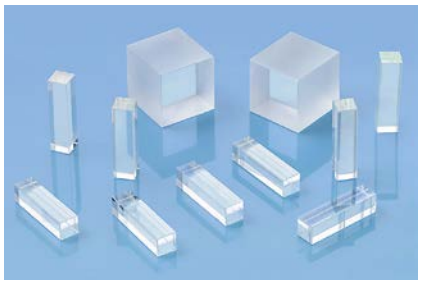
EKSMA OPTICS

Nonlinear & Laser Crystals

Table of Contents

Nonlinear Crystals

LBO – LITHIUM TRIBORATE



LBO is well suited for various nonlinear optical applications:

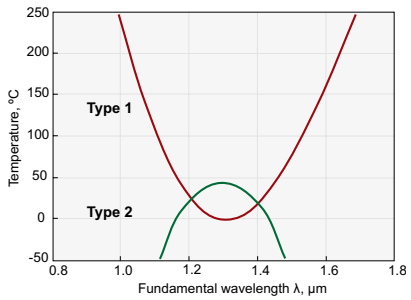
- frequency doubling and tripling of high peak power pulsed Nd doped, Ti:Sapphire and Dye lasers
- optical parametric oscillators (OPO) of both Type 1 and Type 2 phase-matching
- non-critical phase-matching for frequency conversion of CW and quasi-CW radiation.

Standard specifications

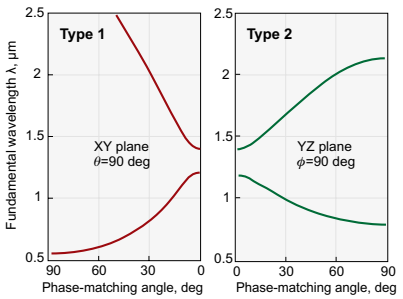
Flatness	λ/8 at 633 nm
Parallelism	< 20 arcsec
Surface quality	10 – 5 scratch & dig (MIL-PRF-13830B)
Perpendicularity	< 5 arcmin
Angle tolerance	< 30 arcmin
Aperture tolerance	± 0.1 mm
Clear aperture	90% of full aperture

Features

- Wide transparency region
- Broad Type 1 and Type 2
- Non-critical phase-matching (NCPM) range
- Small walk-off angle
- High damage threshold
- Wide acceptance angle
- High optical homogeneity



NCPM SHG temperature dependance of LBO



SHG tuning curves of LBO

We offer:

- Crystals length up to 90 mm and aperture up to 60×60 mm
- AR, BBAR, P-coatings
- Different mounting and repolishing services

Standard Crystals list

Size, mm	θ, deg	φ, deg	Coating	Application	Catalogue number	
3x3x10	90	11.6	AR/AR @ 1064+532 nm	SHG @ 1064 nm	LBO-401	
3x3x15	90	11.6	AR/AR @ 1064+532 nm	SHG @ 1064 nm	LBO-402	
4x4x10	90	11.6	AR/AR @ 1064+532 nm	SHG @ 1064 nm	LBO-301	
4x4x15	90	11.6	AR/AR @ 1064+532 nm	SHG @ 1064 nm	LBO-302	
4x4x20	90	11.6	AR/AR @ 1064+532 nm	SHG @ 1064 nm	LBO-303	
5x5x10	90	11.6	AR/AR @ 1064+532 nm	SHG @ 1064 nm	LBO-501	
5x5x15	90	11.6	AR/AR @ 1064+532 nm	SHG @ 1064 nm	LBO-503	
5x5x20	90	11.6	AR/AR @ 1064+532 nm	SHG @ 1064 nm	LBO-502	
3x3x15	90	0	AR/AR @ 1064+532 nm	NCPM SHG @ 1064 nm, T = 149 °C	LBO-404	
3x3x20	90	0	AR/AR @ 1064+532 nm	NCPM SHG @ 1064 nm, T = 149 °C	LBO-405	
3x3x30	90	0	AR/AR @ 1064+532 nm	NCPM SHG @ 1064 nm, T = 149 °C	LBO-409	
3x3x50	90	0	AR/AR @ 1064+532 nm	NCPM SHG @ 1064 nm, T = 149 °C	LBO-410	
4x4x10	90	0	AR/AR @ 1064+532 nm	NCPM SHG @ 1064 nm, T = 149 °C	LBO-304	
4x4x15	90	0	AR/AR @ 1064+532 nm	NCPM SHG @ 1064 nm, T = 149 °C	LBO-305	
4x4x20	90	0	AR/AR @ 1064+532 nm	NCPM SHG @ 1064 nm, T = 149 °C	LBO-306	
3x3x10	42.2	90	AR/AR @ 1064+532/355 nm	THG @ 1064 nm	LBO-406	
3x3x15	42.2	90	AR/AR @ 1064+532/355 nm	THG @ 1064 nm	LBO-407	
4x4x10	42.2	90	AR/AR @ 1064+532/355 nm	THG @ 1064 nm	LBO-307	
4x4x15	42.2	90	AR/AR @ 1064+532/355 nm	THG @ 1064 nm	LBO-308	
5x5x10	42.2	90	AR/AR @ 1064+532/355 nm	THG @ 1064 nm	LBO-507	
5x5x15	42.2	90	AR/AR @ 1064+532/355 nm	THG @ 1064 nm	LBO-508	

Physical and Optical properties

Chemical formula	LiB_3O_5		
Crystal structure	orthorhombic, mm2		
Optical symmetry	Negative biaxial		
Space group	$Pna2_1$		
Density	2.47 g/cm^3		
Mohs hardness	6		
Optical homogeneity	$\partial n = 10^{-6}$ cm^{-1}		
Transparency region at "0" transmittance level	155 – 3200 nm		
Linear absorption coefficient at 1064 nm	< 0.01 % cm^{-1}		
Refractive indices:	n_x	n_y	n_z
at 1064 nm	1.5656	1.5905	1.6055
at 532 nm	1.5785	1.6065	1.6212
at 355 nm	1.5971	1.6275	1.6430
Sellmeier equations (λ, μm)	$n_x^2 = 2.4542 + 0.01125 / (\lambda^2 - 0.01135) - 0.01388\,\lambda^2$ $n_y^2 = 2.5390 + 0.01277 / (\lambda^2 - 0.01189) - 0.01849\,\lambda^2 + 4.3025 \times 10^{-5}\lambda^4 - 2.9131 \times 10^{-5}\lambda^6$ $n_z^2 = 2.5865 + 0.0131 / (\lambda^2 - 0.01223) - 0.01862\,\lambda^2 + 4.5778 \times 10^{-5}\lambda^4 - 3.2526 \times 10^{-5}\lambda^6$		
Phase matching range Type 1 SHG	554 – 2600 nm		
Phase matching range Type 2 SHG	790 – 2150 nm		
NCPM SHG temperature dependence:			
Type 1 range 950 – 1300 nm	$T1 = -1893.3\lambda^4 + 8886.6\lambda^3 - 13019.8\lambda^2 + 5401.5\lambda + 863.9$		
Type 1 range 1300 – 1800 nm	$T2 = 878.1\lambda^4 - 6954.5\lambda^3 + 20734.2\lambda^2 - 26378\lambda + 12020$		
Type 2 range 1100 – 1500 nm	$T3 = -21630.6\lambda^4 + 112251\lambda^3 - 220460\lambda^2 + 194153\lambda - 64614.5$		
NCPM SHG at 1064 nm Type 1 temperature	149 °C		
NCPM SHG at 1319 nm Type 2 temperature	43 °C		
Walk-off angle	7 mrad (Type 1 SHG 1064 nm)		
Thermal acceptance	6.4 K×cm (Type 1 SHG 1064 nm)		
Angular acceptance	6.5 mrad×cm (Type 1 SHG 1064 nm) 248 mrad×cm (Type 1 NCPM SHG 1064 nm)		
Nonlinearity coefficients	d_{31} = (1.05±0.09) pm/V; d_{32} = -(0.98±0.09) pm/V; d_{33} = (0.05±0.006) pm/V		
Effective nonlinearity:			
XY plane	$d_{ooe} = d_{32}\ \cos\varphi$		
YZ plane	$d_{oeo} = d_{eoo} = d_{31}\cos\theta$		
Expansion coefficients	$\alpha_x = 10.8 \times 10^{-5}$ K^{-1}; $\alpha_y = -8.8 \times 10^{-5}$ K^{-1}; $\alpha_z = 3.4 \times 10^{-5}$ K^{-1}		
Laser induced damage threshold (LIDT)	>5 J/cm^2 (>500 MW/cm^2), 1064 nm, 10 ns, 10 Hz		

Please contact EKSMA OPTICS for further information or nonstandard specifications.

Related Products

LBO crystals for SHG of Yb:KGW/KYW laser frequency conversion. See page 2.17

Crystal Oven TC2
See page 2.28

149 °C temperature is required to achieve Non-Critical Phase Matching (NCPM) in LBO at type 1 SHG of 1064 nm application. **TC2 oven** is specially designed for this purpose.

Heatpoint Crystal Oven
See page 2.29

Heatpoint is a compact round oven designed for heating (30 – 80 °C) of humidity sensitive nonlinear crystals. It is used to prevent moisture condensation on crystal faces or for thermostabilization of the crystals.

BBO – BETA BARIUM BORATE

Features

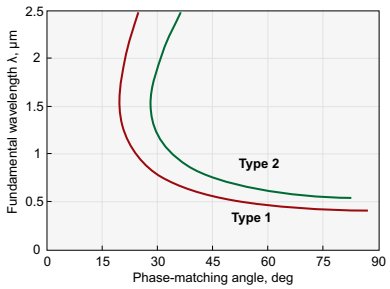
- Wide transparency region
- Broad phase-matching range
- Large nonlinear coefficient
- High damage threshold
- Wide thermal acceptance bandwidth
- High optical homogenity

As a result of its excellent properties BBO has a number of advantages for different applications:

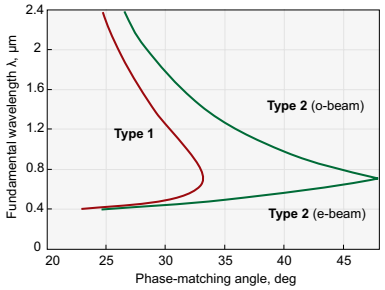
- harmonic generations (up to fifth) of Nd doped lasers
- frequency doubling and tripling of ultrashort pulse Ti:Sapphire and Dye lasers
- optical parametric oscillators (OPO) at both Type 1(ooe) and Type 2 (eoe) phase-matching
- frequency doubling of Argon ion and Copper vapour laser radiation
- electro-optic crystal for Pockels cells
- ultrashot pulse duration measurements by autocorrelation.

Standard specifications

Flatness	λ/8 at 633 nm
Parallelism	< 20 arcsec
Surface quality	10 – 5 scratch & dig (MIL-PRF-13830B)
Perpendicularity	< 5 arcmin
Angle tolerance	< 30 arcmin
Aperture tolerance	± 0.1 mm
Clear aperture	90% of full aperture



SHG tuning curve of BBO



OPO tuning curves of BBO at 355 nm pump

We offer:

- Crystal aperture up to 25 × 25 mm
- Crystal length up to 25 mm
- Thin crystals down to 5 μm thickness
- AR, BBAR, P-coating
- BBO with gold electrodes for e/o applications
- Different mounting and repolishing services

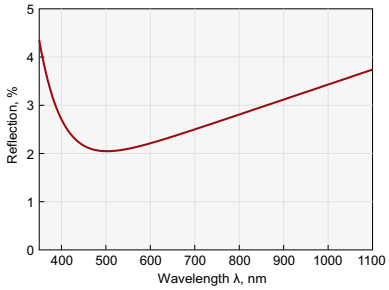
Standard Crystals list

Size, mm	θ, deg	φ, deg	Coating	Application	Catalogue number	
6×6×0.1	29.2	90	P/P @ 400-800 nm	SHG @ 800 nm, Type 1	BBO-601H	
6×6×0.2	29.2	90	P/P @ 400-800 nm	SHG @ 800 nm, Type 1	BBO-602H	
6×6×0.5	29.2	90	P/P @ 400-800 nm	SHG @ 800 nm, Type 1	BBO-603H	
6×6×1	29.2	90	P/P @ 400-800 nm	SHG @ 800 nm, Type 1	BBO-604H	
6×6×2	29.2	90	P/P @ 400-800 nm	SHG @ 800 nm, Type 1	BBO-605H	
6×6×0.1	44.3	90	P/P @ 400-800/266 nm	THG @ 800 nm, Type 1	BBO-609H	
6×6×0.2	44.3	90	P/P @ 400-800/266 nm	THG @ 800 nm, Type 1	BBO-610H	
6×6×0.5	44.3	90	P/P @ 400-800/266 nm	THG @ 800 nm, Type 1	BBO-611H	
6×6×1	44.3	90	P/P @ 400-800/266 nm	THG @ 800 nm, Type 1	BBO-612H	
10×10×0.1	29.2	90	P/P @ 400-800 nm	SHG @ 800 nm, Type 1	BBO-1001H	
10×10×0.2	29.2	90	P/P @ 400-800 nm	SHG @ 800 nm, Type 1	BBO-1002H	
10×10×0.5	29.2	90	P/P @ 400-800 nm	SHG @ 800 nm, Type 1	BBO-1003H	
10×10×1	29.2	90	P/P @ 400-800 nm	SHG @ 800 nm, Type 1	BBO-1004H	
10×10×2	29.2	90	P/P @ 400-800 nm	SHG @ 800 nm, Type 1	BBO-1005H	
10×10×0.1	44.3	90	P/P @ 400-800/266 nm	THG @ 800 nm, Type 1	BBO-1009H	
10×10×0.2	44.3	90	P/P @ 400-800/266 nm	THG @ 800 nm, Type 1	BBO-1010H	
10×10×0.5	44.3	90	P/P @ 400-800/266 nm	THG @ 800 nm, Type 1	BBO-1011H	
10×10×1	44.3	90	P/P @ 400-800/266 nm	THG @ 800 nm, Type 1	BBO-1012H	

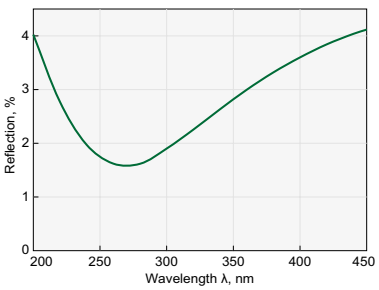
Wide selection of non-standard size and cut angle BBO crystals is available at **www.eksmaoptics.com**

Physical and Optical properties

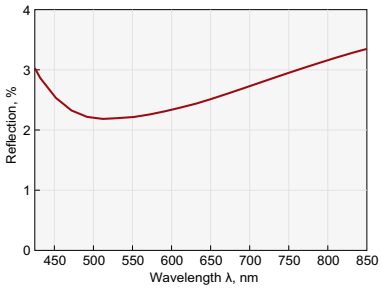
Chemical formula	BaB_2O_4	
Crystal structure	trigonal, 3m	
Optical symmetry	Negative Uniaxial ($n_o > n_e$)	
Space group	R3c	
Density	3.85 g/cm^3	
Mohs hardness	5	
Optical homogeneity	$\partial n = 10^{-6}$ cm^{-1}	
Transparency region at "0" transmittance level	189 – 3500 nm	
Linear absorption coefficient at 1064 nm	< 0.1% cm^{-1}	
Refractive indices	n_o	n_e
at 1064 nm	1.6551	1.5426
at 532 nm	1.6750	1.5555
at 355 nm	1.7055	1.5775
at 266 nm	1.7571	1.6139
at 213 nm	1.8465	1.6742
Sellmeier equations (λ, μm)	$n_o^2 = 2.7366122 + 0.0185720 / (\lambda^2 - 0.0178746) - 0.0143756\ \lambda^2$ $n_e^2 = 2.3698703 + 0.0128445 / (\lambda^2 - 0.0153064) - 0.0029129\ \lambda^2$	
Phase matching range Type 1 SHG	410 – 3300 nm	
Phase matching range Type 2 SHG	530 – 3300 nm	
Walk-off angle	55.9 mrad (Type 1 SHG 1064 nm)	
Angular acceptance	1.2 mrad × cm (Type 1 SHG 1064 nm)	
Thermal acceptance	70 K × cm (Type 1 SHG 1064 nm)	
Nonlinearity coefficients	$d_{22} = \pm 2.2$ pm/V; $d_{15} = d_{31} = \pm 0.08$ pm/V	
Effective nonlinearity expressions	$d_{ooe} = d_{31} \sin\theta - d_{22} \cos\theta \sin 3\varphi$ $d_{eoe} = d_{oee} = d_{22} \cos^2\theta \cos 3\varphi$	
Thermal expansion coefficient	$\alpha_{11} = 4 \times 10^{-6}$ K^{-1}; $\alpha_{33} = 36 \times 10^{-6}$ K^{-1}	
Damage threshold for TEM_{00}	> 0.5 GW/cm^2 at 1064 nm, 10 ns ~ 50 GW/cm^2 at 1064 nm, 1 ps > 200 GW/cm^2 at 800 nm, 100 fs, 50 Hz	



Typical P-coating for BBO SHG@800 nm application



Typical coating for BBO THG@800 nm or SHG@532 nm applications (output face P@266 nm)



Typical coating for BBO SHG@532 nm application (input face P@532 nm)

P-protective coating. It's a single or two layers antireflection coating made at specified wavelength range. Typical reflection values are R≈2% in the mid range, R<4% at the edges. P coating is recommended for ultra-short pulses applications and features low dispersion.

Related Products

Thin BBO crystals for SHG and THG of Ti:Sapphire laser wavelength

See page 2.23

BBO crystals for SHG of Yb:KGW/KYW laser frequency conversion

See page 2.17

Housing accessories

Ring Holders for Nonlinear Crystals

See page 2.26

Positioning Mount 840-0199 for Nonlinear Crystal Housing

Accepts crystals with aperture up to 12x12 mm and thichness up to 3 mm.

See page 2.27

CESIUM LITHIUM BORATE – CLBO

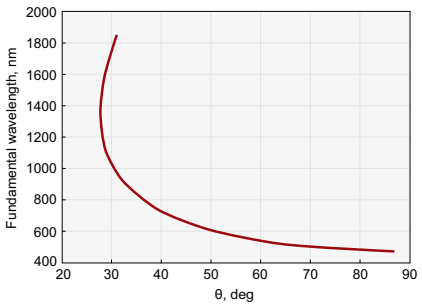
Features

- Well suited for UV applications
- Small walk-off angle
- Large angle tolerance
- No saturation for high power generation

CLBO is a highly hygroscopic NLO crystal material. Therefore, standard CLBO crystals are supplied sealed in 1-inch (ø25.4 mm) housings with anti-reflection coated UV FS protective windows. Unmounted CLBO crystals are available upon custom request.

CLBO is a relatively new nonlinear crystal material, which has excellent properties in the UV that can be used for different applications:

- Harmonic generation (up to fifth) of Nd-doped lasers
- Frequency doubling and tripling of Alexandrite, Ti:Sapphire lasers



SHG Tuning curve of CLBO

Standard Specifications

Flatness	λ/8 @ 633 nm
Parallelism	20 arcsec
Surface quality	10 – 5 scratch & dig (MIL-O-13830A)
Perpendicularity	< 5 arcmin
Angle tolerance	< 30 arcmin
Aperture tolerance	± 0.1 mm
Clear aperture	90% of full aperture

Physical Properties

Chemical formula	$CsLiB_6O_{10}$
Transparency range	180 – 2750 nm
Effective NLO coefficient	1.01 pm/V @ 532 nm 1.16 pm/V @ 488 nm
NLO coefficients	$d_{eff}(I) = d_{36}\sin\theta m \sin(2\varphi)$ $d_{eff}(II) = d_{36}\sin(2\theta m)\cos(2\varphi)$
Sellmeier equations, CLBO at 20°C (0.1914 < λ < 2.09 μm)	$no^2 = 2.2104 + 0.01018 / (\lambda^2 - 0.01424) - 0.01258\lambda^2$ $ne^2 = 2.0588 + 0.00838 / (\lambda^2 - 0.01363) - 0.00607\lambda^2$
Density	2.461 g/cm³
Mohs hardness	5.5
Melting point	1118 K
Thermal conductivity	1.25 W/mK
Refractive indices	n_e = 1.4340, no = 1.4838 @ 1064 nm n_e = 1.4445, no = 1.4971 @ 532 nm
Therm-optic coefficients	$dn_o/dT = -1.9 \times 10^{-6}$/°C $dn_e/dT = -0.5 \times 10^{-6}$/°C

Standard Crystals List

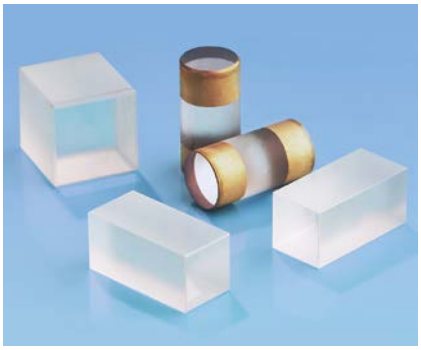
Size, mm	θ, deg	φ, deg	Coating	Catalogue number	
4 × 4 × 10	61.5	45	AR/AR @ 532+266 nm	CLBO-401S	
5 × 5 × 8	61.5	45	AR/AR @ 532+266 nm	CLBO-501S	

CLBO is a highly hygroscopic NLO crystal material. Standard CLBO crystals are supplied sealed in 1-inch (ø25.4 mm) housings with anti-reflection coated UV FS protective windows. Unmounted CLBO crystals are available upon custom request.

Application

Wavelength	Phase matching angle	Deff	Angle tolerence	Walk-off angle
532 + 532 = 266 nm	61.7°	0.84 pm/V	0.49 mrad - cm	1.83°

KDP / DKDP – POTASSIUM DIDEUTERIUM PHOSPHATE



Features

- Laser frequency conversion – harmonic generation for high pulse energy, low repetition (<100 Hz) rate lasers
- Electro-optical modulation
- Q-switching crystal for Pockels cells

Standard specifications

Flatness	λ/6 at 633 nm
Parallelism	< 20 arcsec
Surface quality	20 – 10 scratch & dig (MIL-PRF-13830B)
Perpendicularity	< 5 arcmin
Angle tolerance	< 30 arcmin
Aperture tolerance	± 0.1 mm
Clear aperture	90% of full aperture

Electro-Optical/Q-switching application

- EKSMA OPTICS offers highly deuterated D>96% **electro-optic crystal – DKDP** for Q-switching application;
- Standard dimensions **of electro-optic DKDP crystals** for Q-switching are cylinders dia 9×20 mm and dia 12×24 mm however manufacturing of custom size and rectangular shape crystals is available;
- Gold evaporated or silver paste electrodes are available;
- **Dielectric thin film AR coatings** for specified laser wavelengths are available;
- Typical quarter wave voltage 3.4 kV at 1064 nm;
- Typical contrast ratio between crossed polarizers better than 1:2000;
- Damage threshold of AR coated DKDP surface >5 J/cm^2 at 1064 nm, 10 ns pulses.

Frequency conversion applications

- **DKDP crystals** are used for second harmonic generation of high pulse energy low repetition rate (<100 Hz) Q-switched and mode-locked Nd:YAG lasers. Cut angle of crystal for operation at room temperature is 36.6° for Type 1 phase matching and 53.7° deg for Type 2 phase matching.
- **DKDP crystals** are used for third harmonic generation of high pulse energy Q-switched and mode-locked Nd:YAG lasers via sum frequency generation. Cut angle of crystal for operation at room temperature is 59.3° for Type 2 phase matching.
- Type 1 **DKDP crystals** with non-critical cut angle θ=90° are used for fourth harmonic generation (532 nm → 266 nm) of high pulse energy Q-switched and mode-locked Nd:YAG lasers. Crystal must be heated at ~50 °C temperature to match NCPM conditions.
- Type 1 **KDP crystals** with close to non-critical cut angle θ=76.5° are used for fourth harmonic generation (532 nm → 266 nm) of high pulse energy Q-switched and mode-locked Nd:YAG lasers. KDP has lower absorption at UV wavelengths comparing to DKDP.
- **KDP thin crystals** are used for second harmonic generation of Ti:Sapphire laser radiation or pulse duration measurement in single shot autocorrelators. KDP possesses ~2.4 times larger spectral acceptance and correspondingly smaller group velocity mismatch comparing to BBO crystal for SHG of 800 nm, what sometime is very critical parameter for femtosecond wide spectrum pulses.
- KDP crystals can be supplied by EKSMA OPTICS of aperture up to Ø80 mm. Actually KDP remains the only solution for harmonic generation of very high intensity femtosecond Ti:Sapphire lasers featuring sub-tera Watt or tera Watt peak power pulses in large >30 mm diameter beams.

Standard Crystals list

Size, mm	θ, deg	φ, deg	Coating	Application	Catalogue number	
15x15x13	36.5	45	AR/AR @ 1064+532 nm	SHG @ 1064 nm, Type 1	DKDP-401	
15x15x13	53.5	0	AR/AR @ 1064+532 nm	SHG @ 1064 nm, Type 2	DKDP-402	
12x12x20	59.3	0	AR/AR @ 1064+532 / 355 nm	THG @ 1064 nm, Type 2	DKDP-403	
12x12x20	53.5	0	AR/AR @ 1064 / 1064+532 nm	SHG @ 1064 nm	DKDP-404	
15x15x20	53.5	0	AR/AR @ 1064 / 1064+532 nm	SHG @ 1064 nm	DKDP-405	
15x15x20	59.3	0	AR/AR @ 1064+532 / 355 nm	THG @ 1064 nm	DKDP-406	
12x12x5	76.5	45	AR/AR @ 532/266 nm	SHG @ 532 nm	KDP-401	
15x15x7	76.5	45	AR/AR @ 532/266 nm	SHG @ 532 nm	KDP-402	

Wide selection of non-standard size and cut angle DKDP crystals is available at **www.eksmaoptics.com**

Physical and Optical properties

Crystals		KDP	DKDP
Chemical formula		KH_2PO_4	KD_2PO_4
Symmetry		42 m	42 m
Hygroscopicity		high	high
Density, g/cm^3		2.332	2.355
Thermal conductivity, W/cm×K		$k_{11}= 1.9\times10^{-2}$	$k_{11}= 1.9\times10^{-2}$ $k_{33}= 2.1\times10^{-2}$
Thermal expansion coefficients, K^{-1}		$a_{11}= 2.5\times10^{-5}$ $a_{33}= 4.4\times10^{-5}$	$a_{11}= 1.9\times10^{-5}$ $a_{33}= 4.4\times10^{-5}$
Transmission range, μm		0.18–1.5	0.2–2.0
Residual absorption, cm^{-1} (at 1.06 μm)		0.04	0.005
Measured refractive index (at 1.06 μm)		$n_o = 1.4938$ $n_e = 1.4599$	$n_o = 1.4931$ $n_e = 1.4582$
Sellmeier coeff., λ – wavelength in μm		$n^2 = A + \frac{B\lambda^2}{\lambda^2 - C} + \frac{D}{\lambda^2 - E}$	
A	n_o n_e	2.259276 2.132668	2.2409 2.1260
B	n_o n_e	13.00522 3.2279924	2.2470 0.7844
C	n_o n_e	400 400	126.9205 123.4032
D	n_o n_e	0.01008956 0.008637494	0.0097 0.0086
E	n_o n_e	0.012942625 0.012281043	0.0156 0.0120
Nonlinear coeff. d_{36}, pm/V (at 1.06 μm)		0.43	0.40
Effective nonlinear coefficient Type 1 Type 2		$d_{ooe} = d_{36} \times \sin\theta \times \sin2\varphi$ $d_{eoe} = d_{36} \times \sin\theta \times \cos2\varphi$	
Laser damage threshold, GW/cm^2 at 1.06 μm		10 ps – 100 1 ns – 10 15 ns – 14.4	250 ps – 6 10 ns – 0.5

Phase matching angles and bandwidths for SHG of 1064 nm

Crystal	KDP		DKDP	
Type of phase matching	Type 1 ooe	Type 2 eoe	Type 1 ooe	Type 2 eoe
Cut angle θ, deg	41.2	59.1	36.6	53.7
Acceptances for crystal of 1 cm length (FWHM):				
Δθ (angular), mrad	1.1	2.2	1.2	2.3
ΔT thermal, K	10	11.8	32.5	29.4
Δλ spectral, nm	21	4.5	6.6	4.2
Walk off, mrad	28	25	25	25

ADP, DADP, RDP, CDA and DCDA crystals are available upon request!

KTP – POTASSIUM TITANYL PHOSPHATE

KTP is a standard crystal mostly used in extracavity configuration when a single pass through the crystal is required.

KTP crystals are optimised for SHG intracavity configuration in low peak power CW lasers. Due to the large number of passes through the crystal, low insertion losses and high homogeneity are essential for conversion efficiency. The special highest quality material selected by SHG efficiency mapping of each crystal, fine surface polishing and dual band AR coatings with very low losses allow EKSMA OPTICS to produce KTP crystals suitable for intracavity SHG application.

Standard specifications

Flatness	λ/8 at 633 nm
Parallelism	< 20 arcsec
Surface quality	10 – 5 scratch & dig (MIL-PRF-13830B)
Perpendicularity	< 5 arcmin
Angle tolerance	< 30 arcmin
Aperture tolerance	± 0.1 mm
Clear aperture	90% of full aperture

Features

- Excellent nonlinear, electro-optical and acousto-optical properties
- High nonlinear coefficient
- Wide transparency range
- Broad angular acceptance
- Broad thermal acceptance

We offer:

- Crystal size up to 10×10×20 mm
- Singleband and dualband AR and BBAR coatings
- Standard and customised mounts and housings
- Free technical consulting.

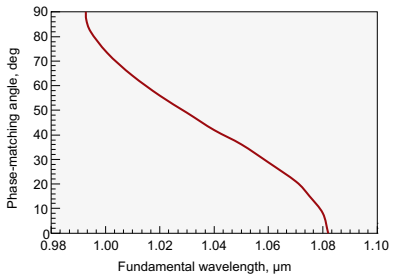


Fig. 1. Type 2 SHG in x-y plane

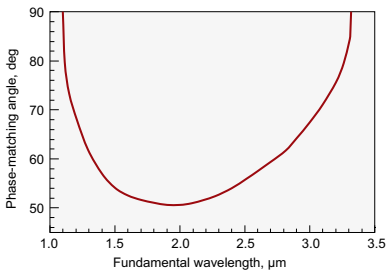


Fig. 2. Type 2 SHG in x-z plane

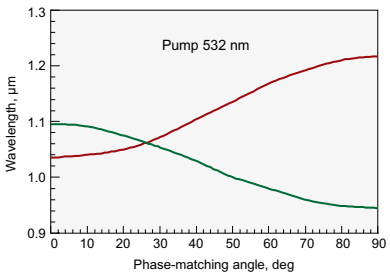


Fig. 3. OPO tuning curve in x-y plane

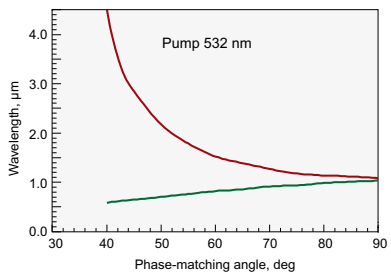


Fig. 4. OPO tuning curve in x-z plane

Fig. 1 represents Type 2 SHG tuning curve of KTP in x-y plane. In x-y plane the slope ∂(Δk)/∂θ is small. This corresponds to quasi-angular noncritical phase-matching, which ensures the double advantage of a large acceptance angle and a small walk off. Otherwise in x-z plane the slope ∂(Δk)/∂λ is almost zero for wavelengths in the range 1.5–2.5 μm and this corresponds to quasi-wavelength noncritical phase-matching, which ensures a large spectral acceptance (see Fig. 2). Wavelength noncritical phase-matching is highly desirable for frequency conversion of short pulses.

As a lasing material for OPG, OPA or OPO, KTP can most usefully be pumped by Nd lasers and their second harmonic or any other source with intermediate wavelength, such as a dye laser (near 600 nm). Fig. 3 and Fig. 4 show the phase-matching angles for OPO/OPA pumped at 532 nm in x-y and x-z plane respectively.

Standard Crystals list

Size, mm	θ, deg	φ, deg	Coating	Application	Catalogue number	
3x3x5	90	23.5	AR/AR @ 1064+532 nm	SHG @ 1064 nm	KTP-401	
3x3x10	90	23.5	AR/AR @ 1064+532 nm	SHG @ 1064 nm	KTP-402	
4x4x6	90	23.5	AR/AR @ 1064+532 nm	SHG @ 1064 nm	KTP-403	
7x7x9	90	23.5	AR/AR @ 1064+532 nm	SHG @ 1064 nm	KTP-404	

Physical properties

Crystal structure	orthorhombic
Point group	mm2
Space group	$Pna2_1$
Lattice constants, Å	a = 6.404, b = 10.616, c = 12.814, z = 8
Density, g/cm^3	3.01
Melting point, °C	1172
Transition temperature, °C	936
Mohs hardness	5
Thermal expansion coefficients, °C^{-1}	$a_x = 11\times10^{-6}$, $a_y = 9\times10^{-6}$, $a_z = 0.6\times10^{-6}$
Thermal conductivity, W/cm°C	13
Not hygroscopic	

Optical properties

Transparency	350–4400 nm	
Refractive indices	at 1064 nm	at 532 nm
	$n_x = 1.7404$	$n_x = 1.7797$
	$n_y = 1.7479$	$n_y = 1.7897$
	$n_z = 1.8296$	$n_z = 1.8877$
Thermooptic coefficients in 0.4 – 1.0 μm range	$\partial n_x/\partial T = 1.1\times10^{-5}\,(K)^{-1}$ $\partial n_y/\partial T = 1.3\times10^{-5}\,(K)^{-1}$ $\partial n_z/\partial T = 1.6\times10^{-5}\,(K)^{-1}$	
Wavelength dispersion of refractive indices	$n_x^2 = 3.0067 + 0.0395/(\lambda^2 - 0.04251) - 0.01247\times\lambda^2$ $n_y^2 = 3.0319 + 0.04152/(\lambda^2 - 0.04586) - 0.01337\times\lambda^2$ $n_z^2 = 3.3134 + 0.05694/(\lambda^2 - 0.05941) - 0.016713\times\lambda^2$	

Nonlinear properties

Phase matching range for:	
Type 2 SHG in x-y plane	0.99÷1.08 μm
Type 2 SHG in x-z plane	1.1÷3.4 μm
For Type 2, SHG @ 1064 nm, cut angle θ=90°, φ=23.5°	
Walk-off	4 mrad
Angular acceptances	$\Delta\theta = 55$ mrad × cm $\Delta\varphi = 10$ mrad × cm
Thermal acceptance	$\Delta T = 22$ K × cm
Spectral acceptance	$\Delta\nu = 0.56$ nm × cm
Up to 80% extracavity SHG efficiency	
Effective nonlinearity	
x-y plane	$d_{eoe} = d_{oee} = d_{15}\sin^2\varphi + d_{24}\cos^2\varphi$
x-z plane	$d_{oeo} = d_{eoo} = d_{24}\sin\theta$ $d_{31} = \pm 1.95$ pm/V $\quad d_{32} = \pm 3.9$ pm/V $d_{33} = \pm 15.3$ pm/V $\quad d_{24} = d_{32} \quad d_{15} = d_{31}$
Damage threshold	>500 MW/cm^2 *for pulses λ=1064 nm, τ=10 ns, 10 Hz, TEM_{00}*

Related Products

Crystal Oven TC2
See page 2.28

Ring Holders for Nonlinear Crystals
See page 2.26

Heatpoint Crystal Oven
See page 2.29

Positioning Mount 840-0199 for Nonlinear Crystal Housing
See page 2.27

KTA – POTASSIUM TITANYLE ARSENATE

Potassium titanyle arsenate ($KTiOAsO_4$), or KTA, is a nonlinear optical crystal for Optical Parametric Oscillation (OPO) application. It has good nonlinear optical and electro-optical properties, e.g. significantly reduced absorption in band range of 2.0 – 5.0 µm, broad angular and temperature bandwidth, low dielectric constants.

Specifications

Flatness	λ/8 at 633 nm
Parallelism	< 20 arcsec
Surface quality	10 – 5 scratch & dig (MIL-PRF-13830B)
Perpendicularity	< 15 arcmin
Angle tolerance	< ± 0.2°
Aperture tolerance	± 0.1 mm
Clear aperture	> 90% central area
Transmitting wavefront distortion	less than λ/8 @ 633 nm

Features

- Significantly reduced absorption in band range of 2.0 – 5.0 µm
- Broad angular bandwidth
- Broad temperature bandwidth
- Low dielectric constants

Primary applications

- OPO for mid IR generation – up to 4 µm
- Sum and Difference Frequency Generation in mid IR range
- Electro-optical modulation and Q-switching

We offer:

- KTA crystals size up to 15×15×30 mm
- AR and BBAR coatings for VIS-IR and mid IR ranges

Standard Crystals list

Size, mm	θ, deg	φ, deg	Coating	Application	Catalogue number	
5×5×20	45	0	AR/AR @ 1064+(1500-4500) nm	Nanosecond OPO @ 1064 nm	KTA-503	
5×5×10	45	0	AR/AR @ 1064+(1500-4500) nm	Picosecond OPG/A @ 1064 nm	KTA-504	
6×6×1	47	0	AR/AR @ 1.2-2.4/2.6-5.0 µm	DFG @ 1.2-2.4 µm	KTA-601H	
6×6×3	46	0	AR/AR @ 1030+(1700-5000) nm	OPO @ 1030 nm	KTA-602H	

Physical properties

Crystal structure	orthorhombic
Point group	mm2
Space group	Pna21
Lattice constants, Å	a = 13.125, b = 6.5716, c = 10.786
Density, g/cm^3	3.45
Melting point, °C	1130
Mohs hardness	5
Thermal conductivity, W/m×K	k_1=1.8, k_2=1.9, k_3=2.1
Not hygroscopic	

Nonlinear & Optical properties

Transparency	350 – 5300 nm
Wavelength dispersion of refractive indices	$n_x^2 = 1.90713 + 1.23522 \times \lambda^2 / (\lambda^2 - 0.196922^2) - 0.01025 \times \lambda^2$ $n_y^2 = 2.15912 + 1.00099 \times \lambda^2 / (\lambda^2 - 0.218442^2) - 0.01096 \times \lambda^2$ $n_z^2 = 2.14768 + 1.29559 \times \lambda^2 / (\lambda^2 - 0.227192^2) - 0.01436 \times \lambda^2$
Electro optical constants	r_{33} = 37.5 pm/V, r_{23} = 15.4 pm/V, r_{13} = 11.5 pm/V
Effective nonlinearity	
x-y plane	$d_{eoe} = d_{oee} = d_{15}\sin^2\varphi + d_{24}\cos^2\varphi$
x-z plane	$d_{oeo} = d_{eoo} = d_{24}\sin\theta$ d_{31}=2.3 pm/V, d_{32}=3.66 pm/V, d_{33}=15.5 pm/V d_{24} = 3.64 pm/V, d_{15} = 2.3 pm/V
Damage threshold	>500 MW/cm^2 for pulses λ=1064 nm, τ=10 ns, 10 Hz, TEM_{00}

$LiNbO_3$ – LITHIUM NIOBATE

Lithium Niobate ($LiNbO_3$) nonlinear optical crystals are well suited for a wide range of applications:

- Electro-optical modulation
- Q-switching
- Laser frequency conversion of wavelengths >1 µm

Specifications

Flatness	λ/8 at 633 nm
Parallelism	< 20 arcsec
Surface quality	10 – 5 scratch & dig (MIL-PRF-13830B)
Perpendicularity	< 5 arcmin
Angle tolerance	< 30 arcmin
Clear aperture	90% of full aperture

Standard Crystals list

Size, mm	Orientation	Coating	Catalogue number	
6×6×25	z-cut	AR/AR @ 1064 nm	LNO-602	
9××9×25	z-cut	AR/AR @ 1064 nm	LNO-901	

Physical and Optical properties

Chemical formula	$LiNbO_3$
Crystal structure	trigonal
Space group	R3C
Density	4.64 g/cm^3
Mohs hardness	5
Optical homogenity	~ 5×10^{-5} / cm
Transparency range	420 – 5200 nm
Absorption coefficient	~ 0.1 % / cm @ 1064 nm
Refractive indices at 1064 nm	$n_e = 2.146$, $n_o = 2.220$ @ 1300 nm $n_e = 2.156$, $n_o = 2.232$ @ 1064 nm $n_e = 2.203$, $n_o = 2.286$ @ 632.8 nm
Sellmeier equations (λ, µm)	$n_o^2 = 4.9048 + 0.11768 / (\lambda^2 - 0.04750) - 0.027169\,\lambda^2$ $n_e^2 = 4.5820 + 0.099169 / (\lambda^2 - 0.04443) - 0.021950\,\lambda^2$
Thermal expansion coefficient @ 25 °C	//a, 2.0×10^{-6} / K //c, 16.7×10^{-6} / K
Thermal conductivity	~ 5 W/m/K @ 25 °C
Thermal optical coefficient	$dn_o/dT = -0.874 \times 10^{-6}$ / K at 1.4 µm $dn_e/dT = 39.073 \times 10^{-6}$ / K at 1.4 µm

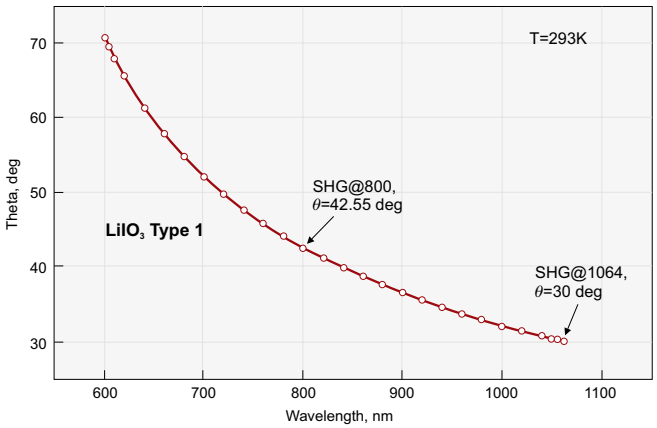
$LiIO_3$ – LITHIUM IODATE

Features

- High nonlinear optical coefficients
- Wide transparency range
- Low damage threshold – not recommended for high power applications

Applications

- Harmonic generators
- Thin $LiIO_3$ for autocorrelation measurements



$LiIO_3$ Second harmonic generation phasematching

Specifications

Flatness	λ/6 at 633 nm
Parallelism	< 30 arcsec
Surface quality	20 – 10 scratch & dig (MIL-PRF-13830B)
Perpendicularity	< 5 arcmin
Angle tolerance (Δθ & Δφ)	< 30 arcmin
Clear aperture	90% of full aperture

Physical and Optical properties

Crystal structure		hexagonal
Point group		6
Density, g/cm^3		4.487
Mohs hardness		3.5–4.0
Transparency range, nm		280–4000
Absorption at 1064 nm, cm^{-1}		< 0.05
Refractive indices	at 1064 nm	$n_o = 1.8571$, $n_e = 1.7165$
	at 800 nm	$n_o = 1.8676$, $n_e = 1.7245$
	at 532 nm	$n_o = 1.8982$, $n_e = 1.7480$
Phase matching range for Type 1 SHG, nm		570–4000
Acceptances for Type 1 SHG at 1064 nm		
	Angular, mrad×cm	0.77
	Spectral, cm^{-1}×cm	12.74
Walk-off for Type 1 SHG at 1064 nm, mrad		74.30
Nonlinear optical coefficient d_{31}, pm/V		4.4 (at 1064 nm)
Effective nonlinearity		$d_{ooe} = d_{15}\sin\theta$
Damage threshold, MW/cm^2		> 100 for TEM_{00}, 1064 nm, 10 ns, 10 Hz
Wavelength dispersion of refractive indices (λ – in μm)		$n_e^2 = 1.673463 + \frac{1.245229\,\lambda^2}{\lambda^2 - 0.028224} - 0.003641\,\lambda^2$ $n_o^2 = 2.083648 + \frac{1.332068\,\lambda^2}{\lambda^2 - 0.035306} - 0.008525\,\lambda^2$

Housing accessories

Ring Holders for Nonlinear Crystals

See page 2.26

Positioning Mount 840-0199 for Nonlinear Crystal Housing

See page 2.27

$ZnGeP_2$ / $AgGaSe_2$ / $AgGaS_2$ / GaSe – INFRARED NONLINEAR CRYSTALS

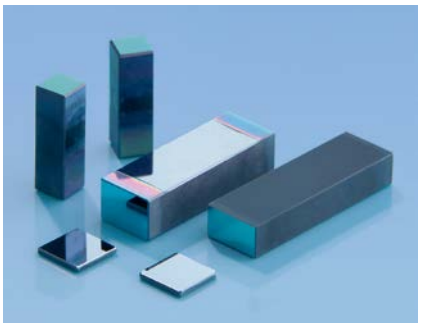
$ZnGeP_2$

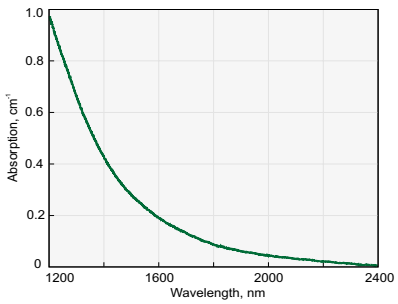
$ZnGeP_2$ (ZGP) crystal has transmission band edges at 0.74 and 12 µm. However it's useful transmission range is from 1.9 to 8.6 µm and from 9.6 to 10.2 µm. ZGP crystal has the largest nonlinear optical coefficient and relatively high laser damage threshold. The crystal is successfully used in diverse applications:

- up-conversion of CO_2 and CO laser radiation to near IR range via harmonics generation and mixing processes;
- efficient SHG of pulsed CO, CO_2 and chemical DF-laser;
- efficient down conversion of Holmium, Thulium and Erbium and laser wavelengths to mid infrared wavelength ranges by OPO process.

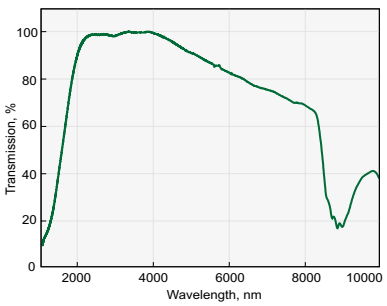
Crystals with high damage threshold BBAR coatings and the lowest absorption coefficient $\alpha < 0.05$ cm^{-1} at pump wavelengths 2.05 – 2.1 µm „o"- polarisation are available for OPO applications.

Typical absorption coefficient is <0.03 cm^{-1} at 2.5 – 8.2 µm range.

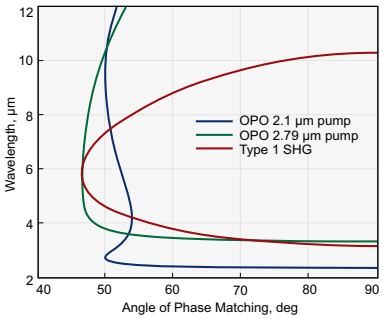




Absorption spectra of $ZnGeP_2$ crystal near 2 µm



Transmission spectra of 15 mm long AR coated $ZnGeP_2$ crystal for OPO @ 2.1 µm



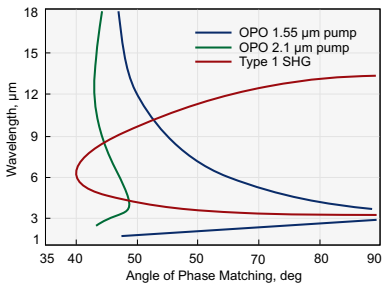
Type 1 OPO and SHG tuning curves in $ZnGeP_2$

Type 1 $ZnGeP_2$ crystalS for OPO at 3.5-5 µm range pumped at ~2.1 µm

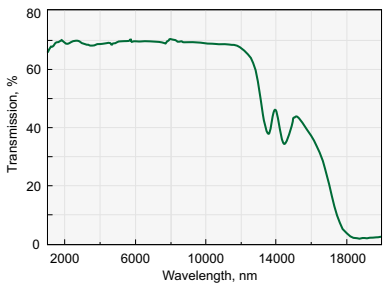
Size, mm	θ, deg	φ, deg	Coating	Application	Catalogue number
7×5×15	54	0	AR @ 2.1 µm + BBAR @ 3.5-5 µm	OPO@2.1 → 3.5-5 µm	ZGP-401
7×5×20	54	0	AR @ 2.1 µm + BBAR @ 3.5-5 µm	OPO@2.1 → 3.5-5 µm	ZGP-402
7×5×25	54	0	AR @ 2.1 µm + BBAR @ 3.5-5 µm	OPO@2.1 → 3.5-5 µm	ZGP-403

$AgGaSe_2$

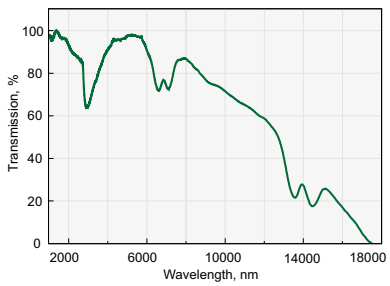
$AgGaSe_2$ has band edges at 0.73 and 18 µm. Its useful transmission range of 0.9–16 µm and wide phase matching capability provide excellent potential for OPO applications when pumped by a variety of currently available lasers. Tuning from 2.5–12 µm has been obtained when pumping by Ho:YLF laser at 2.05 µm; as well as NCPM operation from 1.9–5.5 µm when pumping at 1.4–1.55 µm. Efficient SHG of pulsed CO_2 laser has been demonstrated.



Type 1 OPO and SHG tuning curves in $AgGaSe_2$



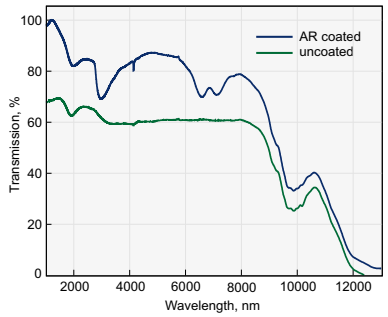
Transmission spectra of 18 mm long uncoated $AgGaSe_2$ crystal



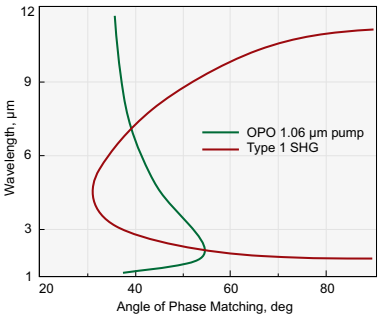
Transmission spectra of 25 mm long AR coated $AgGaSe_2$ crystal

$AgGaS_2$

$AgGaS_2$ is transparent from 0.53 to 12 µm. Although nonlinear optical coefficient is the lowest among the above mentioned infrared crystals, its high short wavelength transparency edging at 550 nm is used in OPOs pumped by Nd:YAG laser; in numerous difference frequency mixing experiments using diode, Ti:Sapphire, Nd:YAG and IR dye lasers covering 3–12 µm range; direct infrared countermeasure systems, and SHG of CO_2 laser.



Transmission spectra of 14 mm long AR coated and uncoated $AgGaS_2$ crystal used for OPO pumped by Nd:YAG laser



Type 1 OPO and SHG tuning curves in $AgGaS_2$

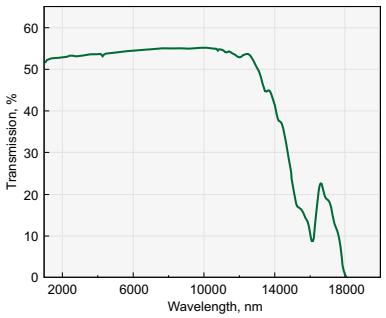
List of Standard $AgGaS_2$ Crystals

Size, mm	θ, deg	φ, deg	Coating	Application	Catalogue number	
5×5×1	39	45	BBAR/BBAR @ 1.1-2.6 / 2.6-11 µm	DFG @ 1.2-2.4 µm -> 2.4-11 µm	AGS-401H	
6×6×2	50	0	BBAR/BBAR @ 1.1-2.6 / 2.6-11 µm	DFG @ 1.2-2.4 µm -> 2.4-11 µm	AGS-402H	
5×5×0.4	34	45	BBAR/BBAR @ 3-6 / 1.5-3 µm	SHG @ 3-6 µm, Type 1	AGS-403H	
5×5×0.4	39	45	BBAR/BBAR @ 1.1-2.6 / 2.6-11 µm	DFG @ 1.2-2.4 µm -> 2.4-11 µm	AGS-404H	
8×8×0.4	39	45	BBAR/BBAR @ 1.1-2.6 / 2.6-11 µm	DFG @ 1.2-2.4 µm, Type 1	AGS-801H	
8×8×1	39	45	BBAR/BBAR @ 1.1-2.6 / 2.6-11 µm	DFG @ 1.2-2.4 µm, Type 1	AGS-802H	

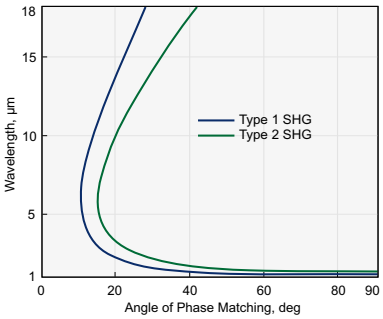
Crystals are mounted into open ring holders (see page 2.26).

GaSe

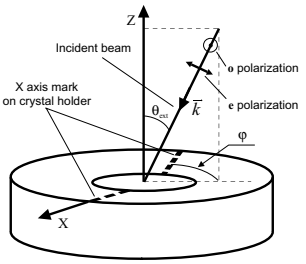
GaSe has band edges at 0.65 and 18 µm. GaSe has been successfully used for efficient SHG of CO_2 laser, for SHG of pulsed CO, CO_2 and chemical DF-laser (λ = 2.36 µm) radiation; up conversion of CO and CO_2 laser radiation into the visible range; infrared pulses generation via difference frequency mixing of Neodymium and infrared dye laser or (F-)-centre laser pulses; OPG light generation within 3.5–18 µm; efficient TeraHertz generation in 100–1600 µm range. It is impossible to cut crystals for certain phase matching angles because of material structure (cleave along (001) plane) limiting areas of applications.



Transmission spectra of 17 mm long uncoated GaSe crystal



Type 1 and Type 2 SHG tuning curves in GaSe



GaSe, Z-Cut

Clear aperture, mm	Thickness, µm	Holder, mm	Catalogue number	
Ø7	10	Ø25.4	GaSe-10H1	
Ø7	30	Ø25.4	GaSe-30H1	
Ø7	100	Ø25.4	GaSe-100H1	
Ø7	500	Ø25.4	GaSe-500H1	
Ø7	1000	Ø25.4	GaSe-1000H1	
Ø7	2000	Ø25.4	GaSe-2000H1	

Please note that from now all standard GaSe crystals are provided mounted into Ø25.4 mm ring holders.
Crystals could be mounted into Ø40 mm holders under your request.

Related Products

Ring Holders for Nonlinear Crystals

See page 2.26

Optical nonlinear crystals $ZnGeP_2$, $AgGaSe_2$, $AgGaS_2$, GaSe have gained tremendous interest for middle and deep infrared applications due to their unique features. The crystals have large effective optical nonlinearity, wide spectral and angular acceptances, broad transparency range, non-critical requirements for temperature stabilization and vibration control, are well mechanically processed (except GaSe).

Physical Properties

Crystal		$ZnGeP_2$	$AgGaSe_2$	$AgGaS_2$	GaSe
Crystal Symmetry		Tetragonal	Tetragonal	Tetragonal	Hexagonal
Point Group		42m	42m	42m	62m
Lattice Constants, Å	a	5.465	5.9901	5.757	3.742
	c	10.771	10.8823	10.305	15.918
Density, g/cm3		4.175	5.71	4.56	5.03

Optical Properties

Crystal		$ZnGeP_2$	$AgGaSe_2$	$AgGaS_2$	GaSe
Optical transmission, μm		0.74–12	0.73–18	0.53–12	0.65–18
Indices of Refraction at					
1.06 μm	n_o	3.2324	2.7005	2.4508	2.9082
	n_e	3.2786	2.6759	2.3966	2.5676
5.3 μm	n_o	3.1141	2.6140	2.3954	2.8340
	n_e	3.1524	2.5823	2.3421	2.4599
10.6 μm	n_o	3.0725	2.5915	2.3466	2.8158
	n_e	3.1119	2.5585	2.2924	2.4392
Absorption Coefficient, cm^{-1} at					
1.06 μm		3.0	<0.02	<0.09	0.25
2.5 μm		0.03	<0.01	0.01	0.05
5.0 μm		0.02	<0.01	0.01	0.05
7.5 μm		0.02	—	0.02	0.05
10.0 μm		0.4	–	<0.6	0.05
11.0 μm		0.8	–	0.6	0.05

Nonlinear Optical Properties

Crystal	$ZnGeP_2$	$AgGaSe_2$	$AgGaS_2$	GaSe
Laser damage threshold, MW/cm^2	60	25	10	28
at pulse duration, ns	100	50	20	150
at wavelength, μm	2.05	10.6	1.06	9.3
Nonlinearity, pm/V	111	43	31	63
Phase matching angle for Type 1 SHG at 10.6 μm, deg	76	55	67	14
Walk-off angle at 5.3 μm, deg	0.57	0.67	0.85	3.4

Thermal Properties

Crystal		$ZnGeP_2$	$AgGaSe_2$	$AgGaS_2$	GaSe
Melting point, °C		1298	851	998	1233
Thermal Expansion Coefficient, 10^{-6}/°K	⊥	17.5[a]	23.4[c]	12.5	9.0
	⊥	9.1[b]	18.0[d]		
	||	1.59[a]	-6.4[c]	-13.2	8.25
	||	8.08[b]	-16.0[d]		

a) at 293–573 K, b) at 573–873 K, c) at 298–423 K, d) at 423–873 K

Sellmeier equations for calculation of indices of refraction

Crystal		A	B	C	D	E	F	Expression
$ZnGeP_2$	n_o	8.0409	1.68625	0.40824	1.2880	611.05	–	$n^2 = A + B\lambda^2/(\lambda^2 - C) + D\lambda^2/(\lambda^2 - E)$
	n_e	8.0929	1.8649	0.41468	0.84052	452.05	–	
$AgGaSe_2$	n_o	6.8507	0.4297	0.15840	0.00125	–	–	$n^2 = A + B/(\lambda^2 - C) - D\lambda^2$
	n_e	6.6792	0.4598	0.21220	0.00126	–	–	
$AgGaS_2$	n_o	3.3970	2.3982	0.09311	2.1640	950.0	–	$n^2 = A + B/(1 - C/\lambda^2) + D/(1 - E/\lambda^2)$
	n_e	3.5873	1.9533	0.11066	2.3391	1030.7	–	
GaSe	n_o	7.443	0.405	0.0186	0.0061	3.1485	2194	$n^2 = A + B/\lambda^2 + C/\lambda^4 + D/\lambda^6 + E/(1 - F/\lambda^2)$
	n_e	5.76	0.3879	-0.2288	0.1223	1.855	1780	

BBO / LBO / KDP / $LiIO_3$ / $AgGaS_2$ / GaSe – ULTRATHIN NONLINEAR CRYSTALS

Thin crystals are used in different applications with femtosecond pulses:

- Harmonic generation (SHG, SFG)
- Optical parametric generation and amplification (OPG, OPA)
- Difference frequency generation (DFG)
- Pulse width measurements by auto and cross correlation
- THz frequency generation (in GaSe crystal)

The propagation of a ultrashort optical pulses through the crystal results in a delay of the pulses because of Group Velocities Mismatch (GVM), a duration broadening because of Group Delay Dispersion (GDD) and a frequency chirp. Unfortunately those effects forces to limit nonlinear crystal thickness in frequency generation schemes.

For two collinearly propagating pulses with different group velocities their quasistatic interaction length (L_{qs}) is defined as distance over which they separate by a path equal to the one of the pulses duration (or to the desired pulse duration):

$$L_{qs} = \tau/GVM\ ;$$

where GVM is the group velocity mismatch and τ is the duration of the pulse. GVM calculations are presented for the most popular Type 1 phase matching applications for different crystals in *Table 2*.

Optimal BBO, LBO, KDP and $LiIO_3$ crystal thicknesses which are limited by GVM for Type 1 SHG of 800 nm at different fundamental pulse duration are presented in the *Table 3*. Also effective coefficients and phase matching angles at room temperature (20 °C) are calculated. If longer crystal will be used this will cause second harmonic pulse broadening to the duration longer than fundamental pulse duration (or desired pulse duration).

Group delay dispersion (GDD) has an important impact on the propagation of pulses, because a pulse always has certain spectral width, so that dispersion will cause its frequency components to propagate with different velocities. In case of crystals where we have normal dispersion when refractive index decreases with increasing wavelength this leads to a lower group velocity of higher-frequency components, and thus to a positive chirp.

The frequency dependence of the group velocity also has an influence on the pulse duration. If the pulse is initially unchirped, dispersion in a crystal will always increase its duration. This is called dispersive pulse broadening. For an originally unchirped Gaussian pulse with the duration τ_0, the pulse duration is increased according to:

$$t = \tau_0 \sqrt{1 + \left(\frac{4 \ln 2 \cdot D \cdot L}{\tau_0^2} \right)^2}$$

L – thickness of the crystal in mm. D – second order group delay dispersion or dispersion parameter. *Table 1* gives D parameter for Type 1 phase matching SHG @ 800 nm for 800 nm pulse with „o" polarization and 400 nm pulse with „e" polarization in different crystals.

Table 1. **D parameter for Type 1 SHG @ 800 nm orientation crystals for 800 nm (o-pol) and 400 nm (e-pol) pulses**

Crystal	D at 800 nm	D at 400 nm
BBO	75 $fsec^2/mm$	196 $fsec^2/mm$
LBO	47 $fsec^2/mm$	128 $fsec^2/mm$
KDP	27 $fsec^2/mm$	107 $fsec^2/mm$
$LiIO_3$	196 $fsec^2/mm$	589 $fsec^2/mm$

We may calculate that spectrum limited initial 30 fsec Gaussian pulse at 400 nm will be broadened to 35 fsec pulse after passing 1 mm thickness BBO crystal.

Table 2. **Group velocity mismatch between shortest and longest wave pulse for Type 1 phase matching**

Crystal	SFM 800+266 nm	SFM 800+400 nm	SHG 800 nm	SHG 1030 nm	SHG 1064 nm	DFG 1.26-2.18 → 3 μm	DFG 1.48-1.74 → 10 μm
BBO	2074 fs/mm	737 fs/mm	194 fs/mm	94 fs/mm	85 fs/mm	–	–
LBO	–	448 fs/mm	123 fs/mm	51 fs/mm	44 fs/mm	–	–
KDP	–	370 fs/mm	77 fs/mm	1 fs/mm	-7 fs/mm	–	–
LiIO3	–	–	559 fs/mm	285 fs/mm	262 fs/mm	–	–
$AgGaS_2$	–	–	–	–	–	170 fs/mm	-10 fs/mm

Table 3. **Quasistatic interaction length for Type 1 SHG of 800 nm**

Crystal	200 fs	100 fs	50 fs	20 fs	10 fs	Cut angles θ, φ	Coefficient deff
BBO	1.0 mm	0.5 mm	0.26 mm	0.1 mm	0.05 mm	29.2°, 90°	2.00 pm/V
LBO	1.6 mm	0.8 mm	0.4 mm	0.16 mm	0.08 mm	90°, 31.7°	0.75 pm/V
KDP	2.6 mm	1.3 mm	0.6 mm	0.26 mm	0.13 mm	44.9°, 45°	0.30 pm/V
$LiIO_3$	0.4 mm	0.18 mm	0.01 mm	0.04 mm	0.018 mm	42.5°, 0°	3.59 pm/V

FREE STANDING CRYSTALS

The crystals of thickness down to 100 µm can be supplied as free standing crystals not attached to the support. However the ring mounts are highly recommended for safe handling of these thin crystals. The tolerance is ±50 µm for crystals of thickness down to 300 µm and ±20 µm for crystals of thickness down to 100 µm.

GaSe crystal is supplied glued in to dia Ø40 mm ring holder only.

Crystal	Minimal aperture	Maximal aperture	Minimal thickness
BBO	2×2 mm	25×25 mm	0.1 mm
LBO	2×2 mm	60×60 mm	0.1 mm
KDP	2×2 mm	Ø75 mm	0.1 mm*
$LiIO_3$	2×2 mm	50×50 mm	0.1 mm*
$AgGaS_2$	5×5 mm	20×20 mm	0.1 mm
GaSe	Ø5 mm	Ø19 mm	0.01 mm

* the thickness should be about 0.5 mm for max aperture KDP and $LiIO_3$

OPTICALLY CONTACTED CRYSTALS

BBO crystals of thickness less than 100 µm can be supplied optically contacted on UV Fused Silica substrates sizes 10×10×2 mm or 12×12×2 mm. Other sizes of substrates are also available on request. The tolerances of BBO crystal thickness is +10/-5 µm.

Crystal	Minimal aperture	Maximal aperture	Minimal thickness
BBO	5×5 mm	18×18 mm	10±5 µm

EKSMA OPTICS provides various AR, BBAR and protective coatings for all free standing crystals and optically contacted crystals. Ring mounts made from anodized aluminium and teflon are available for safe and convenient handling of ultrathin crystals.

Standard specifications of crystals

Crystals	BBO, LBO	KDP, $LiIO_3$, $AgGaS_2$	GaSe
Flatness	λ/6 at 633 nm	λ/4 at 633 nm	cleaved perpendicularly to optical axis. Polish is not available
Parallelism	< 10 arcsec	< 30 arcsec	
Angle tolerance	< 15 arcmin	< 30 arcmin	
Surface quality	10 – 5 scratch/dig	20 – 10 scratch/dig	

Related Products

Other Ultrahin BBO crystals available. See pages 2.17; 2.23

Ring Holders for Nonlinear Crystals
See page 2.26

Positioning Mount 840-0199 for Nonlinear Crystal Housing
See page 2.27

Nd:YAG – NEODYMIUM DOPED YTTRIUM ALUMINIUM GARNET

Nd:YAG crystal is the most popular lasing media for solid-state lasers. EKSMA OPTICS offers standard specifications high optical quality Nd:YAG rods with high damage threshold AR @ 1064 nm coatings.

Properties of 1.0% Nd:YAG at 25 °C

Formula	$Y_{2.97}Nd_{0.03}Al_5O_{12}$
Crystal structure	Cubic
Density	4.55 g/cm^3
Melting point	1970 °C
Mohs hardness	8.5
Transition	$^4F_{3/2} \rightarrow {}^4I_{11/2}$ @ 1064 nm
Fluorescence lifetime	230 µs for 1064 nm
Thermal conductivity	0.14 Wcm^{-1}K^{-1}
Specific heat	0.59 Jg^{-1}K^{-1}
Thermal expansion	6.9×10^{-6} °C^{-1}
∂n/∂t	7.3×10^{-6} °C^{-1}
Young's modulus	3.17×10^4 Kg/mm^{-2}
Poisson ratio	0.25
Thermal shock resistance	790 Wm^{-1}
Refractive index	1.818 @ 1064 nm

Standard Rods Sizes

Diameter, mm	Length, mm	Doping, %	Wedge of the ends, deg	Catalogue number	
3	53	0.9	0/0	E-Y-3-0.9-A/A	
3	65	0.8	0/0	E-Y-3-0.8-A/A	
3	65	1.1	0/0	E-Y-3-1.1-A/A	
4	65	0.8	3/3 parallel	E-Y-4-0.8-A/A	
4	65	1.1	3/3 parallel	E-Y-4-1.1-A/A	
6.35	85*	1.1	3/3 parallel	E-Y-6.35-1.1-A/A	
8	85*	1.1	3/3 parallel	E-Y-8-1.1-A/A	
10	85*	1.1	3/3 parallel	E-Y-10-1.1-A/A	
12	100*	0.8	3/3 parallel	E-Y-12-0.8-A/A	
12	100*	1.1	3/3 parallel	E-Y-12-1.1-A/A	

* rods with barrel grooving, except 10 mm at both ends of the rod without grooving.

Related Products

Laser Safety Eyewear
See page 1.17

Visualizator 990-0840
See page 1.17

Specifications of Standard Nd:YAG Laser Rods

Nd Doping Level	0.8% or 1.1%
Orientation	<111> crystalline direction
Surface Quality	10 – 5 scratch & dig (MIL-PRF-13830B)
Surface Flatness	λ/10 at 633 nm
Parallelism	< 10 arcsec
Perpendicularity	< 5 arcmin for plano/plano ends
Diameter Tolerance	+0 / -0.05 mm
Length Tolerance	+1 / -0.5 mm
Clear Aperture	> 90 % of full aperture
Chamfers	0.1 mm at 45 deg
Coating	both sides coated AR @ 1064 nm, R < 0.2%, AOI = 0 deg
Barrel grooving	all dia 6.35, 8, 10, 12 mm rods with barrel grooving

Yb:KGW / Yb:KYW – Yb-DOPED POTASSIUM GADOLINIUM TUNGSTATE

Features

- High absorption coefficient @ 981 nm
- High stimulated emission cross section
- Low laser threshold
- Extremely low quantum defect $\lambda_{pump}/\lambda_{se}$
- Broad polarized output at 1023–1060 nm
- High slope efficiency with diode pumping (~ 60%)
- High Yb doping concentration

Applications

- Yb:KGW and Yb:KYW thin (100–150 µm) crystals are used as lasing materials to generate ultrashort (hundreds of fsec) high power (>22 W) pulses. Standard pumping @ 981 nm, output: 1023–1060 nm
- Yb:KGW and Yb:KYW can be used as ultrashort pulses amplifiers
- Yb:KGW and Yb:KYW are some of the best materials for high power thin disk lasers

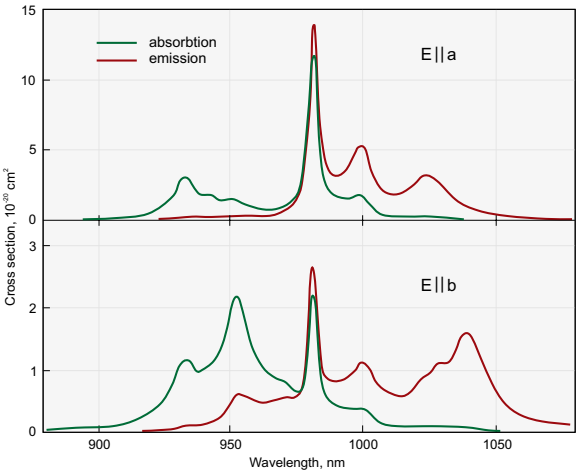
Yb-Doped Potassium Gadolinium Tungstate (**Yb:KGd(WO$_4$)$_2$**) and Yb-doped Potassium Itrium Tungstate (**Yb:KY(WO$_4$)$_2$**) single crystals are the laser crystals for diode or laser pumped solid-state laser applications.

Custom manufacturing capabilities

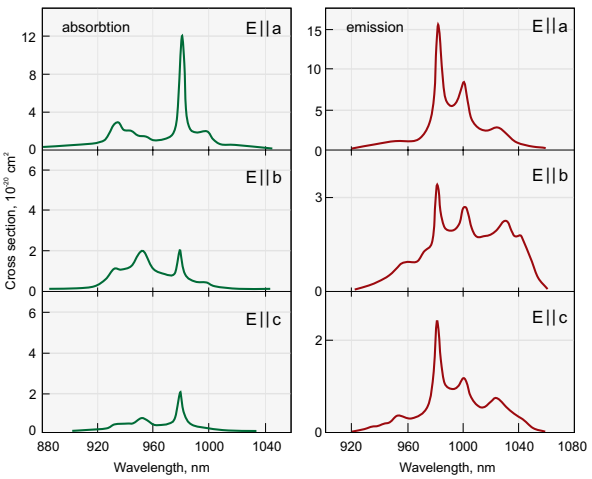
- Various shapes (slabs, rods, cubes)
- Different dopant levels
- Diversified coatings

Properties of Yb:KGW and Yb:KYW

Name	Yb:KGW	Yb:KYW
Yb^{3+} concentration	0.5–5%	0.5–100%
Crystal structure	monoclinic	monoclinic
Point group	C2/c	C2/c
Lattice parameters	a=8.095 Å, b=10.43 Å, c=7.588 Å, β=94.43°	a=8.05 Å, b=10.35 Å, c=7.54 Å, β=94°
Thermal expansion	α_a=4×10^{-6}/°C, α_b=3.6×10^{-6}/°C, α_c=8.5×10	—
Thermal conductivity	K_a=2.6 W/mK, K_b=3.8 W/mK, K_c=3.4 W/mK	—
Density	7.27 g/cm^3	6.61 g/cm^3
Mohs' hardness	4–5	4–5
Melting temperature	1075 °C	—
Transmission range	0.35–5.5 µm	0.35–5.5 µm
Refractive indices (λ=1.06 µm)	n_g=2.037, n_p=1.986, n_m=2.033	—
Thermo-optic coefficients @ 1064 nm	$\partial n_p/\partial T$= -15.7×10^{-6} K^{-1} $\partial n_m/\partial T$= -11.8×10^{-6} K^{-1} $\partial n_g/\partial T$= -17.3×10^{-6} K^{-1}	*For 20% Yb:KYW* $\partial n_p/\partial T$= -13.08×10^{-6} K^{-1} $\partial n_m/\partial T$= -7.61×10^{-6} K^{-1} $\partial n_g/\partial T$= -11.83×10^{-6} K^{-1}
Laser wavelength	1023–1060 nm	1025–1058 nm
Fluorescence lifetime	0.3 ms	0.3 ms
Stimulated emission cross section (**E**‖a)	2.6×10^{-20} cm^2	3×10^{-20} cm^2
Absorption peak and bandwidth	α_a=26 cm^{-1}, λ=981 nm, Δλ=3.7 nm	α_a=40 cm^{-1}, λ=981 nm, Δλ=3.5 nm
Absorption cross section	1.2×10^{-19} cm^2	1.33×10^{-19} cm^2
Lasing threshold	35 mW	70 mW
Stark levels energy (in cm^{-1}) of the $^2F_{5/2}$ manifolds of Yb^{3+} @ 77K	10682, 10471, 10188	10695, 10476, 10187
Stark levels energy (in cm^{-1}) of the $^2F_{7/2}$ manifolds of Yb^{3+} @ 77K	535, 385, 163, 0	568, 407, 169, 0

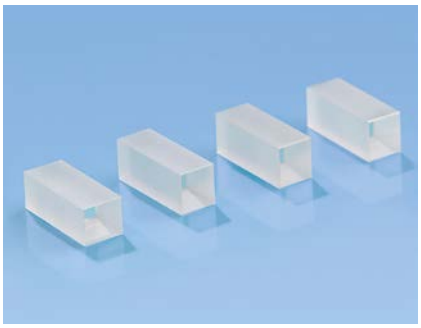


Absorption and emission spectra of Yb(5%):KYW



Absorption and emission spectra of Yb(5%):KGW

Nd:KGW – Nd-DOPED POTASSIUM GADOLINIUM TUNGSTATE



Nd:KGW crystals are low lasing threshold, highly efficient laser material exceptionally suitable for laser rangefinding applications.

The efficiency of Nd:KGW lasers is 3–5 times higher than the one of Nd:YAG lasers. Nd:KGW laser medium is one of the best choices ensuring effective laser generation at low pump energies (0.5 – 1 J). These crystals supplied by EKSMA OPTICS feature high optical quality and great value of bulk resistans for laser radiation.

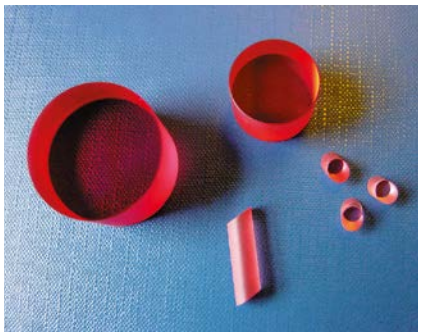
Standard specifications

Orientation	[010] ± 30 min
Dopant concentration	2 – 10 at %
Diameter tolerance	+0.0 / -0.1 mm
Length tolerance	+1.0 / -0.0 mm
Chamfer	45(±10) deg × 0.2(±0.1) mm
Flatness	λ/10 @ 633 nm
Parallelism	better than 30 arcsec
Perpendicularity	better than 15 arcmin
Surface Quality	10 – 5 scratch & dig (MIL-PRF-13830B)
Absorption losses	< 0.005 cm^{-1}

Physical and Laser properties

Chemical formula	$KGd(WO_4)$:Nd
Lattice constants	a = 8.095 Å, b = 10 Å, c = 7.588 Å
Optical orientation	n_g = b, n_pc = 20 deg
Angle between optical axis	86.5 angular grad
Density	7.27 g/cm^3
Mohs hardness	5
Thermal conductivity	2.8 W/(m×grad) [100] 2.2 W/(m×grad) [010] 3.5 W/(m×grad) [001]
Thermal expansion	4×10^{-6} $grad^{-1}$ [100] 3.6×10^{-6} $grad^{-1}$ [010] 8.5×10^{-6} $grad^{-1}$ [001]
Phase transition	1005 °C
Melting point	1075 °C
Transmission range	0.35–5.5 µm
Refractive index	n_g = 2.033 @ 1.067 µm n_p = 1.937 @ 1.067 µm n_m = 1.986 @ 1.067 µm
Transition	$^4F_{3/2} \rightarrow {}^4I_{11/2}$
Laser wavelength	1.0672 µm
Fluorescence lifetime	120 µs
Fluorescent width	24 cm^{-1}
Emission cross-section	4.3×10^{-19} cm^{-2}
Emission temperature drift	8.5×10^{-4} nm, K^{-1}

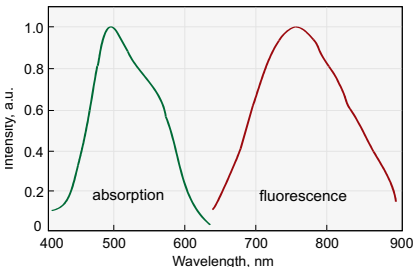
Ti:Sapphire – TITANIUM DOPED SAPPHIRE



$Al_2O_3:Ti^{3+}$ – titanium-doped sapphire crystals combine outstanding physical and optical properties with broadest lasing range.

$Al_2O_3:Ti^{3+}$ indefinitely long stability and useful lifetime added to the lasing over entire band of 660 – 1050 nm challenge "dirty" dyes in variety of applications. Medical laser systems, lidars, laser spectroscopy, direct femtosecond pulse generation by Kerr-type mode-locking – there are few of existing and potential applications.

The absorption band of Ti:Sapphire centered at 490 nm makes it suitable for variety of laser pump sources – argon ion, frequency doubled Nd:YAG and YLF, copper vapour lasers. Because of 3.2 µs fluorescence lifetime Ti:Sapphire crystals can be effectively pumped by short pulse flashlamps in powerful laser systems.



Ti_2O_3 wt %	a, cm^{-1} @ 490 nm	a, cm^{-1} @ 514 nm	a, cm^{-1} @ 532 nm
0.03	0.7*	0.6	0.5
0.05	1.1	0.9	0.8
0.07	1.5	1.3	1.2
0.10	2.2	1.9	1.7
0.12	2.6	2.2	2.0
0.15	3.3	2.8	2.5
0.20	4.3	3.7	3.4
0.25	5.4	4.6	4.1

* Presented values are given with ±0.05 cm^{-1} accuracy.

Standard specifications

Orientation	optical axis C normal to rod axis
Ti_2O_3 concentration	0.03–0.25 wt %
Figure Of Merit	> 150 (> 300 available on special requests)
Size	up to 15 mm dia and up to 30 mm length
End configurations	flat/flat or Brewster/Brewster ends
Flatness	λ/10 @ 633 nm
Parallelism	10 arcsec
Surface Quality	10 – 5 scratch & dig (MIL-PRF-13830B)
Wavefront distortion	λ/4 inch

Physical and Laser properties

Chemical formula	$Ti^{3+}:Al_2O_3$
Crystal structure	Hexagonal
Lattice constants	a=4.748, c=12.957
Density	3.98 g/cm^3
Mohs hardness	9
Thermal conductivity	0.11 cal/(°C×sec×cm)
Specific heat	0.10 cal/g
Melting point	2050 °C
Laser action	4-Level Vibronic
Fluorescence lifetime	3.2 µsec (T=300K)
Tuning range	660–1050 nm
Absorbtion range	400–600 nm
Emission peak	795 nm
Absorption peak	488 nm
Refractive index	1.76 @ 800 nm

GaSe / ZnTe – SEMICONDUCTOR TERAHERTZ CRYSTALS

ZnTe

ZnTe (Zinc Telluride) crystals with <110> orientation are used for THz generation by optical rectification process. Optical rectification is a difference frequency generation in media with large second order susceptibility. For femtosecond laser pulses which have large bandwidth the frequency components interact with each other and their difference produce bandwidth from 0 to several THz.

Detection of the THz pulse occurs via free-space electro-optic detection in another <110> oriented ZnTe crystal. The THz pulse and the visible pulse are propagated collinearly through the ZnTe crystal. The THz pulse induces a birefringence in ZnTe crystal which is read out by a linearly polarized visible pulse. When both the visible pulse and the THz pulse are in the crystal at the same time, the visible polarization will be rotated by the THz pulse. Using a λ/4 waveplate and a beamsplitting polarizer together with a set of balanced photodiodes, it is possible to map THz pulse amplitude by monitoring the visible pulse polarization rotation after the ZnTe crystal at a variety of delay times with respect to the THz pulse. The ability to read out the full electric field, both amplitude and delay, is one of the attractive features of time-domain THz spectroscopy.

ZnTe are also used for IR optical components substrates and vacuum deposition.

NOTE: ZnTe crystal contains micro bubbles and they are visible in projection of illuminated crystal. However this does not affect the THz generation. We do not accept complains on presence of bubbles in crystal.

ZnTe, <110> Cut

Size, mm	Thickness, mm	Holder, mm	Catalogue number	
10×10	0.1	Ø25.4	ZnTe-100H	
10×10	0.2	Ø25.4	ZnTe-200H	
10×10	0.5	Ø25.4	ZnTe-500H	
10×10	1.0	Ø25.4	ZnTe-1000H	
10×10	2.0	Ø25.4	ZnTe-2000H	
10×10	3.0	Ø25.4	ZnTe-3000H	

GaSe

GaSe (Gallium Selenide) crystals used for THz generation shows a large bandwidth of up to 41 THz. GaSe is a negative uniaxial layered semiconductor with a hexagonal structure of 62 m point group and a direct bandgap of 2.2 eV at 300 K. GaSe crystal features high damage threshold, large nonlinear optical coefficient (54 pm/V), suitable transparent range, and low absorption coefficient, which make it an alternative solution for broadband mid infrared electromagnetic waves generation. Due to broadband THz generation and detection using a sub-20 fs laser source, GaSe emitter-detector system performance is considered to achieve comparable or even better results than using thin ZnTe crystals.

In order to achieve frequency selective THz wave generation and detection system, GaSe crystals of appropriate thickness should be used.

NOTE: because of material structure it is possible to cleave GaSe crystal along (001) plane only. Another disadvantage is softness and fragility of GaSe.

GaSe crystal mounted in Ø25.4 mm holder

GaSe, Z-Cut

Clear aperture, mm	Thickness, µm	Holder, mm	Catalogue number	
Ø7	10	Ø25.4	GaSe-10H1	
Ø7	30	Ø25.4	GaSe-30H1	
Ø7	100	Ø25.4	GaSe-100H1	
Ø7	500	Ø25.4	GaSe-500H1	
Ø7	1000	Ø25.4	GaSe-1000H1	
Ø7	2000	Ø25.4	GaSe-2000H1	

Please note that from now all standard GaSe crystals are provided mounted into Ø25.4 mm ring holders. Crystals could be mounted into Ø40 mm holders under your request.

Raman Crystals

KGW / $Ba(NO_3)_2$ – CRYSTALS FOR STIMULATED RAMAN SCATTERING

EKSMA OPTICS offers crystalline materials – **Barium Nitrate – $Ba(NO_3)_2$** and **undoped potassium gadolinium tungstate $KGd(WO_4)_2$** or KGW which have attracted much interest for stimulated Raman scattering (SRS). These materials can be used for frequency conversion in lasers for extending the tuning range. SRS in crystals is compatible with current all-solid-state technology and provides a very simple, compact means of frequency conversion.

$Ba(NO_3)_2$ has a highest Raman gain coefficient. The gain coefficient affects the threshold for Raman laser. However, the thermal lensing is particularly strong in this material. This is indicated by the large value ∂n/∂T and low thermal conductivity. Thermal effects are significantly smaller in KGW. This along with the high damage threshold make the crystal an excellent candidate for power scaling.

Comparing $Ba(NO_3)_2$ and KGW for Raman application $Ba(NO_3)_2$ is more optimal in case of ns and longer pulses, KGW – in case of shorter pulses.

$Ba(NO_3)_2$ Physical and Optical properties

Crystal symmetry	cubic, $P2_13$
Transmission range	0.35 – 1.8 µm
Density	3.25 g/cm³
Hardness Mohs	2.5 – 3
Refractive indices @ 1064 nm	n = 1.555
Raman shift	1048 cm^{-1}
Raman gain, pump 1064 nm	11 cm/GW
Thermal conductivity, W/mK	1.17
∂n/∂T	-20×10^{-6} K^{-1}
Optical Damage Threshold	~ 0.4 GW/cm²

KGW Physical and Optical properties

Crystal symmetry	monoclinic, C2/c
Transmission range	0.35–5.5 µm
Density	7.27 g/cm³
Hardness Mohs	4 – 5
Refractive indices @ 1064 nm	$n_g = 2.061$; $n_m = 2.010$; $n_p = 1.982$
Raman shift	901 cm^{-1} (p[mm]p) 768 cm^{-1} (p[gg]p)
Raman gain, pump 1064 nm	3.3 cm/GW (901 cm^{-1}) 4.4 cm/GW (768 cm^{-1})
Thermal conductivity, W/mK	K_a=2.6; K_b=3.8; K_c=3.4
∂n/∂T	0.4×10^{-6} K^{-1}
Optical Damage Threshold	> 10 GW/cm²

Raman wavelengths

in KGW (oscillation coefficient 901.5 cm^{-1}) and $Ba(NO_3)_2$ (oscillation coefficient 1048.6 cm^{-1}) crystals

Stokes	KGW pumped @ 532 nm	KGW pumped @ 1064 nm	$Ba(NO_3)_2$ pumped @ 532 nm	$Ba(NO_3)_2$ pumped @ 1064 nm	Typical efficiency, %
1 Stoke	558	1177	563	1197	35–70
2 Stoke	588	1316	598	1369	20–40
3 Stoke	621	1494	638	1599	10–15
4 Stoke	658	1726	684	1924	<10
1 Antistoke	507	970	503	957	10–30

Standard specifications

	$Ba(NO_3)_2$	KGW
Surface quality, scratch & dig (MIL-PRF-13830B)	40-20	10-5
Flatness @ 633 nm	λ/4	λ/8
Maximal element dimensions, mm	10×10×100	10×10×80

Standard KGW Crystals. Updoped, b-cut

Dimensions, mm	Coating	Catalogue number
7 × 7 × 30	Uncoated	KGW-701
5 × 7.5 × 30	BBAR/BBAR @ 400 – 700 nm	KGW-702

Co:Spinel / Cr^{4+}:YAG – PASSIVE Q-SWITCHING CRYSTALS

Cr^{4+}:YAG crystals

Fe:ZnSe, Cr:ZnSe, Co:ZnS solid-state saturable absorbers also are available upon request

Co:Spinel (Co^{2+}:$MgAl_2O_4$) is a relatively new material for passive Q-switching in lasers emitting from 1.2 to 1.6 µm, in particular, for eye-safe 1.54 µm Er:glass laser, but also works at 1.44 µm and 1.34 µm wavelengths. High absorption cross section (3.5×10^{-19} cm^2) permits Q-switching of Er:glass laser without intracavity focusing both with flash-lamp and diode-laser pumping. Negligible excited-state absorption results in high contrast of Q-switch, i.e. the ratio of initial (small signal) to saturated absorption is higher than 10 (Fig. 1).

Cr^{4+}:YAG is one of the best passive Q-switch for high power lasers emitting at ~1 µm wavelength. Standard diameter apertures – 5, 8, 9.5 mm and various initial transmission (or optical density) are available upon request. Also Cr^{4+}:YAG laser rods for ultra-short pulse solid-state lasers are available.

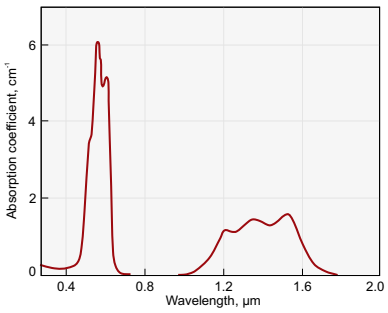


Fig. 1. Absorption spectra of the Co:Spinel crystal

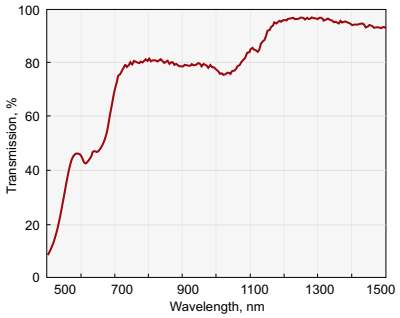


Fig. 2. Transmission of AR coated at 1064 nm Cr:YAG Q-switch with initial transmission of 80% at 1064 nm

Specifications

	Co:Spinel	Cr^{4+}:YAG
Working wavelength range, µm	1.2 – 1.6	0.8 – 1.2
Ground state absorption cross section, cm^2	3.5×10^{-19} (at 1.54 µm)	5×10^{-18} (at 1.06 µm)
Excited state absorption cross-section, cm^2	–	7×10^{-19} (at 1.06 µm)
Initial transmittance, %	30 – 99	20 – 99
Transmission tolerances	±2 %	±2 %
Wavefront distortion	<λ/10 @ 632.8 nm	<λ/8 @ 632.8 nm
Diameter tolerances	+0.0 / -0.2 mm	+0.0 / -0.2 mm
Parallelism error	< 20 arcsec	≤ 30 arcsec
Perpendicularity	< 5 arcmin	≤ 15 arcsec
Surface quality	10 – 5 scratch & dig (per MIL-O-13830A)	20 – 10 scratch & dig (per MIL-O-13830A)
Chamfer	<0.1 mm @ 45°	<0.1 mm @ 45°
AR Coating reflectivity	<0.2 % @ 1540 nm	<0.2 % @ 1064 nm

Standard Cr^{4+}:YAG Crystals

Initial Transmission, %	Diameter, mm	Catalogue number	
20	7	CrYAG-07-20	
30	7	CrYAG-07-30	
35	7	CrYAG-07-35	
40	7	CrYAG-07-40	
45	7	CrYAG-07-45	
50	7	CrYAG-07-50	
65	7	CrYAG-07-65	
70	7	CrYAG-07-70	
80	7	CrYAG-07-80	
85	7	CrYAG-07-85	

Standard Co:Spinel Crystals

Initial Transmission, %	Diameter, mm	Catalogue number	
30	5	CoMALO-05-30	
40	5	CoMALO-05-40	
50	5	CoMALO-05-50	
60	5	CoMALO-05-60	
70	5	CoMALO-05-70	
80	5	CoMALO-05-80	
90	5	CoMALO-05-90	

Positioners & Holders

RING HOLDERS FOR NONLINEAR CRYSTALS – 830-0001

830-0001-10

830-0001-06

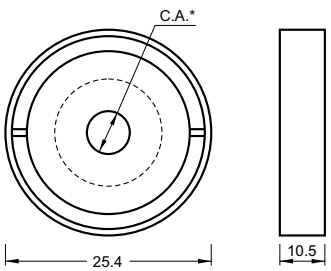
Features

- Black anodized aluminium body
- Teflon or white anodized aluminium adapter for particular crystal size
- Easy assembling and disassembling

Ring mounts made from black anodized aluminum and Teflon or white anodized aluminium adapter are available for safe and convenient handling of nonlinear crystals. The crystals are glued into white anodized aluminium adapter (830-0001-06). No glue is used for fixation of the crystal into open ring holder with teflon adapter. The standard sizes are Ø25.4 or Ø30 mm and thickness – 6, 10.5, 13.5 or 17.5 mm depending on crystal size.

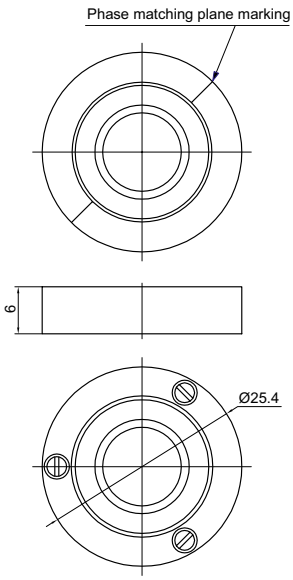
Please indicate the exact crystal size when ordering.

Diameter, mm	Thickness, mm	Max. acceptable crystal size, mm	Catalogue number	
25.4	6	12×12×0.5	**830-0001-06**	
25.4	10.5	12×12×3	**830-0001-10**	
25.4	13.5	12×12×6	**830-0001-13**	
25.4	17.5	12×12×15	**830-0001-17**	
30	10.5	15×15×3	**830-0002-10**	
30	13.5	15×15×6	**830-0002-13**	
30	17.5	15×15×15	**830-0002-17**	



** C.A. - depends on crystal aperture*

830-0001-10



830-0001-06

Housing accessories

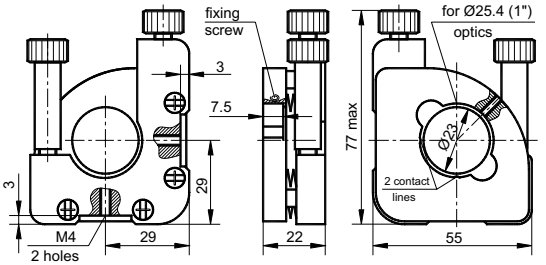
Positioning Mount 840-0199 for Nonlinear Crystal Housing

See page 2.27

KINEMATIC POSITIONING MOUNT – 840-0193

Features

- For Ø25.4 mm (1 inch) ring holders
- Kinematic design
- Tilt/tip range ±2°
- Sensitivity 3 arcsec
- Both tilt and tip controlled from aside the optical path
- Fine adjustment screws with 0.25 mm pitch
- Hardened seats under adjustment screws



Catalogue number	Weight, kg	
840-0193	0.12	

POSITIONING MOUNT FOR NONLINEAR CRYSTAL HOUSING – 840-0199

840-0199 Positioning Mount with ***830-0001*** Ring Holder

Features

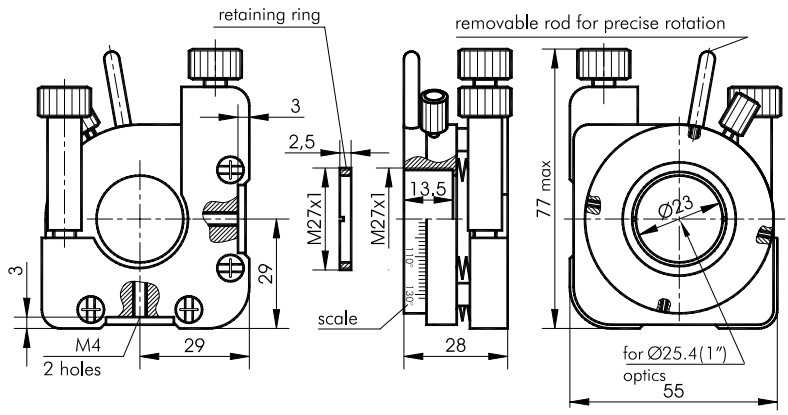
- Accepts Ø25.4 mm and up to 10.5 mm thickness ring housings
- Kinematic design
- Wedge and ball drive mechanism
- Tilt/tip range: ±2°
- Sensitivity: 3 arcsec
- Fine adjustment screws with 0.25 mm pitch
- Hardened seats under adjustment screws
- Rotation range: 360°
- Scale gradation: 2°
- Compact and robust design
- Material: black anodized aluminum

This kinematic mount accepts crystal housings of Ø25.4 mm and thickness up to 10.5 mm.

Large knobs on the adjusting screws relieve the strain on operator fingers during adjustment. Both screws protrude from the top allowing convenient adjustment outside the laser beam path and providing easy access for adjustments in densely packed optical set-ups.

An extra M4 tapped hole on the side of the base allows you to operate the mount as a side-drive adjustment control mount. The mount is made of black anodized aluminium to help minimize reflections.

A retaining ring M27×1, two Teflon rings and a tightening key to fix the crystal ring housing is included.



Catalogue number	Weight, kg	
840-0199	0.12	

Crystal Ovens

Many of widely used nonlinear crystals are susceptible to ambient humidity, for example KD*P, BBO, LBO. Protective coatings applied to the surface can reduce degradation to some extent only. To improve the protection of surfaces of the crystals from the degradation it is desirable to keep the crystals at higher than ambient temperature, which helps avoid condensation on the crystal surfaces.

In addition, if the crystal is used for harmonics generation, the phase-matching angle depends on crystal temperature. For example, the output power of second harmonics generator based on KD*P crystal can decrease by 50 % if the crystal temperature changes just by one degree, hence for good laser stability precise crystal temperature stabilization is necessary.

TEMPERATURE CONTROLLER TC2 WITH OVEN CO1 – TC2 / CO1

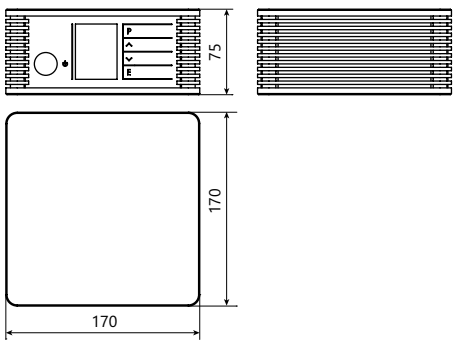
TC2 and CO1 is high temperature set (up to 200 °C) consisting of thermocontroller TC2 and crystal oven CO1. TC2 has two independent outputs and can control two CO1-30 ovens simultaneously. Controller is equipped by LAN and USB computer control interfaces.

The nonlinear crystal is mounted into adapter before insertion into oven CO1. Such design facilitates handling and replacement of the crystal. The nonlinear crystal can be sealed with fused silica windows in order to provide extra protection. The standard adapters are 30 and 50 mm length with apertures of 3×3, 4×4, 5×5, 6×6 mm and up to 12×12 mm size. Oven is delivered with one, customer's specific size of adapter. Adapters for different sizes can be ordered separately.

Specifications

Model	TC2 + CO1-30	TC2 + CO1-50
Quantity of ovens possible to connect to one controller TC2	2	
Temperature tuning range	RT – 200 °C	
Maximum crystals dimensions	12×12×30 mm	12×12×50 mm
Sealing (optional)	FS windows (operation wavelength must be specified before ordering)	
Temperature tuning step	0.05 °C	
Accuracy	± 0.5 °C	
Long-term stability	± 0.05 °C	
Control interfaces	LAN, USB	
Mains	90–264 V, 47–66 Hz	
Power consumption	< 50 W	
Dimensions, Dia×D	Ø52×52 mm	Ø52×72 mm

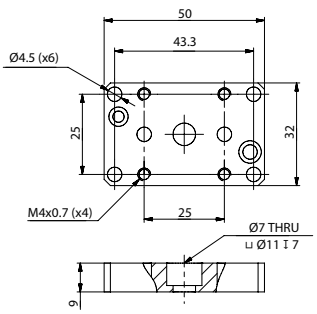
Specifications are subject to changes without advance notice.

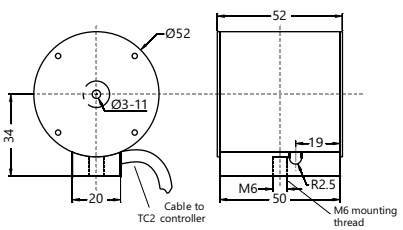


Temperature controller ***TC2*** outline drawing

Related products

Adapter MS-4 for CO1 mounting on tilt stage





Crystal oven ***CO1-30*** outline drawing

COMPACT OVEN FOR NONLINEAR CRYSTALS – Heatpoint

Heatpoint is a compact round oven designed for heating and thermo-stabilization of humidity sensitive nonlinear crystals. Temperature of the oven can be adjusted in 25 – 70 °C range using a small thermocontroller attached on a wire. Heatpoint ovens exhibit precise long-term stability and are ideal for keeping nonlinear crystals at their optimal operational temperature, preventing moisture condensation on crystal's faces.

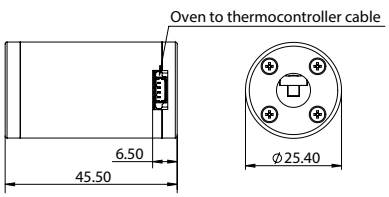
Because of their compact design, Heatpoint ovens can be easily installed into tight spaces. These ovens can be mounted in any standard one-inch optics positioning mount.

Heatpoints are available in two sizes: HP15 accepts crystals up to 15 mm in length, while slightly longer HP30 fits crystals up to 30 mm in length. The exact aperture of the crystal must be specified when ordering, as a special adapter is made for the installation.

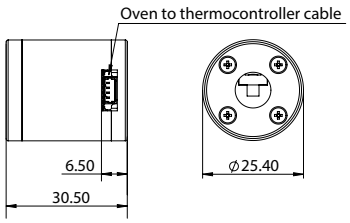
Each oven is made exactly for specific crystal aperture size, so it cannot be used for different size crystals.

Heatpoint HP30

Heatpoint HP15



HP30 dimensions



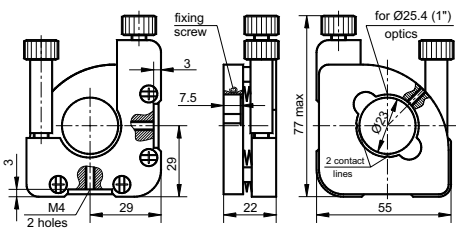
HP15 dimensions

Heatpoint HP30 with thermocontroller

Specifications

Model	HP15	HP30
Crystal length (max)	15 mm	30 mm
Crystal aperture (max)	6 × 6 mm	
Temperature tuning range	25 – 70 °C	
Temperature tuning step	0.1 °C	
Long-term stability	± 0.1 °C	
Temperature ramp rate	3 °C/min	
Powering requirements	12 V DC	
Power consumption (PMAX)	6 W	
Power connector	2.1/5.5 mm	
Power adaptor (included)	90 – 264 V AC, 47 – 66 Hz, 12 V DC	
Dimensions (oven)	Ø 25.4 × 30.5 mm	Ø 25.4 × 45.5 mm
Dimensions (thermocontroller)	60 × 14 × 7.5 mm	
Distance (wiring length) from oven to thermocontroller	250 mm	

Related products



Positioning mount ***840-0193***

Nd:YAG Laserline Components

Table of Contents

Nd:YAG Laser Optics

LASER MIRRORS

Our Nd:YAG laser mirrors are suitable for fundamental Nd:YAG laser 1064 nm, frequency-doubled 532 nm, frequency-tripled 355 nm and frequency quadrupled 266 nm wavelength application. Two kinds of substrate material are available. Laser line mirrors are designed for 45° angle of incidence. Featuring high polishing quality, low scattering and high damage threshold, our dielectric reflectors enables perfect beam steering for Nd:YAG lasers.

Substrate

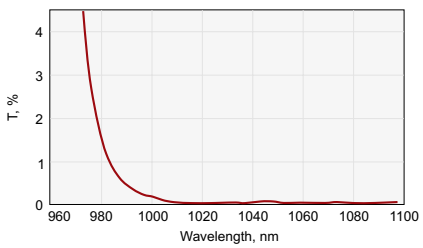
Material	UV grade Fused Silica or BK7 glass
S1 Surface Flatness	λ/10 at 633 nm
S1 Surface Quality	20–10 scratch & dig (MIL-PRF-13830B)
S2 Surface Quality	Commercial polish
Diameter Tolerance	+0.00 mm -0.12 mm
Thickness Tolerance	±0.25 mm
Wedge	< 3 min
Chamfer	0.3 mm at 45° typical

Coating

Technology	Electron beam multilayer dielectric or Ion Beam Sputtering
Adhesion and Durability	Per MIL-C-675A. Insoluble in lab solvents
Clear Aperture	Exceeds central 85% of diameter
Damage Threshold:	
BK7 laser line mirrors	5 J/cm², 8 nsec pulse, 1064 nm typical
UV FS laser line mirrors	8 J/cm², 8 nsec pulse, 1064 nm typical
BK7 dual line mirrors	1 J/cm², 8 nsec pulse, 1064 nm typical
UV FS dual line mirrors	2 J/cm², 8 nsec pulse, 1064 nm typical
Coated Surface Flatness	λ/10 at 633 nm over clear aperture
Angle of Incidence	0 or 45°

LASER LINE MIRRORS

Substrate material: **BK7 grade A**

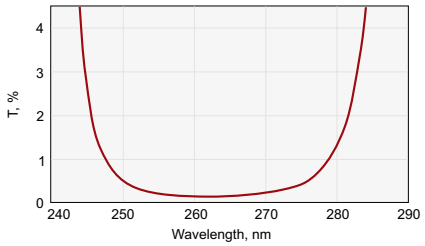


HR 1064 nm, AOI = 45°

Wavelength, nm	AOI=0°			AOI=45°		
	R, % (s+p)/2	Catalogue number		R, % (s+p)/2	Catalogue number	
Size – Ø12.7 × 3 mm						
351–361	99.7	031-0350-i0		99.5	031-0350	
527–532	99.7	031-0530-i0		99.5	031-0530	
1047–1064	99.7	031-1060-i0		99.5	031-1060	
Size – Ø12.7 × 6 mm						
351–361	99.7	031-0350T6-i0		99.5	031-0350T6	
527–532	99.7	031-0530T6-i0		99.5	031-0530T6	
1047–1064	99.7	031-1060T6-i0		99.5	031-1060T6	
Size – Ø25.4 × 6 mm						
351–361	99.7	032-0350-i0		99.5	032-0350	
527–532	99.7	032-0530-i0		99.5	032-0530	
1047–1064	99.7	032-1060-i0		99.5	032-1060	
Size – Ø50.8 × 8 mm						
351–361	99.7	035-0350-i0		99.5	035-0350	
527–532	99.7	035-0530-i0		99.5	035-0530	
1047–1064	99.7	035-1060-i0		99.5	035-1060	
Size – Ø76.2 × 12.7 mm						
527–532	99.7	037-0530-i0		99.5	037-0530	
1047–1064	99.7	037-1060-i0		99.5	037-1060	

LASER LINE MIRRORS

Substrate material: **UV grade Fused Silica**

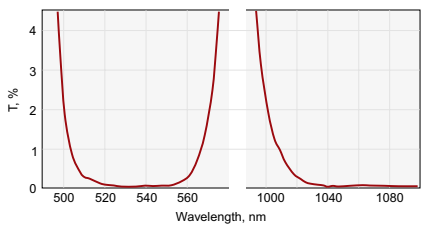


HR 266 nm, AOI = 45°

Wavelength, nm	AOI=0°		AOI=45°	
	R, % (s+p)/2	Catalogue number	R, % (s+p)/2	Catalogue number
Size – Ø12.7 × 3 mm				
262–266	99	041-0260-i0	99	041-0260
351–361	99.7	041-0350-i0	99.5	041-0350
527–532	99.7	041-0530-i0	99.5	041-0530
1047–1064	99.7	041-1060-i0	99.5	041-1060
Size – Ø12.7 × 6 mm				
262–266	99	041-0260T6-i0	99	041-0260T6
351–361	99.7	041-0350T6-i0	99.5	041-0350T6
527–532	99.7	041-0530T6-i0	99.5	041-0530T6
1047–1064	99.7	041-1060T6-i0	99.5	041-1060T6
Size – Ø25.4 × 6 mm				
262–266	99	042-0260-i0	99	042-0260
351–361	99.7	042-0350-i0	99.5	042-0350
527–532	99.7	042-0530-i0	99.5	042-0530
1047–1064	99.7	042-1060-i0	99.5	042-1060
Size – Ø50.8 × 8 mm				
262–266	99	045-0260-i0	99	045-0260
351–361	99.7	045-0350-i0	99.5	045-0350
527–532	99.7	045-0530-i0	99.5	045-0530
1047–1064	99.7	045-1060-i0	99.5	045-1060
Size – Ø76.2 × 12.7 mm				
351–361	99.7	047-0350-i0	99.5	047-0350
527–532	99.7	047-0530-i0	99.5	047-0530
1047–1064	99.7	047-1060-i0	99.5	047-1060

DUAL BAND MIRRORS

Substrate material: **BK7 grade A**



HR 532+1064 nm, AOI = 45°

Wavelength, nm	AOI=0°		AOI=45°	
	R, % (s+p)/2	Catalogue number	R, % (s+p)/2	Catalogue number
Size – Ø12.7 × 3 mm				
532+1064	99.7	051-5306-i0	99.5	051-5306
633+1064	99.7	051-6306-i0	99.5	051-6306
Size – Ø12.7 × 6 mm				
532+1064	99.7	051-5306T6-i0	99.5	051-5306T6
633+1064	99.7	051-6306T6-i0	99.5	051-6306T6
Size – Ø25.4 × 6 mm				
532+1064	99.7	052-5306-i0	99.5	052-5306
633+1064	99.7	052-6306-i0	99.5	052-6306
Size – Ø50.8 × 8 mm				
532+1064	99.7	055-5306-i0	99.5	055-5306
633+1064	99.7	055-6306-i0	99.5	055-6306
Size – Ø76.2 × 12.7 mm				
532+1064	99.7	057-5306-i0	99.5	057-5306
633+1064	99.7	057-6306-i0	99.5	057-6306

Related Products

Prisms See page 1.50

Kinematic Mirror/Beamsplitter Mounts 840-0056

Find more at EksmaOptics.com

DUAL BAND MIRRORS

Substrate material: **UV grade Fused Silica**

Wavelength, nm	AOI=0°		AOI=45°	
	R, % (s+p)/2	Catalogue number	R, % (s+p)/2	Catalogue number
Size – Ø12.7 × 3 mm				
532+1064	99.7	061-5306-i0	99.5	061-5306
633+1064	99.7	061-6306-i0	99.5	061-6306
355+532	99.7	061-3553-i0	99.5	061-3553
Size – Ø12.7 × 6 mm				
532+1064	99.7	061-5306T6-i0	99.5	061-5306T6
633+1064	99.7	061-6306T6-i0	99.5	061-6306T6
355+532	99.7	061-3553T6-i0	99.5	061-3553T6
Size – Ø25.4 × 6 mm				
532+1064	99.7	062-5306-i0	99.5	062-5306
633+1064	99.7	062-6306-i0	99.5	062-6306
355+532	99.7	062-3553-i0	99.5	062-3553
Size – Ø50.8 × 8 mm				
532+1064	99.7	065-5306-i0	99.5	065-5306
633+1064	99.7	065-6306-i0	99.5	065-6306
355+532	99.7	065-3553-i0	99.5	065-3553
Size – Ø76.2 × 12.7 mm				
532+1064	99.7	067-5306-i0	99.5	067-5306
633+1064	99.7	067-6306-i0	99.5	067-6306
355+532	99.7	067-3553-i0	99.5	067-3553

Related Products

Laser Line and Dual Laser Line Mirrors of other wavelengths

See page 1.19

Metal Coated Mirrors

See page 1.25

HIGH POWER IBS COATED LASER MIRRORS

Substrate

Material	UV grade fused silica
S1 Surface Flatness	λ/10 at 633 nm
S1 Surface Quality	20 – 10 scratch & dig (MIL-PRF-13830B)
S2 Surface Quality	Commercial polish
Diameter Tolerance	+0.00 mm / -0.12 mm
Thickness Tolerance	±0.25 mm
Wedge	< 3 min
Chamfer	0.3 mm at 45° typical

Coating

Technology	Ion Beam Sputtering (IBS)
Adhesion and Durability	Per MIL-C-675A, Insoluble in lab solvents
Clear Aperture	Exceeds central 85% of diameter
Coated Surface Flatness	λ/10 at 633 nm over clear aperture

Design wavelength – 266 nm. LIDT > 6 J/cm², 10 ns pulse, 100 Hz, 266 nm typical

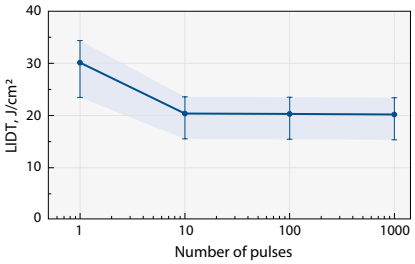
Wavelength, nm	AOI, deg	R, % (s+p)/2	Ø 12.7 x 6 mm	Ø 25.4 x 6 mm	Ø 50.8 x 12 mm
			Catalogue number	Catalogue number	Catalogue number
266	45	99.5	041-0266HHR	042-0266HHR	045-0266HHR
266	0	99.5	041-0266HHR-i0	042-0266HHR-i0	045-0266HHR-i0

Design wavelength – 355 nm. LIDT > 10 J/cm², 10 ns pulse, 100 Hz, 355 nm typical

Wavelength, nm	AOI, deg	R, % (s+p)/2	Ø 12.7 x 6 mm	Ø 25.4 x 6 mm	Ø 50.8 x 12 mm
			Catalogue number	Catalogue number	Catalogue number
355	45	99.8	041-0350T6UHHR	042-0350UHHR	045-0350UHHR
355	0	99.8	041-0350T6UHHR-i0	042-0350UHHR-i0	045-0350UHHR-i0

Design wavelength – 532 nm. LIDT >10 J/cm², 10 ns pulse, 100 Hz, 532 nm typical.

Wavelength, nm	AOI, deg	R, % (s+p)/2	Ø 12.7 x 6 mm	Ø 25.4 x 6 mm	Ø 50.8 x 12 mm
			Catalogue number	Catalogue number	Catalogue number
532	45	99.9	041-0530T6HHR	042-0530HHR	045-0530T12HHR
532	0	99.95	041-0530T6HHR-i0	042-0530HHR-i0	045-0530T12HHR-i0
532	0-45	99.9	041-0530T6HHR-i0-45	042-0530HHR-i0-45	045-0530T12HHR-i0-45



LIDT of High Power Laser Mirrors @ 532 nm

Test conditions:

Wavelength	532 nm
Pulse duration	(5.4 ± 0.3) ns
Repetition rate	100 Hz
AOI	45°
Polarization	linear P
Beam diameter (1/e²)	(206.0 ± 6.7) µm

Design wavelength – 532 nm. **LIDT >20 J/cm²**, 10 ns pulse, 100 Hz, 532 nm typical.

Wavelength, nm	AOI, deg	R, % (s+p)/2	Ø 12.7 x 6 mm		Ø 25.4 x 6 mm		Ø 50.8 x 12 mm	
			Catalogue number		Catalogue number		Catalogue number	
532	45	99.9	041-0530T6UHHR		042-0530UHHR		045-0530T12UHHR	
532	0	99.95	041-0530T6UHHR-i0		042-0530UHHR-i0		045-0530T12UHHR-i0	

Design wavelength – 800 nm. **LIDT >30 J/cm²**, 10 ns pulse, 100 Hz, 800 nm typical.

Wavelength, nm	AOI, deg	R, % (s+p)/2	Ø 12.7 x 6 mm		Ø 25.4 x 6 mm		Ø 50.8 x 12 mm	
			Catalogue number		Catalogue number		Catalogue number	
800	45	99.9	041-0800NT6UHHR		042-0800NUHHR		045-0800NT12UHHR	
800	0	99.95	041-0800NT6UHHR-i0		042-0800NUHHR-i0		045-0800NT12UHHR-i0	

Design wavelength – 1064 nm. **LIDT >20 J/cm²**, 10 ns pulse, 100 Hz, 1064 nm typical.

Wavelength, nm	AOI, deg	R, % (s+p)/2	Ø 12.7 x 6 mm		Ø 25.4 x 6 mm		Ø 50.8 x 12 mm	
			Catalogue number		Catalogue number		Catalogue number	
1064	45	99.9	041-1060T6HHR		042-1060HHR		045-1060T12HHR	
1064	0	99.95	041-1060T6HHR-i0		042-1060HHR-i0		045-1060T12HHR-i0	
1064	0-45	99.9	041-1060T6HHR-i0-45		042-1060HHR-i0-45		045-1060T12HHR-i0-45	

Design wavelength – 1064 nm. **LIDT >40 J/cm²**, 10 ns pulse, 100 Hz, 1064 nm typical.

Wavelength, nm	AOI, deg	R, % (s+p)/2	Ø 12.7 x 6 mm		Ø 25.4 x 6 mm		Ø 50.8 x 12 mm	
			Catalogue number		Catalogue number		Catalogue number	
1064	45	99.9	041-1060NT6UHHR		042-1060NUHHR		045-1060NT12UHHR	
1064	0	99.95	041-1060NT6UHHR-i0		042-1060NUHHR-i0		045-1060NT12UHHR-i0	

Design wavelength – 532+1064 nm. **LIDT >15 J/cm²** at 1064 nm and **LIDT >5 J/cm²** at 532 nm, 10 ns pulse, 10 Hz typical.

Wavelength, nm	AOI, deg	R, % (s+p)/2	Ø 12.7 x 6 mm		Ø 25.4 x 6 mm		Ø 50.8 x 12 mm	
			Catalogue number		Catalogue number		Catalogue number	
532+1064	45	99.5	061-5306HHR		062-5306HHR		065-5306HHR	
532+1064	0	99.5	061-5306HHR-i0		062-5306HHR-i0		065-5306HHR-i0	

Design wavelength – 532+1064 nm. **LIDT >30 J/cm²** at 1064 nm and **LIDT >10 J/cm²** at 532 nm, 10 ns pulse, 10 Hz typical.

Wavelength, nm	AOI, deg	R, % (s+p)/2	Ø 12.7 x 6 mm		Ø 25.4 x 6 mm		Ø 50.8 x 12 mm	
			Catalogue number		Catalogue number		Catalogue number	
532+1064	45	99.5	061-5306UHHR		062-5306UHHR		065-5306UHHR	
532+1064	0	99.5	061-5306UHHR-i0		062-5306UHHR-i0		065-5306UHHR-i0	

LASER HARMONIC SEPARATORS

Features

- Offered on Ø 0.5 or 1 inch substrates of BK7 or UV FS with surface flatness λ/10

Harmonic separators are dichroic beamsplitters that reflect one wavelength and transmit the others. Reflectance is higher than 99.5% for the wavelength of interest and transmittance is at least 90% for the rejected wavelengths. The rear surface of harmonic separators is antireflection coated.

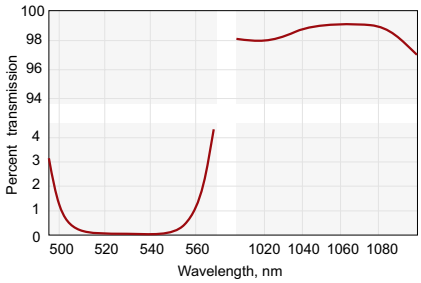
Substrate

Material	UV grade Fused Silica or BK7 glass
S1 Surface Flatness	λ/10 typical at 633 nm
S1 Surface Quality	20–10 scratch & dig (MIL-PRF-13830B)
S2 Surface Flatness	λ/10 typical at 633 nm
S2 Surface Quality	20–10 scratch & dig (MIL-PRF-13830B)
Diameter Tolerance	+0.00 mm -0.12 mm
Thickness Tolerance	±0.25 mm
Parallelism	< 30 arcsec
Chamfer	0.3 mm at 45° typical

LASER HARMONIC SEPARATORS WITH HIGH TRANSMISSION

Coating

Technology	Ion Beam Sputtering (IBS)
Damage Threshold	>10 J/cm², 8 nsec pulse, 1064 nm typical
Back side anti-reflection coated	AOI 45°, R<0.5% AOI 0°, R<0.1%



041-5105HT.
HR > 99.9% @ 532 nm, HT > 99% @ 1064 nm, AOI = 45°

Reflected wavelength, nm	Reflection	Transmission	AOI, deg	Ø12.7×3 mm		Ø25.4×6 mm	
				Catalogue number		Catalogue number	
266	R_{sp}>99.0%	T_{sp}>98% @ 532 + 1064 nm	0	041-2510HT		042-2510HT	
266	R_{sp}>99.0%	T_{sp}>98% @ 532 + 1064 nm	45	041-2515HT		042-2515HT	
355	R_{sp}>99.5%	T_{sp}>98% @ 532 nm + T_{sp}>99% @ 1064 nm	0	041-3510HT		042-3510HT	
355	R_{sp}>99.5%	T_{sp}>98% @ 532 nm + T_{sp}>99% @ 1064 nm	45	041-3515HT		042-3515HT	
532	R_{sp}>99.9%	T_{sp}>99% @ 1064 nm	0	041-5100HT		042-5100HT	
532	R_{sp}>99.9%	T_{sp}>99% @ 1064 nm	45	041-5105HT		042-5105HT	
1064	R_{sp}>99.5%	T_{sp}>98% @ 532 nm	0	041-6500HT		042-6500HT	
1064	R_{sp}>99.5%	T_{sp}>98% @ 532 nm	45	041-6505HT		042-6505HT	

STANDARD LASER HARMONIC SEPARATORS

Coating

Technology	Electron beam multilayer dielectric
Adhesion and Durability	Per MIL-C-675A. Insoluble in lab solvents
Damage Threshold: BK7	>2 J/cm², 8 nsec pulse, 1064 nm typical
Damage Threshold: UV FS	>5 J/cm², 8 nsec pulse, 1064 nm typical

Clear Aperture	Exceeds central 85% of diameter
Coated Surface Flatness	λ/10 at 633 nm over clear aperture
Back side antireflection coated	AOI 45°, R<0.5% AOI 0°, R<0.2%

Reflected wavelength, nm, R > 99.5%	Transmitted wavelength, nm	Transmission, %	AOI, deg	Substrate material	Ø12.7x3 mm		Ø25.4x6 mm	
					Catalogue number		Catalogue number	
266	355+532+1064	>90	0	UVFS	041-2310		042-2310	
266	355+532+1064	>90	45	UVFS	041-2315		042-2315	
266	532	>95	0	UVFS	041-2500		042-2500	
266	532	>95	45	UVFS	041-2505		042-2505	
355	1064	>95	0	UVFS	041-3100		042-3100	
355	1064	>95	45	UVFS	041-3105		042-3105	
355	532	>95	0	UVFS	041-3500		042-3500	
355	532	>95	45	UVFS	041-3505		042-3505	
355	532+1064	>95	0	UVFS	041-3510		042-3510	
355	532+1064	>95	45	UVFS	041-3515		042-3515	
532	1064	>95	0	BK7	031-5100		032-5100	
532	1064	>95	45	BK7	031-5105		032-5105	
532	1064	>95	0	UVFS	041-5100		042-5100	
532	1064	>95	45	UVFS	041-5105		042-5105	
532+1064	355	>85	0	UVFS	041-5140		042-5140	
532+1064	355	>85	45	UVFS	041-5145		042-5145	
1064	532	>93	0	BK7	031-6500		032-6500	
1064	532	>93	45	BK7	031-6505		032-6505	
1064	532	>93	0	UVFS	041-6500		042-6500	
1064	532	>93	45	UVFS	041-6505		042-6505	

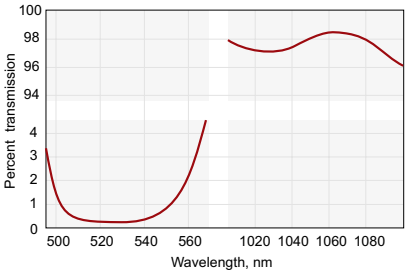
Related Products

Pellin-Broca Prisms
See page 1.52

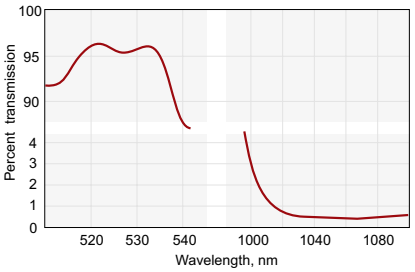
Housing accessories

Adapter for Beamsplitter at 45° 840-0116
Find more at EksmaOptics.com

Kinematic Mirror and Beamsplitter Mount 840-0020
Find more at EksmaOptics.com



031-5105.
HR > 99.5% @ 532 nm, HT > 95% @ 1064 nm, AOI = 45°



031-6500.
HR > 99.5% @ 1064 nm, HT > 93% @ 532 nm, AOI = 0°

LASER OUTPUT COUPLERS

An output coupler is a partially reflecting dielectric mirror used in a laser cavity. It transmits a part of the circulating intracavity power for generating a useful output from the laser.

A low transmission output coupler leads to a low laser threshold, but also possibly to poor laser efficiency if the losses due to output coupling do not dominate over other parasitic losses in the laser cavity. The output coupler transmission is often chosen to maximize the achieved output power, although its optimum value may be lower or higher if there are other design purposes (minimizing the intracavity intensities or suppressing Q-switching instabilities in a passively mode-locked laser).

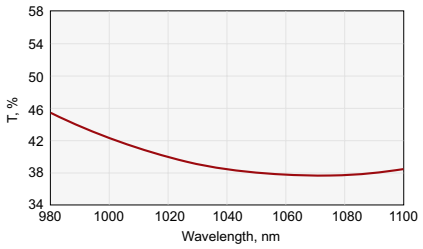
Substrate

Material	UV grade Fused Silica or BK7 glass
S1 Surface Flatness	λ/10 typical at 633 nm
S1 Surface Quality	20 –10 scratch & dig (MIL-PRF-13830B)
S2 Surface Flatness	λ/10 typical at 633 nm
S2 Surface Quality	20 –10 scratch & dig (MIL-PRF-13830B)
Diameter Tolerance	+0.00 mm; -0.12 mm
Thickness Tolerance	±0.25 mm
Parallelism	30 arcsec
Chamfer	0.3 mm at 45° typical

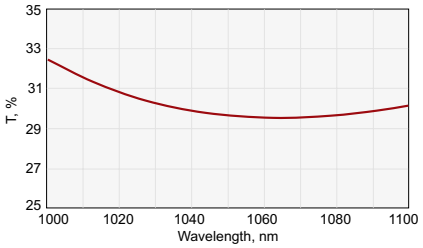
Coating

Technology	Electron beam multilayer dielectric
Adhesion and Durability	Per MIL-C-675A. Insoluble in lab solvents
Clear Aperture	Exceeds central 85% of diameter
Damage Threshold:	
BK7	>3 J/cm², 8 nsec pulse, 1064 nm typical
UV FS	>6 J/cm², 8 nsec pulse, 1064 nm typical
Coated Surface Flatness	λ/10 at 633 nm over clear aperture
Angle of Incidence	0 – 8° (normal)
Back side antireflection coated	R < 0.2%

LASER OUTPUT COUPLERS



R = 60±2% @ 1064 nm, AOI=0°



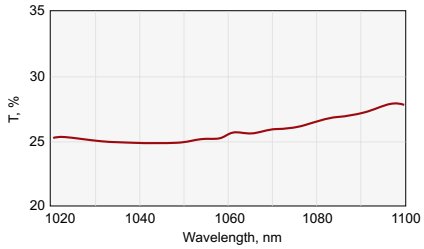
R = 70±2% @ 1064 nm, AOI=0°

Size – **Ø12.7 × 3 mm**

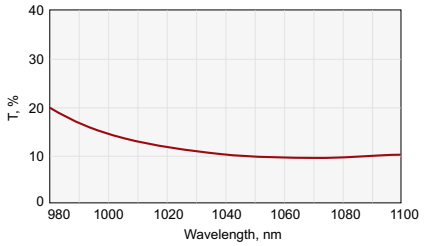
Wavelength, nm	Reflection, %	Transmission, %	Substrate material	Catalogue number	
1064	15±3	85±3	BK7	031-0015	
1064	20±3	80±3	BK7	031-0020	
1064	25±3	75±3	BK7	031-0025	
1064	30±3	70±3	BK7	031-0030	
1064	40±3	60±3	BK7	031-0040	
1064	50±3	50±3	BK7	031-0050	
1064	60±3	40±3	BK7	031-0060	
1064	65±3	35±3	BK7	031-0065	
1064	70±3	30±3	BK7	031-0070	
1064	75±3	25±3	BK7	031-0075	
1064	80±3	20±3	BK7	031-0080	
1064	85±3	15±3	BK7	031-0085	
1064	90±2	10±2	BK7	031-0090	
1064	95±2	5±2	BK7	031-0095	
1064	97±1	3±1	BK7	031-0097	
1064	98±1	2±1	BK7	031-0098	
1064	99.0±0.5	1.0±0.5	BK7	031-0099	

Size – **Ø12.7 × 3 mm**

Wavelength, nm	Reflection, %	Transmission, %	Substrate material	Catalogue number	
1064	20±3	80±3	UV FS	041-0020	
1064	30±3	70±3	UV FS	041-0030	
1064	40±3	60±3	UV FS	041-0040	
1064	50±3	50±3	UV FS	041-0050	
1064	60±3	40±3	UV FS	041-0060	
1064	65±3	35±3	UV FS	041-0065	
1064	70±3	30±3	UV FS	041-0070	
1064	75±3	25±3	UV FS	041-0075	
1064	80±3	20±3	UV FS	041-0080	
1064	85±3	15±3	UV FS	041-0085	
1064	90±2	10±2	UV FS	041-0090	
1064	95±2	5±2	UV FS	041-0095	
1064	97±1	3±1	UV FS	041-0097	
1064	98±1	2±1	UV FS	041-0098	
1064	99.0±0.5	1.0±0.5	UV FS	041-0099	



R = 75±3% @ 1064 nm, AOI=0°



R = 90±2% @ 1064 nm, AOI=0°

Size – **Ø25.4 × 6 mm**

Wavelength, nm	Reflection, %	Transmission, %	Substrate material	Catalogue number	
1064	15±3	85±3	BK7	032-0015	
1064	20±3	80±3	BK7	032-0020	
1064	25±3	75±3	BK7	032-0025	
1064	30±3	70±3	BK7	032-0030	
1064	40±3	60±3	BK7	032-0040	
1064	50±3	50±3	BK7	032-0050	
1064	60±3	40±3	BK7	032-0060	
1064	65±3	35±3	BK7	032-0065	
1064	70±3	30±3	BK7	032-0070	
1064	75±3	25±3	BK7	032-0075	
1064	80±3	20±3	BK7	032-0080	
1064	85±3	15±3	BK7	032-0085	
1064	90±2	10±2	BK7	032-0090	
1064	95±2	5±2	BK7	032-0095	
1064	97±1	3±1	BK7	032-0097	
1064	98±1	2±1	BK7	032-0098	
1064	99.0±0.5	1.0±0.5	BK7	032-0099	
1064	15±3	85±3	UV FS	042-0015	
1064	20±3	80±3	UV FS	042-0020	
1064	25±3	75±3	UV FS	042-0025	
1064	30±3	70±3	UV FS	042-0030	
1064	40±3	60±3	UV FS	042-0040	
1064	50±3	50±3	UV FS	042-0050	
1064	60±3	40±3	UV FS	042-0060	
1064	65±3	35±3	UV FS	042-0065	
1064	70±3	30±3	UV FS	042-0070	
1064	75±3	25±3	UV FS	042-0075	
1064	80±3	20±3	UV FS	042-0080	
1064	85±3	15±3	UV FS	042-0085	
1064	90±2	10±2	UV FS	042-0090	
1064	95±2	5±2	UV FS	042-0095	
1064	97±1	3±1	UV FS	042-0097	
1064	98±1	2±1	UV FS	042-0098	
1064	99.0±0.5	1.0±0.5	UV FS	042-0099	

Related Products

Uncoated Flat Windows See page 1.9

Kinematic Mirror and Beamsplitter Mount 840-0020

Find more at EksmaOptics.com

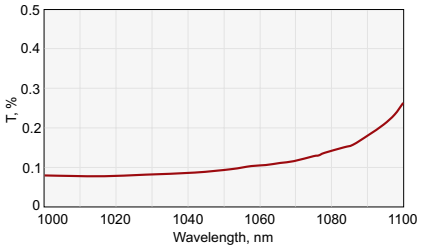
LASER REAR MIRRORS

Substrate

Material	UV grade Fused Silica or BK7 glass
S1 Surface Flatness	λ/10 at 633 nm
S1 Surface Quality	20–10 scratch & dig (MIL-PRF-13830B)
S2 Surface Quality	Commercial polish
Diameter Tolerance	+0.00 mm; -0.12 mm
Thickness Tolerance	±0.25
Chamfer	0.3 mm at 45° typical

Coating

Technology	Electron beam multilayer dielectric
Adhesion and Durability	Per MIL-C-675A. Insoluble in lab solvents
Clear Aperture	Exceeds central 85% of diameter
Damage Threshold:	
BK7	>2 J/cm², 8 nsec pulse, 1064 nm
UV FS	>5 J/cm², 8 nsec pulse, 1064 nm
Angle of Incidence	0 – 8° (normal)
Reflectivity	R > 99.7%



R > 99.8% @ 1064 nm

Size – **Ø25.4 × 6 mm**

Wavelength, nm	Substrate type	Radius, mm	Substrate material	Catalogue number
1047–1064	Plano	∞	BK7	032-1060-i0
1064	Plano-concave	-50	BK7	032-8005
1064	Plano-concave	-100	BK7	032-8010
1064	Plano-concave	-150	BK7	032-8015
1064	Plano-concave	-200	BK7	032-8020
1064	Plano-concave	-250	BK7	032-8025
1064	Plano-concave	-500	BK7	032-8050
1064	Plano-concave	-1000	BK7	032-8100
1064	Plano-concave	-2000	BK7	032-8200
1064	Plano-concave	-2500	BK7	032-8250
1064	Plano-concave	-4000	BK7	032-8400
1064	Plano-concave	-5000	BK7	032-8500
1047–1064	Plano	∞	UV FS	042-1060-i0
1064	Plano-concave	-50	UV FS	042-8005
1064	Plano-concave	-100	UV FS	042-8010
1064	Plano-concave	-150	UV FS	042-8015
1064	Plano-concave	-200	UV FS	042-8020
1064	Plano-concave	-250	UV FS	042-8025
1064	Plano-concave	-500	UV FS	042-8050
1064	Plano-concave	-1000	UV FS	042-8100
1064	Plano-concave	-2000	UV FS	042-8200
1064	Plano-concave	-2500	UV FS	042-8250
1064	Plano-concave	-4000	UV FS	042-8400
1064	Plano-concave	-5000	UV FS	042-8500
1064	Plano-convex	+100	BK7	032-9010
1064	Plano-convex	+200	BK7	032-9020
1064	Plano-convex	+300	BK7	032-9030
1064	Plano-convex	+500	BK7	032-9050
1064	Plano-convex	+1000	BK7	032-9100
1064	Plano-convex	+2000	BK7	032-9200
1064	Plano-convex	+3000	BK7	032-9300
1064	Plano-convex	+4000	BK7	032-9400
1064	Plano-convex	+100	UV FS	042-9010
1064	Plano-convex	+200	UV FS	042-9020
1064	Plano-convex	+300	UV FS	042-9030
1064	Plano-convex	+500	UV FS	042-9050
1064	Plano-convex	+1000	UV FS	042-9100
1064	Plano-convex	+2000	UV FS	042-9200
1064	Plano-convex	+3000	UV FS	042-9300
1064	Plano-convex	+4000	UV FS	042-9400

Related Products

Uncoated Curved Windows See page 1.6

Kinematic Mirror Mount 840-0010

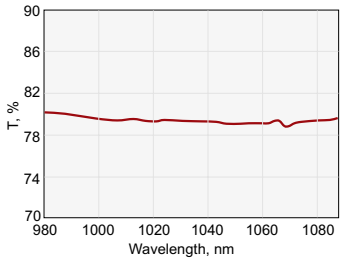
Find more at EksmaOptics.com

LASER BEAMSPLITTERS

Features

- Designed for average polarization: $R=(R_s+R_p)/2$ and $T=(T_s+T_p)/2$

Beamsplitter splits average polarized laser beam into two beams separated by 90° from each other.



042-7120A.
R = 20±3%, T = 80±3% @ 1064 nm

Substrate

Material	UV grade Fused Silica or BK7 glass
S1 Surface Flatness	λ/10 typical at 633 nm
S1 Surface Quality	20–10 scratch & dig (MIL-PRF-13830B)
S2 Surface Flatness	λ/10 typical at 633 nm
S2 Surface Quality	20–10 scratch & dig (MIL-PRF-13830B)
Diameter Tolerance	+0.00 mm; -0.12 mm
Thickness Tolerance	±0.25 mm
Parallelism	30 arcsec
Chamfer	0.3 mm at 45° typical

Coating

Technology	Electron beam multilayer dielectric
Adhesion and Durability	Per MIL-C-675A. Insoluble in lab solvents
Clear Aperture	Exceeds central 85% of diameter
Damage Threshold:	
BK7	>5 J/cm², 8 nsec pulse, 1064 nm typical
UV FS	>8 J/cm², 8 nsec pulse, 1064 nm typical
Angle of Incidence	45±3 degrees
Back side antireflection coated	R < 0.5%

Designed for average polarization. $R=(R_s+R_p)/2$ and $T=(T_s+T_p)/2$

Wavelength, nm	Reflection, %	Transmission, %	Substrate material	Ø12.7x3 mm Catalogue number		Ø25.4x6 mm Catalogue number	
1064	20±3	80±3	BK7	031-7120A		032-7120A	
1064	30±3	70±3	BK7	031-7130A		032-7130A	
1064	50±3	50±3	BK7	031-7150A		032-7150A	
1064	70±3	30±3	BK7	031-7170A		032-7170A	
1064	75±3	25±3	BK7	031-7175A		032-7175A	
1064	80±3	20±3	BK7	031-7180A		032-7180A	
1064	90±3	10±3	BK7	031-7190A		032-7190A	
532	20±3	80±3	BK7	031-7220A		032-7220A	
532	30±3	70±3	BK7	031-7230A		032-7230A	
532	50±3	50±3	BK7	031-7250A		032-7250A	
532	70±3	30±3	BK7	031-7270A		032-7270A	
532	80±3	20±3	BK7	031-7280A		032-7280A	
1064	20±3	80±3	UV FS	041-7120A		042-7120A	
1064	30±3	70±3	UV FS	041-7130A		042-7130A	
1064	50±3	50±3	UV FS	041-7150A		042-7150A	
1064	70±3	30±3	UV FS	041-7170A		042-7170A	
1064	75±3	25±3	UV FS	041-7175A		042-7175A	
1064	80±3	20±3	UV FS	041-7180A		042-7180A	
1064	90±3	10±3	UV FS	041-7190A		042-7190A	
532	20±3	80±3	UV FS	041-7220A		042-7220A	
532	30±3	70±3	UV FS	041-7230A		042-7230A	
532	50±3	50±3	UV FS	041-7250A		042-7250A	
532	70±3	30±3	UV FS	041-7270A		042-7270A	
532	80±3	20±3	UV FS	041-7280A		042-7280A	
355	20±3	80±3	UV FS	041-7320A		042-7320A	
355	30±3	70±3	UV FS	041-7330A		042-7330A	
355	50±3	50±3	UV FS	041-7350A		042-7350A	
355	70±3	30±3	UV FS	041-7370A		042-7370A	
355	80±3	20±3	UV FS	041-7380A		042-7380A	
266	20±3	80±3	UV FS	041-7920A		042-7920A	
266	30±3	70±3	UV FS	041-7930A		042-7930A	
266	50±3	50±3	UV FS	041-7950A		042-7950A	
266	70±3	30±3	UV FS	041-7970A		042-7970A	
266	80±3	20±3	UV FS	041-7980A		042-7980A	

Related Products

Uncoated Flat Windows

See page 1.9

Designed for S- polarization

Wavelength, nm	Reflection, %	Transmission, %	Substrate material	Ø12.7x3 mm Catalogue number	Ø25.4x6 mm Catalogue number
1064	20±3	80±3	BK7	031-7120S	032-7120S
1064	30±3	70±3	BK7	031-7130S	032-7130S
1064	50±3	50±3	BK7	031-7150S	032-7150S
1064	70±3	30±3	BK7	031-7170S	032-7170S
1064	80±3	20±3	BK7	031-7180S	032-7180S
532	20±3	80±3	BK7	031-7220S	032-7220S
532	30±3	70±3	BK7	031-7230S	032-7230S
532	50±3	50±3	BK7	031-7250S	032-7250S
532	70±3	30±3	BK7	031-7270S	032-7270S
532	80±3	20±3	BK7	031-7280S	032-7280S
1064	20±3	80±3	UV FS	041-7120S	042-7120S
1064	30±3	70±3	UV FS	041-7130S	042-7130S
1064	50±3	50±3	UV FS	041-7150S	042-7150S
1064	70±3	30±3	UV FS	041-7170S	042-7170S
1064	80±3	20±3	UV FS	041-7180S	042-7180S
532	20±3	80±3	UV FS	041-7220S	042-7220S
532	30±3	70±3	UV FS	041-7230S	042-7230S
532	50±3	50±3	UV FS	041-7250S	042-7250S
532	70±3	30±3	UV FS	041-7270S	042-7270S
532	80±3	20±3	UV FS	041-7280S	042-7280S
355	20±3	80±3	UV FS	041-7320S	042-7320S
355	30±3	70±3	UV FS	041-7330S	042-7330S
355	50±3	50±3	UV FS	041-7350S	042-7350S
355	70±3	30±3	UV FS	041-7370S	042-7370S
355	80±3	20±3	UV FS	041-7380S	042-7380S
266	20±3	80±3	UV FS	041-7920S	042-7920S
266	30±3	70±3	UV FS	041-7930S	042-7930S
266	50±3	50±3	UV FS	041-7950S	042-7950S
266	70±3	30±3	UV FS	041-7970S	042-7970S
266	80±3	20±3	UV FS	041-7980S	042-7980S

Designed for P- polarization

Wavelength, nm	Reflection, %	Transmission, %	Substrate material	Ø12.7x3 mm Catalogue number	Ø25.4x6 mm Catalogue number
1064	20±3	80±3	BK7	031-7120P	032-7120P
1064	30±3	70±3	BK7	031-7130P	032-7130P
1064	50±3	50±3	BK7	031-7150P	032-7150P
1064	70±3	30±3	BK7	031-7170P	032-7170P
1064	80±3	20±3	BK7	031-7180P	032-7180P
532	20±3	80±3	BK7	031-7220P	032-7220P
532	30±3	70±3	BK7	031-7230P	032-7230P
532	50±3	50±3	BK7	031-7250P	032-7250P
532	70±3	30±3	BK7	031-7270P	032-7270P
532	80±3	20±3	BK7	031-7280P	032-7280P
1064	20±3	80±3	UV FS	041-7120P	042-7120P
1064	30±3	70±3	UV FS	041-7130P	042-7130P
1064	50±3	50±3	UV FS	041-7150P	042-7150P
1064	70±3	30±3	UV FS	041-7170P	042-7170P
1064	80±3	20±3	UV FS	041-7180P	042-7180P
532	20±3	80±3	UV FS	041-7220P	042-7220P
532	30±3	70±3	UV FS	041-7230P	042-7230P
532	50±3	50±3	UV FS	041-7250P	042-7250P
532	70±3	30±3	UV FS	041-7270P	042-7270P
532	80±3	20±3	UV FS	041-7280P	042-7280P
355	20±3	80±3	UV FS	041-7320P	042-7320P
355	30±3	70±3	UV FS	041-7330P	042-7330P
355	50±3	50±3	UV FS	041-7350P	042-7350P
355	70±3	30±3	UV FS	041-7370P	042-7370P
355	80±3	20±3	UV FS	041-7380P	042-7380P
266	20±3	80±3	UV FS	041-7920P	042-7920P
266	30±3	70±3	UV FS	041-7930P	042-7930P
266	50±3	50±3	UV FS	041-7950P	042-7950P
266	70±3	30±3	UV FS	041-7970P	042-7970P
266	80±3	20±3	UV FS	041-7980P	042-7980P

Housing accessories

Kinematic Mirror and Beamsplitter Mount 840-0030-02

Adapter for Beamsplitter at 45° 840-0116

Flipping Mirror/ Beamsplitter Mount 840-0155

Find more at EksmaOptics.com

LASER LINE ANTI-REFLECTION COATED PRECISION WINDOWS

Features

- Made of premium quality UV FS and BK7
- AR coated at 266 nm, 355 nm, 532 nm, 1064 nm

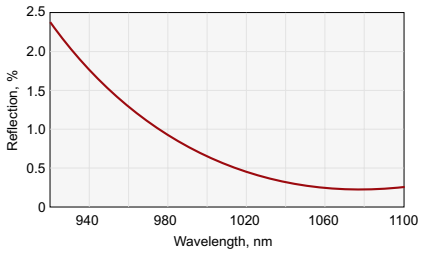
Precision windows are mostly used in laser systems. High quality AR multilayer coatings are applied on windows for fundamental Nd:YAG laser 1064 nm, frequency-doubled 532 nm, frequency-tripled 355 nm and frequency-quadrupled 266 nm applications. Featuring high optical transmission with little distortion of the transmitted signal, precision windows are a good solution for applications that require protective windows.

Specifications

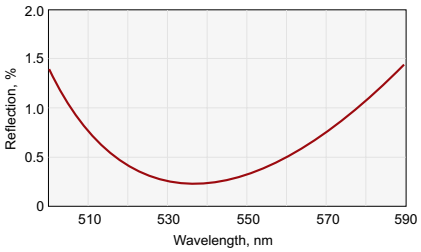
Material	BK7, UV FS
Surface quality	20 –10 scratch & dig (MIL-PRF-13830B)
Clear aperture	90% of the diameter
Diameter tolerance	+0.00; -0.12 mm
Thickness tolerance	±0.2 mm
Surface flatness	λ/10 @ 633 nm
Parallelism	30 arcsec or 3 arcsec

Coating

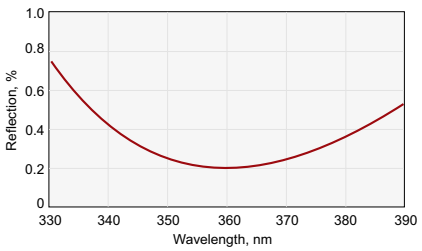
Technology	Electron beam multilayer dielectric
Adhesion and Durability	Per MIL-C-675A. Insoluble in lab solvents
Clear Aperture	Exceeds central 85% of diameter
Damage Threshold:	
BK7	>5 J/cm², 8 nsec pulse, 1064 nm
UV FS	>10 J/cm², 8 nsec pulse, 1064 nm
Angle of Incidence	0 degrees
Coated Surface Flatness	λ/10 at 633 nm over clear aperture



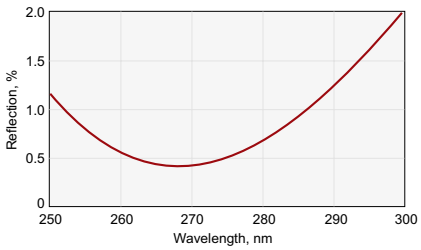
R<0.25%@1064 nm AOI=0°



R<0.25%@532 nm AOI=0°



R<0.25%@355 nm, AOI=0°



R<0.4%@266 nm, AOI=0°

PARALLELISM 30 arcsec

Wavelength, nm	Diameter D, mm	Thickness T, mm	BK7	UV FS
			Catalogue number	Catalogue number
266	12.7	3.0	–	224-1101E
355	12.7	3.0	–	223-1101E
532	12.7	3.0	222-0101E	222-1101E
1064	12.7	3.0	221-0101E	221-1101E
266	25.4	6.0	–	224-1201E
355	25.4	6.0	–	223-1201E
532	25.4	6.0	222-0201E	222-1201E
1064	25.4	6.0	221-0201E	221-1201E
266	38.1	8.0	–	224-1402E
355	38.1	8.0	–	223-1402E
532	38.1	8.0	222-0402E	222-1402E
1064	38.1	8.0	221-0402E	221-1402E
266	50.8	10.0	–	224-1502E
355	50.8	10.0	–	223-1502E
532	50.8	10.0	222-0502E	222-1502E
1064	50.8	10.0	221-0502E	221-1502E

PARALLELISM 3 arcsec

Wavelength, nm	Diameter D, mm	Thickness T, mm	BK7	UV FS
			Catalogue number	Catalogue number
266	12.7	3.0	–	224-1103E
355	12.7	3.0	–	223-1103E
532	12.7	3.0	222-0103E	222-1103E
1064	12.7	3.0	221-0103E	221-1103E
266	25.4	6.0	–	224-1203E
355	25.4	6.0	–	223-1203E
532	25.4	6.0	222-0203E	222-1203E
1064	25.4	6.0	221-0203E	221-1203E
266	38.1	10.0	–	224-1403E
355	38.1	10.0	–	223-1403E
532	38.1	10.0	222-0403E	222-1403E
1064	38.1	10.0	221-0403E	221-1403E
266	50.8	12.0	–	224-1503E
355	50.8	12.0	–	223-1503E
532	50.8	12.0	222-0503E	222-1503E
1064	50.8	12.0	221-0503E	221-1503E

Related Products

Uncoated Precision Windows

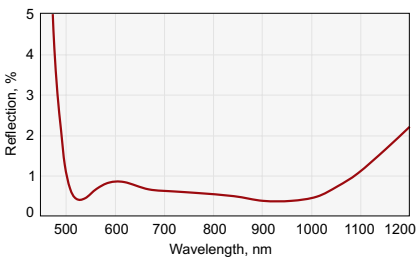
See page 1.10

AR COATED LENS KITS

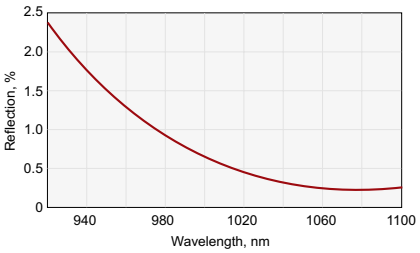
Lens kits contain different types of spherical (plano-convex, biconvex, plano-concave, biconcave) or cylindrical (plano-convex, plano-concave) lenses with various focal lengths. Kits are packed into foam lined plastic boxes for safe handling and storage. Kits are available with laser line and broadband multilayer anti-reflection coatings.

Spherical lens kits consist of 40 (large kit) or 15 (small kit) O25.4 mm lenses made of UVFS or N-BK7.

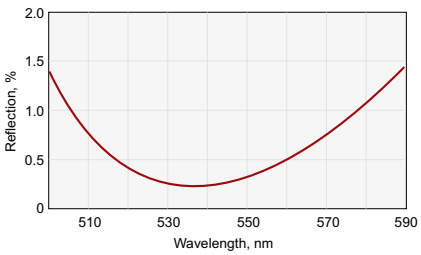
Cylindrical lens kits consist of 12 rectangular lenses (25.4 x 50.8 mm) made of UVFS or N-BK7.



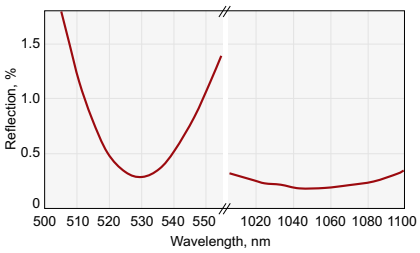
R<1.5% @ 500-1100 nm, AOI=0°



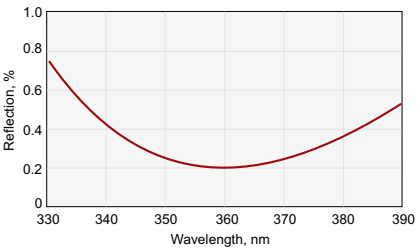
R<0.25% @ 1064 nm AOI=0°



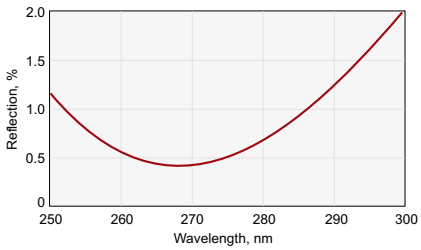
R<0.25% @ 532 nm AOI=0°



R<0.5% @ 532 nm+1064 nm, AOI=0°



R<0.25% @ 355 nm, AOI=0°



R<0.4% @ 266 nm, AOI=0°

BK7 LENS KITS

Small Lens Kit

Large N-BK7 Spherical Lens Kit (40 pcs.)

Coating	Catalogue number	
BBAR @ 400 – 700 nm, R<0.9%	140-0240-AR400-700	
BBAR @ 650 – 1100, R<1.0%	140-0240-AR650-1100	
BBAR @ 1050 – 1700 nm, R<1.0%	140-0240-AR1050-1700	
AR @ 532 + 1064 nm, R<0.5%	140-0240-AR532+1064	
AR @ 1064 nm, R<0.25%	140-0240-AR1064	
AR @ 532 nm, R<0.25%	140-0240-AR532	

Large BK7 Lens Kit

Type	Dia, mm	F, mm	Catalogue number
pl/cx	25.4	30	110-0205E
pl/cx	25.4	40	110-0207E
pl/cx	25.4	50	110-0209E
pl/cx	25.4	60	110-0211E
pl/cx	25.4	75	110-0215E
pl/cx	25.4	100	110-0219E
pl/cx	25.4	125	110-0223E
pl/cx	25.4	150	110-0227E
pl/cx	25.4	200	110-0231E
pl/cx	25.4	250	110-0235E
pl/cx	25.4	300	110-0239E
pl/cx	25.4	350	110-0241E
pl/cx	25.4	400	110-0243E
pl/cx	25.4	500	110-0247E
pl/cx	25.4	700	110-0251E
pl/cx	25.4	1000	110-0259E
bi/cx	25.4	25	111-0204E
bi/cx	25.4	30	111-0206E
bi/cx	25.4	40	111-0208E
bi/cx	25.4	50	111-0210E

Type	Dia, mm	F, mm	Catalogue number
bi/cx	25.4	60	111-0214E
bi/cx	25.4	75	111-0216E
bi/cx	25.4	100	111-0218E
bi/cx	25.4	150	111-0222E
bi/cx	25.4	200	111-0226E
bi/cx	25.4	250	111-0228E
bi/cx	25.4	500	111-0234E
bi/cx	25.4	1000	111-0250E
pl/cv	25.4	-40	112-0207E
pl/cv	25.4	-50	112-0209E
pl/cv	25.4	-75	112-0215E
pl/cv	25.4	-100	112-0219E
pl/cv	25.4	-150	112-0227E
pl/cv	25.4	-200	112-0231E
bi/cv	25.4	-25	114-0204E
bi/cv	25.4	-50	114-0208E
bi/cv	25.4	-75	114-0212E
bi/cv	25.4	-100	114-0214E
bi/cv	25.4	-150	114-0220E
bi/cv	25.4	-200	114-0224E

Small N-BK7 Spherical Lens Kit (15 pcs.)

Coating	Catalogue number	
BBAR @ 400 – 700 nm, R<0.9%	140-0215-AR400-700	
BBAR @ 650 – 1100 nm, R<1.0%	140-0215-AR650-1100	
BBAR @ 1050 – 1700 nm, R<1.0%	140-0240-AR1050-1700	
AR @ 532 + 1064 nm, R<0.5%	140-0215-AR532+1064	
AR @ 1064 nm, R<0.25%	140-0215-AR1064	
AR @ 532 nm, R<0.25%	140-0215-AR532	

Small BK7 Lens Kit

Type	Dia, mm	F, mm	Catalogue number
pl/cx	25.4	30	110-0205E
pl/cx	25.4	40	110-0207E
pl/cx	25.4	50	110-0209E
pl/cx	25.4	60	110-0211E
pl/cx	25.4	75	110-0215E
pl/cx	25.4	100	110-0219E
pl/cx	25.4	150	110-0227E
pl/cx	25.4	200	110-0231E

Type	Dia, mm	F, mm	Catalogue number
pl/cx	25.4	500	110-0247E
pl/cx	25.4	1000	110-0259E
pl/cv	25.4	-40	112-0207E
pl/cv	25.4	-50	112-0209E
pl/cv	25.4	-75	112-0215E
pl/cv	25.4	-100	112-0219E
pl/cv	25.4	-150	112-0227E

N-BK7 Cylindrical Lens Kit (12 pcs.)

Coating	Catalogue number	
BBAR @ 400-700 nm, R<0.9%	140-0212-AR400-700	
BBAR @ 650-1100 nm, R<0.7%	140-0212-AR650-1100	
BBAR @ 1050-1700 nm, R<0.7%	140-0212-AR1050-1700	
AR @ 532+1064 nm, R<0.5%	140-0212-ARD1064	
AR @ 1064 nm, R<0.25%	140-0212-AR1064	

N-BK7 Cylindrical Lens Kit

Type	Size, mm	F, mm	Catalogue number
pl/cx	25.4 × 50.8	50	120-0205E
pl/cx	25.4 × 50.8	75	120-0210E
pl/cx	25.4 × 50.8	100	120-0215E
pl/cx	25.4 × 50.8	150	120-0220E
pl/cx	25.4 × 50.8	200	120-0225E
pl/cx	25.4 × 50.8	300	120-0230E

Type	Size, mm	F, mm	Catalogue number
pl/cx	25.4 × 50.8	500	120-0235E
pl/cx	25.4 × 50.8	1000	120-0240E
pl/cv	25.4 × 50.8	-50	122-0205E
pl/cv	25.4 × 50.8	-75	122-0210E
pl/cv	25.4 × 50.8	-100	122-0215E
pl/cv	25.4 × 50.8	-150	122-0220E

UV FS LENS KITS

Large Lens Kit

Large UV FS Spherical Lens Kit (40 pcs.)

Coating	Catalogue number	
BBAR @ 210 – 400 nm, R<2%	140-1240-AR210-400	
BBAR @ 350 – 900 nm, R<1.5%	140-1240-AR350-900	
BBAR @ 650 – 1100 nm, R<1.0%	140-1240-AR650-1100	
AR @ 532 + 1064 nm, R<0.5%	140-1240-AR532+1064	
AR @ 1064 nm, R<0.25%	140-1240-AR1064	
AR @ 532 nm, R<0.25%	140-1240-AR532	
AR @ 355 nm, R<0.25%	140-1240-AR355	
AR @ 266 nm, R<0.4%	140-1240-AR266	

Large UV FS Lens Kit

Type	Dia, mm	F, mm	Catalogue number
pl/cx	25.4	30	110-1203E
pl/cx	25.4	50	110-1205E
pl/cx	25.4	75	110-1209E
pl/cx	25.4	80	110-1210E
pl/cx	25.4	100	110-1211E
pl/cx	25.4	125	110-1216E
pl/cx	25.4	150	110-1217E
pl/cx	25.4	200	110-1219E
pl/cx	25.4	250	110-1221E
pl/cx	25.4	300	110-1223E
pl/cx	25.4	350	110-1225E
pl/cx	25.4	400	110-1227E
pl/cx	25.4	500	110-1233E
pl/cx	25.4	600	110-1235E
pl/cx	25.4	750	110-1239E
pl/cx	25.4	1000	110-1245E
bi/cx	25.4	25	111-1204E
bi/cx	25.4	40	111-1207E
bi/cx	25.4	50	111-1210E
bi/cx	25.4	75	111-1214E

Type	Dia, mm	F, mm	Catalogue number
bi/cx	25.4	100	111-1218E
bi/cx	25.4	150	111-1222E
bi/cx	25.4	200	111-1226E
bi/cx	25.4	250	111-1230E
bi/cx	25.4	300	111-1234E
bi/cx	25.4	400	111-1238E
bi/cx	25.4	500	111-1240E
bi/cx	25.4	1000	111-1260E
pl/cv	25.4	-50	112-1205E
pl/cv	25.4	-75	112-1209E
pl/cv	25.4	-100	112-1211E
pl/cv	25.4	-150	112-1217E
pl/cv	25.4	-200	112-1219E
pl/cv	25.4	-300	112-1223E
bi/cv	25.4	-25	114-1204E
bi/cv	25.4	-50	114-1208E
bi/cv	25.4	-75	114-1212E
bi/cv	25.4	-100	114-1216E
bi/cv	25.4	-150	114-1220E
bi/cv	25.4	-200	114-1224E

Small UV FS Spherical Lens Kit (15 pcs.)

Coating	Catalogue number	
BBAR @ 210 – 400 nm, R<2%	140-1215-AR210-400	
BBAR @ 350 – 900 nm, R<1.5%	140-1215-AR350-900	
BBAR @ 650 – 1100 nm, R<1.0%	140-1215-AR650-1100	
AR @ 532 + 1064 nm, R<0.5%	140-1215-AR532+1064	
AR @ 1064 nm, R<0.25%	140-1215-AR1064	
AR @ 532 nm, R<0.25%	140-1215-AR532	
AR @ 355 nm, R<0.25%	140-1215-AR355	
AR @ 266 nm, R<0.4%	140-1215-AR266	

Small UV FS Lens Kit

Type	Dia, mm	F, mm	Catalogue number
pl/cx	25.4	30	110-1203E
pl/cx	25.4	50	110-1205E
pl/cx	25.4	75	110-1209E
pl/cx	25.4	100	110-1211E
pl/cx	25.4	125	110-1216E
pl/cx	25.4	150	110-1217E
pl/cx	25.4	200	110-1219E
pl/cx	25.4	300	110-1223E

Type	Dia, mm	F, mm	Catalogue number
pl/cx	25.4	500	110-1233E
pl/cx	25.4	1000	110-1245E
pl/cv	25.4	-50	112-1205E
pl/cv	25.4	-75	112-1209E
pl/cv	25.4	-100	112-1211E
pl/cv	25.4	-125	112-1215E
pl/cv	25.4	-150	112-1217E

UV FS Cylindrical Lens Kit (12 pcs.)

Coating	Catalogue number	
BBAR @ 210-400 nm, R<2%	140-0212-ARB300	
BBAR @ 350-900 nm, R<1.5%	140-0212-ARB625	
BBAR @ 650-1100 nm, R<0.7%	140-0212-ARB825	

UV FS Cylindrical Lens Kit

Type	Size, mm	F, mm	Catalogue number
pl/cx	25.4 × 50.8	50	120-1205E
pl/cx	25.4 × 50.8	75	120-1210E
pl/cx	25.4 × 50.8	100	120-1215E
pl/cx	25.4 × 50.8	150	120-1220E
pl/cx	25.4 × 50.8	200	120-1225E
pl/cx	25.4 × 50.8	300	120-1230E

Type	Size, mm	F, mm	Catalogue number
pl/cx	25.4 × 50.8	500	120-1235E
pl/cx	25.4 × 50.8	1000	120-1240E
pl/cv	25.4 × 50.8	-50	122-1205E
pl/cv	25.4 × 50.8	-75	122-1210E
pl/cv	25.4 × 50.8	-100	122-1215E
pl/cv	25.4 × 50.8	-150	122-1220E

Related Products

Uncoated Lens Kits
See page 1.47

Beam Expanders
See page 5.4

Self-Centring Lens Mounts 830-0010
Find more at EksmaOptics.com

Tweezers/Forceps for Optical Components 260-1050
See page A.4

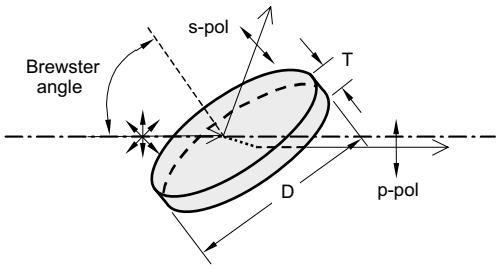
THIN FILM LASER POLARIZERS (56° ANGLE OF INCIDENCE)

Thin film polarizers separate s- and p- polarization components. Due to their high laser damage threshold, thin film polarizers can be used as an alternative to Glan-Taylor laser polarizing prisms or cube polarizing beamsplitters.

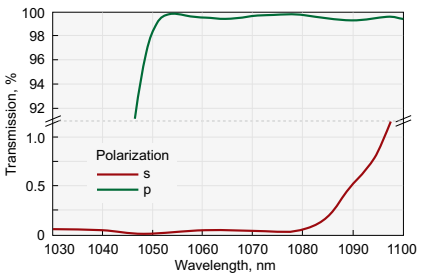
Nd:YAG Laser Line thin film polarizers are used in high energy lasers. They can be used as extracavity attenuators for Nd:YAG laser fundamental and its harmonics or intracavity Q-switch hold-off polarizers.The most efficient way to use these polarizers is at Brewster's angle – 56 ± 2°.

Specifications

Material	BK7, UV FS
Surface quality	20 –10 scratch & dig (MIL-PRF-13830B)
Transmitted wavefront distortion	λ/10 @ 633 nm
Parallelism	<30 arcsec
Clear aperture	>90%
Angle of incidence (AOI)	56 ± 2°
Diameter tolerance	+0.0; -0.12 mm
Thickness tolerance	±0.2 mm
Laser damage threshold	6 J/cm² 10 nsec pulse at 1064 nm typical



HIGH EXTINCTION RATIO POLARIZERS



420-1258HE.
Tp > 98%, Ts < 0.1%

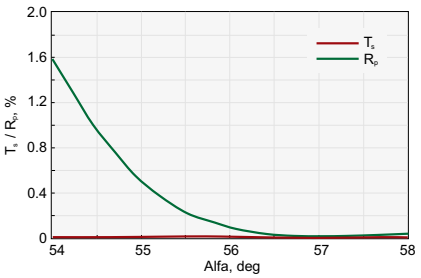
Round Polarizers
Material – UV FS; Tp > 98%, Ts < 0.1%; extinction ratio for transmitted light Tp/Ts: >1000:1

Wavelength, nm	Diameter D, mm	Thickness T, mm	Catalogue number	
355	25.4	3	**420-1252HE**	
532	25.4	3	**420-1254HE**	
1064	25.4	3	**420-1258HE**	

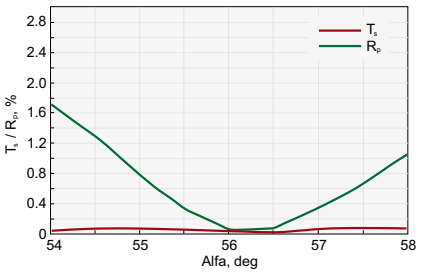
Rectangular Polarizers
Material – UV FS; Tp > 98%, Ts < 0.1%; extinction ratio for transmitted light Tp/Ts: >1000:1

Wavelength, nm	Rectangular dimensions		Thickness T, mm	Catalogue number	
	Length, mm	Width, mm			
532	20	15	6	**420-1484HE**	
532	30	20	6	**420-1584HE**	
1064	20	15	6	**420-1488HE**	
1064	30	20	6	**420-1588HE**	

ULTRA HIGH TRANSMISSION THIN FILM POLARIZERS



420-1254UHT.
Ultra High Transmission @ 532 nm,
Ts<0.2%, Rp<0.2%, AOI=56°

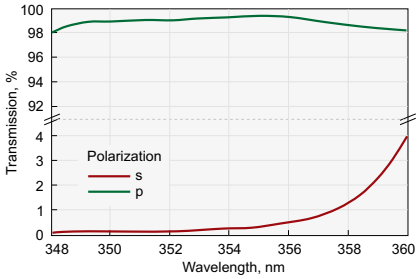


420-1258UHT.
Ultra High Transmission @ 1064 nm,
Ts<0.2%, Rp<0.2%, AOI=56°

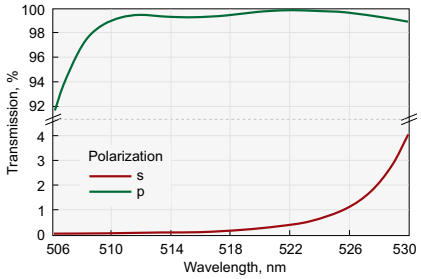
Round Polarizers. Material – UV FS; Ts < 0.2 %, Rp < 0.2 %; extinction ratio for trasmitted light Tp/Ts >500:1

Wavelength, nm	Diameter D, mm	Thickness T, mm	Catalogue number	
532	25.4	3	**420-1254UHT**	
1064	25.4	3	**420-1258UHT**	

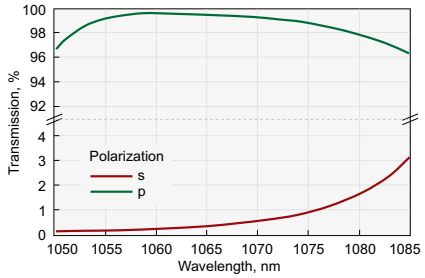
HIGH TRANSMISSION THIN FILM POLARIZERS



420-1252HT.
High Transmission @ 355 nm, Rs/Tp > 99.5/99.0 %



420-1254HT.
High Transmission @ 532 nm, Rs/Tp > 99.5/99.0 %



420-1258HT.
High Transmission @ 1064 nm, Rs/Tp > 99.5/99.0 %

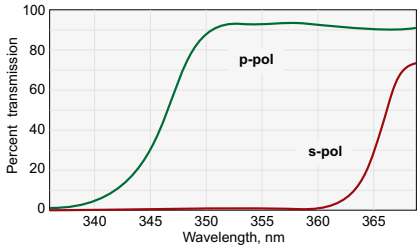
Round Polarizers. Material - UV FS. Rs / Tp > 99.5 / 99.0 %; extinction ratio for transmitted light Tp / Ts >200:1

Wavelength, nm	Diameter D, mm	Thickness T, mm	Catalogue number	
355	25.4	3.0	**420-1252HT**	
532	25.4	3.0	**420-1254HT**	
1064	25.4	3.0	**420-1258HT**	

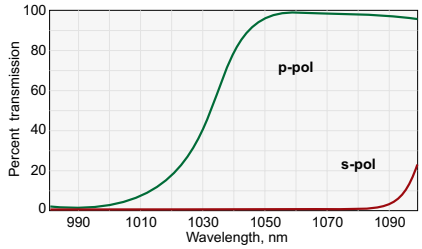
Rectangular Polarizers. Material - UV FS. Rs / Tp > 99.5 / 99.0 %; extinction ratio for transmitted light Tp / Ts >200:1

Wavelength, nm	Rectangular dimensions		Thickness T, mm	Catalogue number	
	Length, mm	Width, mm			
1064	28.6	14.3	3.0	**420-1288HT**	

STANDARD THIN FILM POLARIZERS



420-1252.
Transmission @ 355 nm , Rs/Tp > 99.5/95 %



420-1258.
Transmission @ 1064 nm, Rs/Tp > 99.5/95 %

Round Polarizers. Material – BK7; Rs / Tp > 99.5 / 95.0 %; extinction ratio for transmitted light Tp/Ts >200:1

Wavelength, nm	Diameter D, mm	Thickness T, mm	Catalogue number	
532	12.7	3.0	**420-0124E**	
1064	12.7	3.0	**420-0128E**	
532	25.4	3.0	**420-0254E**	
1064	25.4	3.0	**420-0258E**	
532	50.8	6.0	**420-0504E**	
1064	50.8	6.0	**420-0508E**	

Rectangular Polarizers. Material – BK7; Rs / Tp > 99.5 / 95.0 %; extinction ratio for transmitted light Tp/Ts >200:1

Wavelength, nm	Rectangular dimensions		Thickness T, mm	Catalogue number	
	Length, mm	Width, mm			
532	28.6	14.3	3.0	**420-0284**	
1064	28.6	14.3	3.0	**420-0288**	

Round Polarizers. Material – UV FS; Rs / Tp > 99.5 / 95.0 %; extinction ratio for transmitted light Tp/Ts >200:1

Wavelength, nm	Diameter D, mm	Thickness T, mm	Catalogue number	
355	12.7	3.0	**420-1122E**	
532	12.7	3.0	**420-1124E**	
1064	12.7	3.0	**420-1128E**	
355	25.4	3.0	**420-1252E**	
532	25.4	3.0	**420-1254E**	
1064	25.4	3.0	**420-1258E**	
355	50.8	6.0	**420-1502E**	
532	50.8	6.0	**420-1504E**	
1064	50.8	6.0	**420-1508E**	

Rectangular Polarizers. Material – UV FS; Rs / Tp > 99.5 / 95.0 %; extinction ratio for transmitted light Tp/Ts >200:1

Wavelength, nm	Rectangular dimensions		Thickness T, mm	Catalogue number	
	Length, mm	Width, mm			
355	28.6	14.3	3.0	**420-1282**	
532	28.6	14.3	3.0	**420-1284**	
1064	28.6	14.3	3.0	**420-1288**	

Related Products

Thin Film Laser Polarizers of other wavelengths
See page 1.55

Glan and Wollaston Prisms
See page 1.62

Adapters for Polarizer at 56° 840-0117, 840-0118
Find more at EksmaOptics.com

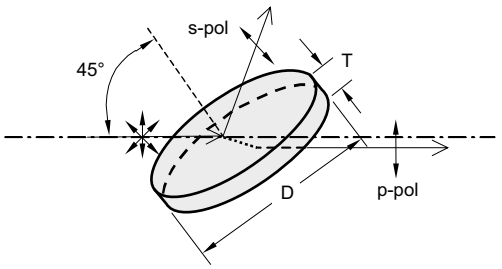
Variable Attenuator for Nd:YAG linearly Polarized Laser Beam 990-0070
Find more at EksmaOptics.com

THIN FILM LASER POLARIZERS (45° ANGLE OF INCIDENCE)

These thin film polarizers separate or combine the s- and p-polarization components at 45° angle of incidence. They are designed for use in high energy lasers. Polarizers are made from UV FS and feature high laser damage threshold reaching 10 J/cm^2 at 1064 nm.

Specifications

Substrate material	UV FS
Surface quality	20–10 scratch & dig (MIL-PRF-13830B)
Transmitted wavefront distortion	λ/10 @ 633 nm
Clear aperture	> 90% of diameter
Angle of Incidence (AOI)	45 ± 2°
Parallelism	< 30 arcsec



THIN FILM POLARIZERS WITH HIGH EXTINCTION RATIO

Round Polarizers

Material – UV FS. Tp > 98%, Ts < 0.1%; extinction ratio for transmitted light Tp/Ts: >1000:1

Wavelength, nm	Diameter D, mm	Thickness T, mm	Catalogue number	
355	25.4	3	**420-1252i45HE**	
532	25.4	3	**420-1254i45HE**	
1064	25.4	3	**420-1258i45HE**	
355	50.8	6	**420-1502i45HE**	
532	50.8	6	**420-1504i45HE**	
1064	50.8	6	**420-1508i45HE**	

STANDARD THIN FILM POLARIZERS

Round Polarizers

Material – UV FS. R_s / T_p > 99.5 / 95.0%. Extinction ratio for transmitted light T_p/T_s >200:1

Wavelength, nm	Diameter D, mm	Thickness T, mm	Catalogue number	
355	25.4	3	**420-1252i45**	
532	25.4	3	**420-1254i45**	
1064	25.4	3	**420-1258i45**	
355	50.8	6	**420-1502i45**	
532	50.8	6	**420-1504i45**	
1064	50.8	6	**420-1508i45**	

QUARTZ RETARDATION PLATES

Quartz Retardation Plates are made of material enabling linear birefringence. These plates are made of high quality optical grade crystalline quartz, featuring high damage threshold. Retardation plates rotate polarization's direction (λ/2) or convert linear into circular polarization or vice versa (λ/4). Quartz retardation plates are supplied mounted and AR coated.

ZERO ORDER OPTICALLY CONTACTED WAVEPLATES

Features

- Zero Order Waveplates for Nd:YAG fundamental and its harmonics
- Easily aligned
- Temperature insensitive
- Moderately insensitive to wavelength

Zero order plates are comprised of two different plates cut parallel to their optical axis. This construction make plates less dependent on temperature. The plates are polished to different thicknesses enabling to achieve required retardation difference. These component plates have orthogonal optic axis directions, so that the roles of the ordinary and extraordinary rays are interchanged in passing from one plate to another. The thickness of the plate determines the phase shift between the ordinary and extraordinary beams for any specific wavelength.

Specifications

Material	Single crystal quartz
Optical axis	normal to facet on circumference of retarder
Clear aperture	Ø17 mm (other dimensions on request)
Ring mount outer diameter	25.4 +0.0 / -0.12 mm
Nominal thickness of waveplate	1.5 – 2.5 mm
Surface quality	20 –10 scratch & dig (MIL-PRF-13830B)
Wavefront distortion	λ/10 @ 633 nm
Parallelism	< 10 arcsec
AR coating	R < 0.4%
Damage threshold	> 0.5 J/cm², 10 nsec pulse, 1064 nm typical

Ø12.7 mm waveplates. Clear aperture Ø11 mm, unmounted

Wavelength, nm	Retardation λ/2		Retardation λ/4	
	Catalogue number		Catalogue number	
1064	460-4205D12		460-4405D12	
532	460-4230D12		460-4430D12	
355	460-4240D12		460-4440D12	
266	460-4245D12		460-4445D12	

Ø20 mm waveplates. Clear aperture Ø17 mm, mounted into Ø25.4 mm ring holder

Wavelength, nm	Retardation λ/2		Retardation λ/4	
	Catalogue number		Catalogue number	
1064	460-4205		460-4405	
532	460-4230		460-4430	
355	460-4240		460-4440	
266	460-4245		460-4445	

Related Products

Zero Order Optically Contacted Plates of other wavelengths. See page 1.65

Achromatic Air-Spaced Waveplates. See page 1.67

ZERO ORDER AIR-SPACED WAVEPLATES

Features

- For high power laser application

Specifications

Material	Single crystal quartz
Optical axis	normal to facet on circumference of retarder
Clear aperture	Ø17 mm
Ring mount outer diameter	25.4 +0.0 / -0.12 mm
Surface quality	20 –10 scratch & dig (MIL-PRF-13830B)
Wavefront distortion	λ/10 @ 633 nm
Parallelism	< 10 arcsec
AR coating	R < 0.5%
Damage threshold	> 10 J/cm², 10 nsec pulse, 1064 nm typical

Wavelength, nm	AR coating range, nm	Retardation λ/2		Retardation λ/4	
		Catalogue number		Catalogue number	
1064	1035–1095	464-4205		464-4405	
532	515–545	464-4230		464-4430	
355	345–365	464-4240		464-4440	
266	257–275	464-4245		464-4445	
213	210–216	464-4253		464-4453	

Related Products

Polarizer Holder 840-0180

Find more at EksmaOptics.com

LOW ORDER WAVEPLATES

Features

- Thickness 0.15–0.35 mm
- Thinner than multiple order

Low order plates are less temperature sensitive and temperature dependent than multiple order plates. These plates are suitable for high and low power applications.

Ø12.7 mm waveplates. Clear aperture Ø11 mm, unmounted

Wavelength, nm	Retardation λ/2		Retardation λ/4	
	Catalogue number		Catalogue number	
1064	461-4205D12		461-4405D12	
532	461-4230D12		461-4430D12	
355	461-4240D12		461-4440D12	

Ø20 mm waveplates. Clear aperture Ø17 mm, mounted into Ø25.4 mm ring holder

Wavelength, nm	Retardation λ/2		Retardation λ/4	
	Catalogue number		Catalogue number	
1064	461-4205		461-4405	
532	461-4230		461-4430	
355	461-4240		461-4440	

Specifications

Material	Single crystal quartz
Optical axis	normal to facet on circumference of retarder
Clear aperture	Ø17 mm (other dimensions on request)
Ring mount outer diameter	25.4 +0.0 / -0.12 mm
Nominal thickness of waveplate	0.15 – 0.35 mm
Surface quality	20–10 scratch & dig (MIL-PRF-13830B)
Wavefront distortion	λ/10 @ 633 nm
Parallelism	< 10 arcsec
AR coating	R < 0.4%
Damage threshold	10 J/cm², 10 nsec pulse, 1064 nm typical

Related Products

Low Order Plates of other wavelengths

See page 1.68

High Precision Rotation Polarizer, Waveplate Mount 840-0186

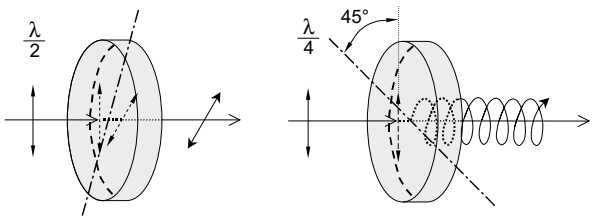
Find more at EksmaOptics.com

MULTIPLE ORDER WAVEPLATES

Features

- Polished to 1 – 1.5 mm thickness
- Made from a single crystalline plate

Multiple order plates are more dependent on the temperature changes than zero order plates. A change of ±1% from the designed wavelength of multiple order plate can result in difficulties in retardation. Contrary, with zero order plates ±1% and even ±2% change from the designed wavelength can cause only small retardation change.



Ø12.7 mm waveplates. Clear aperture Ø11 mm, unmounted

Wavelength, nm	Retardation λ/2		Retardation λ/4	
	Catalogue number		Catalogue number	
1064	462-4205D12		462-4405D12	
532	462-4230D12		462-4430D12	
355	462-4240D12		462-4440D12	

Ø20 mm waveplates. Clear aperture Ø17 mm, mounted into Ø25.4 mm ring holder

Wavelength, nm	Retardation λ/2		Retardation λ/4	
	Catalogue number		Catalogue number	
1064	462-4205		462-4405	
532	462-4230		462-4430	
355	462-4240		462-4440	
266	462-4245		462-4445	

Specifications

Material	Single crystal quartz
Optical axis	normal to facet on circumference of retarder
Clear aperture	Ø17 mm (other dimensions on request)
Ring mount outer diameter	25.4 +0.0 / -0.2 mm
Nominal thickness of waveplate	0.8 – 1.5 mm
Surface quality	20–10 scratch & dig (MIL-PRF-13830B)
Wavefront distortion	λ/10 @ 633 nm
Parallelism	< 10 arcsec
AR coating	R < 0.4%
Damage threshold	10 J/cm², 10 nsec pulse, 1064 nm typical

Related Products

Multiple Order Plates of other wavelengths

See page 1.69

Adjustable Polarizer Holder of Side Drive 840-0195

Find more at EksmaOptics.com

MULTIPLE ORDER DUAL WAVELENGTH WAVEPLATES

Features

- Operate at both first and second Nd:YAG laser harmonics
- Retardation tolerance < λ/300

Retardation and Wavelength	Catalogue number	
λ @ 1064 nm + λ/2 @ 532 nm	463-4120	
λ @ 1064 nm + λ/4 @ 532 nm	463-4140	
λ/2 @ 1064 nm + λ @ 532 nm	463-4210	
λ/2 @1064 nm + λ/2 @ 532 nm	463-4220	
λ/2 @1064 nm + λ/4 @ 532 nm	463-4240	
λ/4 @ 1064 nm + λ @ 532 nm	463-4410	
λ/4 @ 1064 nm + λ/2 @ 532 nm	463-4420	
λ/4 @ 1064 nm + λ/4 @ 532 nm	463-4440	

Specifications

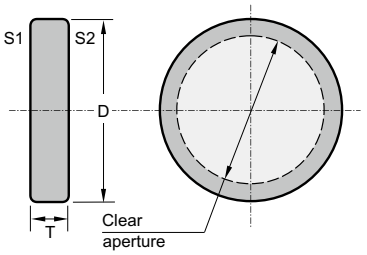
Material	Single crystal quartz
Optical axis	normal to facet on circumference of retarder
Clear aperture	Ø17 mm
Ring mount outer diameter	25.4 +0.0 / -0.2 mm
Nominal thickness of waveplate	0.2 – 1.2 mm
Surface quality	20 –10 scratch & dig (MIL-PRF-13830B)
Wavefront distortion	λ/10 @ 633 nm
Parallelism	< 10 arcsec
AR coating	R < 0.5%
Damage threshold	5 J/cm², 10 nsec pulse, 1064 nm typical

POLARIZATION PLANE ROTATORS

Features

- Made of crystalline quartz
- Intended to rotate a beam polarization plane strictly to an appropriate angle using the circular birefringent effect

Compared to a waveplate, a rotator has an intrinsic advantage, being independent of rotation around its own optical axis. It needs no adjustment, only to be installed normal to incident radiation. A polarization plane rotator is normally used for the specific wavelength. It is only slightly dependent on ambient temperature.



Polarization plane rotators for any wavelength from 200 to 2300 nm are available.

Specifications

Material	Single crystal quartz
Optical axis	Normal to faces S1, S2 of rotator
Clear aperture	17 mm for 20 mm diameter
Ring mount outer diameter	D = 25.4 +0.0 / -0.2 mm
Mount Thickness	T = 6 – 20 mm (depending on wavelength and rotation angle)
Surface quality	20-10 scratch & dig (MIL-PRF-13830B)
Wavefront distortion	λ/10
Parallelism	< 10 arcsec
AR coating	R < 0.2% both sides
Damage threshold	5 J/cm², 10 nsec pulse, 1064 nm typical

Wavelength, nm	Rotation angle of polarization plane, deg	Catalogue number	
266	45	470-4264	
266	90	470-4269	
355	45	470-4354	
355	90	470-4359	
532	45	470-4534	
532	90	470-4539	
1064	45	470-4644	
1064	90	470-4649	

Please contact us for other size or wavelengths requirements.

Related Products

Polarization plane rotators of other wavelengths
See page 1.71

Kinematic Mirror and Beamsplitter Mount 840-0020
Find more at EksmaOptics.com

Kinematic Positioning Mount 840-0193
Find more at EksmaOptics.com

VARIABLE ATTENUATOR FOR Nd:YAG LINEARLY POLARIZED LASER BEAM 990-0070

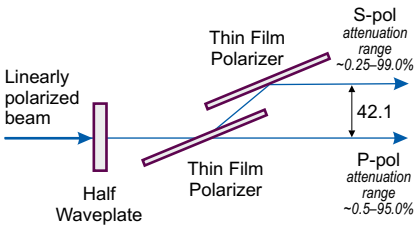
Features

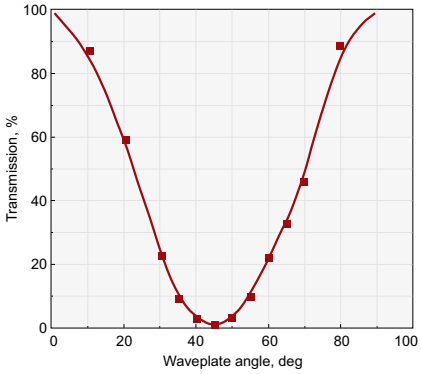
- Divides laser beam into two parallel beams of manually adjustable intensity ratio
- Large dynamic range
- Transmitted beam shift ~0.5 mm
- High Optical damage threshold

Note: Movable base ***820-0090***, Rod Holder ***820-0050-02*** and standard rod should be ordered seperately.

This variable attenuator/beamsplitter consists of special design opto-mechanical Adapter and precision opto-mechanical holder 840-0197. Two thin film brewster type polarizers, which reflect s-polarized light while transmitting p-polarized light, are housed into adapter. A quartz multiple order half waveplate is housed in rotating holder 840-0197.

The intensity ratio of those two beams may be continuously varied without alteration of other beam parameters by rotating the waveplate. The intensity of either exit beam, or their intensity ratio, can be controlled over a wide dynamic range. P-polarization could be selected for maximum transmission, or high-purity s-polarization could be reflected when maximum attenuation of the transmitted beam takes place. The holder 840-0197 allows to adjust angle of incidence of the Thin Film Brewster type polarizers by ±2° and to get the maximum polarization contrast.





Specifications

Aperture diameter	17 mm
Damage threshold	5 J/cm² pulsed at 1064 nm, typical
Polarization Contrast (after 1st polarizer)	>1:200
Polarization Contrast (after 2nd polarizer)	>1:500
Weight	0.35 kg

Wavelength, nm	Catalogue number	
266	**990-0070-266H ***	
355	**990-0070-355**	
532	**990-0070-532**	
1064	**990-0070-1064**	

* With Zero Order Air-Spaced half waveplate.

Related Products

Neutral Density Filters
See page 1.14

Thin Film Laser Polarizers for Nd:YAG applications
See page 3.17

Motorized Variable Attenuator for Linearly Polarized Laser Beam 990-0070M
See page 5.10

Beam dumps 990-0800, 990-0820
See page 5.19

VARIABLE ATTENUATOR FOR Nd:YAG LINEARLY POLARIZED LASER BEAM 990-0071

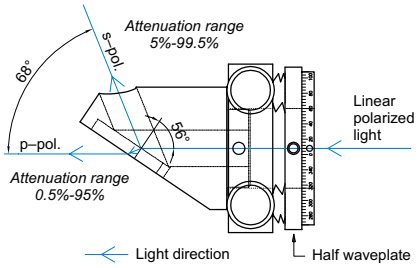
Features

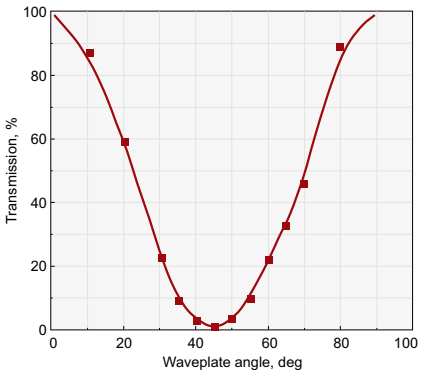
- Divides laser beam into separated by 68° angle two beams of manually adjustable intensity ratio
- Large dynamic range
- Transmitted beam shift ~0.5 mm
- High Optical damage threshold

Note: Solid Base Height Extender ***820-0210*** and Standard Rod ***820-0020-20*** should be ordered separately

This variable attenuator/beamsplitter consists of special design opto-mechanical adapter for polarizer at 56° 840-0117A or 840-0118A and precision opto-mechanical holder 840-0197. Thin Film Brewster type polarizer, which reflect s-polarized light at 56° while transmitting p-polarized light, is housed into adapter for polarizer at 56°. Quartz multiple order half waveplate is housed in rotating holder 840-0197.

The intensity ratio of those two beams may be continuously varied without alteration of other beam parameters by rotating the waveplate. The intensity of either exit beam, or their intensity ratio, can be controlled over a wide dynamic range. P-polarization could be selected for maximum transmission, or high-purity s-polarization could be reflected when maximum attenuation of the transmitted beam takes place. The holder 840-0197 allows to adjust Angle Of Incidence of the Thin Film Brewster type polarizer by ±2° and to get the maximum polarization contrast.





Specifications

Aperture diameter	10 mm
Damage threshold	5 J/cm² pulsed at 1064 nm, typical
Polarization Contrast	>1:200
Weight	0.25 kg

Wavelength, nm	Catalogue number	
266	**990-0071-266H ***	
355	**990-0071-355**	
532	**990-0071-532**	
1064	**990-0071-1064**	

* With Zero Order Air-Spaced half waveplate.

Related Products

Motorized Variable Attenuator for Linearly Polarized Laser Beam 990-0071M

See page 5.13

Multiple Order Plates for Nd:YAG applications

See page 3.21

Thin Film Laser Polarizers for Nd:YAG applications

See page 3.17

VARIABLE ATTENUATOR FOR Nd:YAG LASER PULSES 990-0072

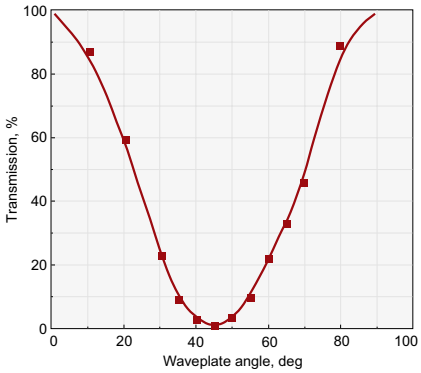
Features

- Divides laser beam into two beams of manually adjustable intensity ratio separated by 68° angle
- Large dynamic range
- Trasmitted beam shift ~1 mm
- High optical damage threshold
- Motorized version 990-0072M available online

This variable attenuator/beamsplitter consists of Polarizer Holder 840-0190-01 and Kinematic Mirror/Beamsplitter Mount 840-0056-12. UVFS Thin Film Brewster type polarizer diameter 50.8 mm, which reflect s-polarized light while transmitting p-polarized light, is housed into Beamsplitter Mount 840-0056-12. A quartz Multi Order Half Waveplate diameter 25.4 mm housed in rotating holder 840-0190-01 and placed in the incident linearly polarized laser beam.

The intensity ratio of those two separted and different polarized beams may be continuously varied without alteration of other beam parameters by rotating the waveplate. The intensity of either exit beam, or their intensity ratio, can be controlled over a wide dynamic range. P-polarization could be selected for maximum transmission, or high-purity s-polarization could be reflected when maximum attenuation of the transmitted beam takes place.

The holder 840-0056-12 allows to adjust Angle Of Incidence of the Thin Film Brewster type polarizers by ±4.5° and to get the maximum extinction contrast. The mounts are on rods, rod holders and Movable Base 820-0090. The optical axis height from the table top can be adjusted in the range 78-88 mm. Other height can be offered as custom changing the standard rods and rod holders into higher.

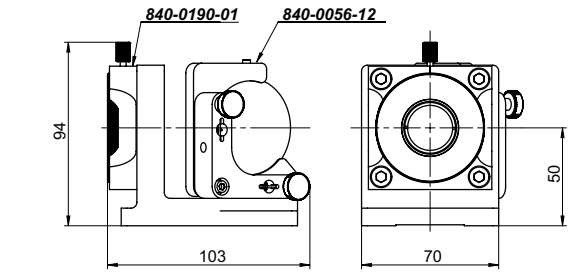


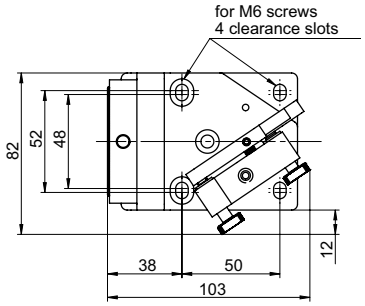
Specifications

Clear Aperture diameter	22 mm
Damage threshold	>5 J/cm², 10 ns pulse, 10 Hz at 1064 nm, typical
Polarization Contrast	>1:200
Transmitted beam shift	~1 mm
Weight	0.45 kg

Wavelength, nm	Catalogue number	
266	990-0072-266H *	
355	990-0072-355	
532	990-0072-532	
1064	990-0072-1064	

* With Zero Order Air-Spaced half waveplate.





VARIABLE ATTENUATOR FOR Nd:YAG LASER PULSES 990-0073

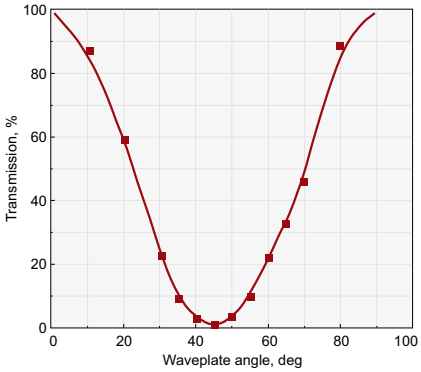
Features

- Divides laser beam into two beams of manually adjustable intensity ratio separated by 68° angle
- Large dynamic range
- Trasmitted beam shift ~1.4 mm
- High optical damage threshold

This variable attenuator/beamsplitter consists of Polarizer Holder 840-0180-A2 and Kinematic Mirror/Beamsplitter Mount 840-0056-13. UVFS Thin Film Brewster type polarizer Ø76.2 mm, which reflect s-polarized light while transmitting p-polarized light, is housed into Beamsplitter Mount 840-0056-13. A quartz Multi Order Half Waveplate Ø40 mm housed in rotating holder 840-0180-A2 and placed in the incident linearly polarized laser beam.

The intensity ratio of those two separated and different polarized beams may be continuously varied without alteration of other beam parameters by rotating the waveplate. The intensity of either exit beam, or their intensity ratio, can be controlled over a wide dynamic range. P-polarization could be selected for maximum transmission, or high-purity s-polarization could be reflected when maximum attenuation of the transmitted beam takes place.

The holder 840-0056-13 allows to adjust Angle Of Incidence of the Thin Film Brewster type polarizers by ±4.5° and to get the maximum extinction contrast. The mounts are on rods, rod holders and Movable Base 820-0090. The optical axis height from the table top can be adjusted in the range 92-98 mm. Other height can be offered as custom changing the standard rods and rod holders into higher.

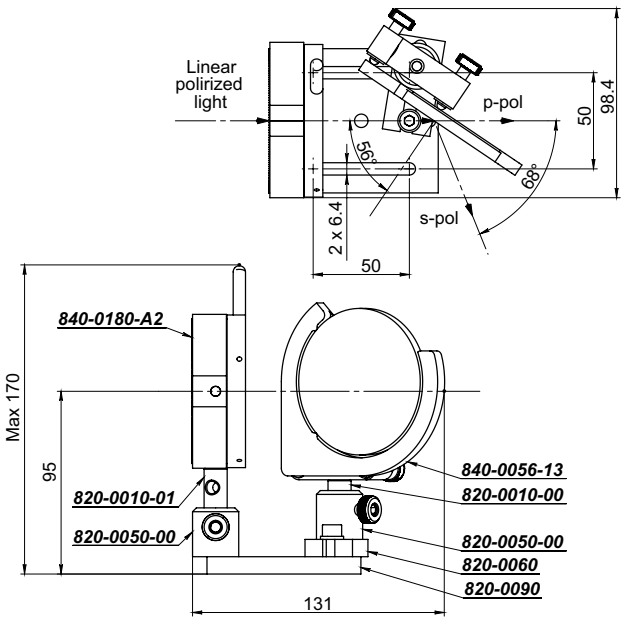


Specifications

Clear Aperture diameter	36 mm
Damage threshold	>5 J/cm^2, 10 ns pulse, 10 Hz at 1064 nm, typical
Polarization Contrast	>1:200
Transmitted beam shift	~1.4 mm
Weight	0.6 kg

Wavelength, nm	Catalogue number	
266	990-0073-266H *	
355	990-0073-355	
532	990-0073-532	
1064	990-0073-1064	

* With Zero Order Air-Spaced half waveplate.



Nd:YAG Laser Crystals

Nd:YAG CRYSTALS (STANDARD RODS)

Specifications of standard Nd:YAG Laser Rods

Nd Doping Level	0.8% or 1.1%
Orientation	<111> crystalline direction
Surface Quality	10 – 5 scratch & dig (MIL-PRF-13830B)
Surface Flatness	λ/10 at 633 nm
Parallelism	< 10 arcsec
Perpendicularity	< 5 arcmin for plano/plano ends
Diameter Tolerance	+0 / -0.05 mm
Length Tolerance	+1 / -0.5 mm
Clear Aperture	> 90 % of full aperture
Chamfers	0.1 mm at 45 deg
Coating	Both sides coated AR @ 1064 nm, R < 0.2%, AOI = 0 deg
Barrel Grooving	All Ø6.35, 8, 10, 12 mm rods with barrel grooving

Diameter, mm	Length, mm	Doping, %	Wedge of the ends, deg	Description	Coating	Application	Catalogue number	
3	53	0.9	0/0	Nd:YAG	AR/AR @ 1064 nm	Generation @ 1064 nm	E-Y-3-0.9-A/A	
3	65	0.8	0/0	Nd:YAG	AR/AR @ 1064 nm	Generation @ 1064 nm	E-Y-3-0.8-A/A	
3	65	1.1	0/0	Nd:YAG	AR/AR @ 1064 nm	Generation @ 1064 nm	E-Y-3-1.1-A/A	
4	65	0.8	3/3 parallel	Nd:YAG	AR/AR @ 1064 nm	Generation @ 1064 nm	E-Y-4-0.8-A/A	
4	65	1.1	3/3 parallel	Nd:YAG	AR/AR @ 1064 nm	Generation @ 1064 nm	E-Y-4-1.1-A/A	
6.35	85*	1.1	3/3 parallel	Nd:YAG	AR/AR @ 1064 nm	Generation @ 1064 nm	E-Y-6.35-1.1-A/A	
8	85*	1.1	3/3 parallel	Nd:YAG	AR/AR @ 1064 nm	Generation @ 1064 nm	E-Y-8-1.1-A/A	
10	85*	1.1	3/3 parallel	Nd:YAG	AR/AR @ 1064 nm	Generation @ 1064 nm	E-Y-10-1.1-A/A	
12	100*	0.8	3/3 parallel	Nd:YAG	AR/AR @ 1064 nm	Generation @ 1064 nm	E-Y-12-0.8-A/A	
12	100*	1.1	3/3 parallel	Nd:YAG	AR/AR @ 1064 nm	Generation @ 1064 nm	E-Y-12-1.1-A/A	

* Rods with barrel grooving, except 10 mm at both ends of the rod without grooving.

Related Products

Laser Safety Eyewear

See page 1.17

Visualizator 990-0840

See page 1.17

Pockels Cells for Q-Switching

Find more at EksmaOptics.com

NONLINEAR CRYSTALS for SHG @ 1064 nm

LBO CRYSTALS

LBO crystals feature the highest damage threshold, small walk-off and have high efficiency. These crystals are the best choice for harmonics generation of relatively high power and high repetition rate Q-switched or mode-locked lasers.

Size, mm	Orientation		Type	Coating	Application	Catalogue number	
	Theta, deg	Phi, deg					
3x3x10	90	11.6	Type 1	AR/AR @ 1064+532 nm	SHG@1064 nm	LBO-401	
3x3x15	90	11.6	Type 1	AR/AR @ 1064+532 nm	SHG@1064 nm	LBO-402	
4x4x10	90	11.6	Type 1	AR/AR @ 1064+532 nm	SHG@1064 nm	LBO-301	
4x4x15	90	11.6	Type 1	AR/AR @ 1064+532 nm	SHG@1064 nm	LBO-302	
4x4x20	90	11.6	Type 1	AR/AR @ 1064+532 nm	SHG@1064 nm	LBO-303	
5x5x10	90	11.6	Type 1	AR/AR @ 1064+532 nm	SHG@1064 nm	LBO-501	
5x5x15	90	11.6	Type 1	AR/AR @ 1064+532 nm	SHG@1064 nm	LBO-503	
5x5x20	90	11.6	Type 1	AR/AR @ 1064+532 nm	SHG@1064 nm	LBO-502	
3x3x15	90	0	Type 1	AR/AR @ 1064+532 nm	NCPM SHG@1064 nm, T=149 °C	LBO-404	
3x3x20	90	0	Type 1	AR/AR @ 1064+532 nm	NCPM SHG@1064 nm, T=149 °C	LBO-405	
3x3x30	90	0	Type 1	AR/AR @ 1064+532 nm	NCPM SHG@1064 nm, T=149 °C	LBO-409	
3x3x50	90	0	Type 1	AR/AR @ 1064+532 nm	NCPM SHG@1064 nm, T=149 °C	LBO-410	
4x4x10	90	0	Type 1	AR/AR @ 1064+532 nm	NCPM SHG@1064 nm, T=149 °C	LBO-304	
4x4x15	90	0	Type 1	AR/AR @ 1064+532 nm	NCPM SHG@1064 nm, T=149 °C	LBO-305	
4x4x20	90	0	Type 1	AR/AR @ 1064+532 nm	NCPM SHG@1064 nm, T=149 °C	LBO-306	

KTP CRYSTALS

KTP crystals feature the highest efficiency and are suited for low average power or CW lasers applications. These crystals are temperature change insensitive and operate with sharply focused or highly divergent laser beams.

Size, mm	Orientation		Type	Coating	Application	Catalogue number	
	Theta, deg	Phi, deg					
3x3x5	90	23.5	Type 2	AR/AR @ 1064+532 nm	SHG@1064 nm	KTP-401	
3x3x10	90	23.5	Type 2	AR/AR @ 1064+532 nm	SHG@1064 nm	KTP-402	
4x4x6	90	23.5	Type 2	AR/AR @ 1064+532 nm	SHG@1064 nm	KTP-403	
7x7x9	90	23.5	Type 2	AR/AR @ 1064+532 nm	SHG@1064 nm	KTP-404	

DKDP CRYSTALS

Large aperture DKDP crystals are used for high energy Q-switched lasers with large beam diameters.

Size, mm	Orientation		Type	Coating	Application	Catalogue number	
	Theta, deg	Phi, deg					
15x15x13	36.5	45	Type 1	AR/AR @ 1064/1064+532 nm	SHG@1064 nm	DKDP-401	
15x15x13	53.5	0	Type 2	AR/AR @ 1064/1064+532 nm	SHG@1064 nm	DKDP-402	
12x12x20	53,5	0	Type 2	AR/AR @ 1064/1064+532 nm	SHG@1064 nm	DKDP-404	
15x15x20	53,5	0	Type 2	AR/AR @ 1064/1064+532 nm	SHG@1064 nm	DKDP-405	

Please contact EKSMA OPTICS for special OEM and large volume pricing.

Related Products

Ovens with thermocontrollers and heaters for different crystal sizes

See pages 2.28–2.29

NONLINEAR CRYSTALS for THG @ 1064 nm

LBO CRYSTALS

Size, mm	Orientation		Type	Coating	Application	Catalogue number	
	Theta, deg	Phi, deg					
3x3x10	42.2	90	Type 2	AR/AR @ 1064+532/355 nm	THG@1064 nm	LBO-406	
3x3x15	42.2	90	Type 2	AR/AR @ 1064+532/355 nm	THG@1064 nm	LBO-407	
5x5x15	42.2	90	Type 2	AR/AR @ 1064+532/355 nm	THG@1064 nm	LBO-508	

DKDP CRYSTALS

Size, mm	Orientation		Type	Coating	Application	Catalogue number	
	Theta, deg	Phi, deg					
12x12x20	59.3	0	Type 2	AR/AR @ 1064+532/355 nm	THG@1064 nm	DKDP-403	
15x15x20	59.3	0	Type 2	AR/AR @ 1064+532/355 nm	THG@1064 nm	DKDP-406	

NONLINEAR CRYSTALS for 4HG @ 1064 nm

BBO CRYSTALS

Size, mm	Orientation		Type	Coating	Application	Catalogue number	
	Theta, deg	Phi, deg					
7x7x6	47.6	90	Type 1	P/P @ 532/266 nm	SHG@532 nm	BBO-700	

KDP CRYSTALS

Size, mm	Orientation		Type	Coating	Application	Catalogue number	
	Theta, deg	Phi, deg					
12x12x5	76.5	45	Type 1	AR/AR @ 532/266 nm	SHG@532 nm	KDP-401	
15x15x7	76.5	45	Type 1	AR/AR @ 532/266 nm	SHG@532 nm	KDP-402	

Housing Accessories

Ring Holders for Nonlinear Crystals

See page 2.27

Positioning Mount 840-0199 for Nonlinear Crystal Housing

See page 2.26

FemtoLine Components

Table of Contents

LASER MIRRORS

Laser mirrors for femtosecond applications are designed to have a broad operating wavelength range and linear phase versus frequency characteristics (group delay dispersion (GDD)). The coating is a single layer dielectric and has no phase shift over the operating wavelength region. High reflectivity mirrors always have higher reflection, broader operating region and lower pulse distortion for s-polarization than for p-polarization for the same dielectric coating. If possible use the mirrors with s-polarized beam.

Our standard mirrors are suitable for fundamental Ti:Sapphire and Yb:KGW or KYW lasers and their doubled, tripled or quadrupled frequencies.

Substrate

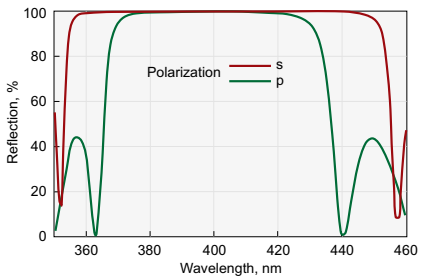
Material	UV grade Fused Silica or BK7 glass
S1 Surface Flatness	λ/10 at 633 nm
S1 Surface Quality	20 –10 scratch & dig (MIL-PRF-13830B)
S2 Surface Quality	Commercial polish
Diameter Tolerance	+0.00 mm -0.12 mm
Thickness Tolerance	±0.25 mm
Wedge	< 3 min
Chamfer	0.3 mm at 45° typical

Coating

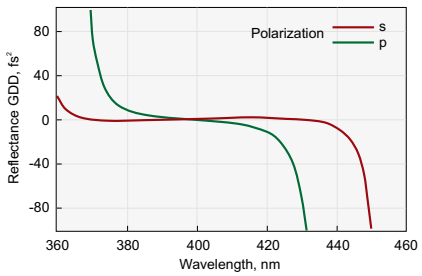
Technology	Electron beam multilayer dielectric or Ion beam sputtering
Adhesion and Durability	Per MIL-C-675A. Insoluble in lab solvents
Clear Aperture	Exceeds central 85% of diameter
Angle of Incidence	0 or 45±3°
Designed for average polarization	R=(Rs+Rp)/2
Laser Damage Threshold	>100 mJ/cm², 50 fsec pulse, 50 Hz, 800 nm typical
Coated Surface Flatness	λ/10 at 633 nm over clear aperture

LOW GDD ULTRAFAST MIRRORS

Substrate material: **BK7 grade A**



HR>99.5% @ 380 – 420 nm, AOI=45°



HRsp @ 380 – 420 GDD, AOI=45°

Wavelength, nm	AOI=0°			AOI=45°		
	R, % (s+p)/2	Catalogue number		R, % (s+p)/2	Catalogue number	
Size – Ø12.7 × 3 mm						
380 – 420	99.7	031-0400-i0		99.5	031-0400	
500 – 530	99.7	031-0515-i0		99.5	031-0515	
760 – 840	99.7	031-0800-i0		99.5	031-0800	
1000 – 1060	99.7	031-1030-i0		99.5	031-1030	
Size – Ø12.7 × 6 mm						
380 – 420	99.7	031-0400T6-i0		99.5	031-0400T6	
500 – 530	99.7	031-0515T6-i0		99.5	031-0515T6	
760 – 840	99.7	031-0800T6-i0		99.5	031-0800T6	
1000 – 1060	99.7	031-1030T6-i0		99.5	031-1030T6	
Size – Ø25.4 × 6 mm						
380 – 420	99.7	032-0400-i0		99.5	032-0400	
500 – 530	99.7	032-0515-i0		99.5	032-0515	
760 – 840	99.7	032-0800-i0		99.5	032-0800	
1000 – 1060	99.7	032-1030-i0		99.5	032-1030	
Size – Ø50.8 × 8 mm						
380 – 420	99.7	035-0400-i0		99.5	035-0400	
500 – 530	99.7	035-0515-i0		99.5	035-0515	
760 – 840	99.7	035-0800-i0		99.5	035-0800	
1000 – 1060	99.7	035-1030-i0		99.5	035-1030	
Size – Ø76.2 × 12.7 mm						
380 – 420	99.7	037-0400-i0		99.5	037-0400	
500 – 530	99.7	037-0515-i0		99.5	037-0515	
760 – 840	99.7	037-0800-i0		99.5	037-0800	
1000 – 1060	99.7	037-1030-i0		99.5	037-1030	

Related Products

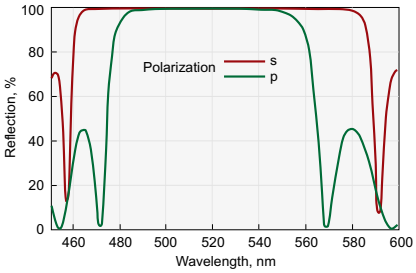
Adapter for Mirror at 45° 840-0115

Find more at EksmaOptics.com

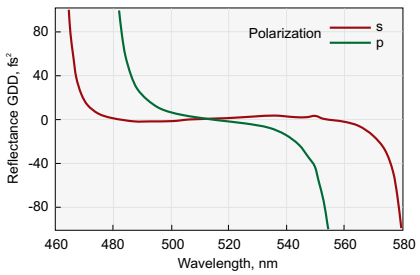
LOW GDD ULTRAFAST MIRRORS

Substrate material: **UV grade Fused Silica**

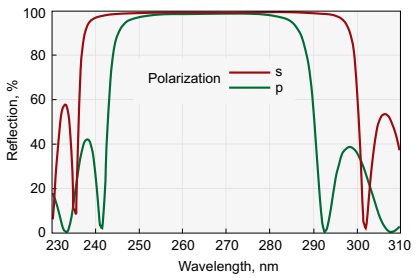
Recommended for high power laser applications operating in UV region.



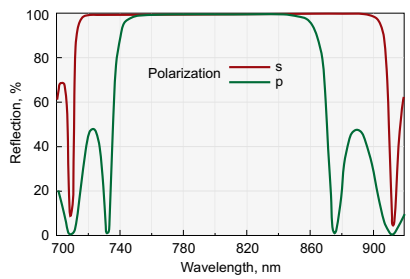
HR>99.5% @ 500-530 nm, AOI=45°



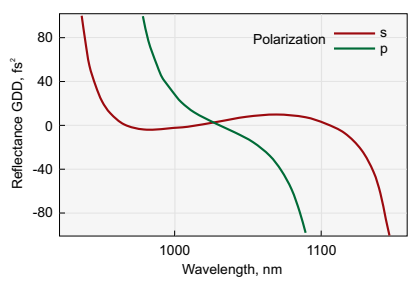
HRsp @ 500-530 GDD, AOI=45°



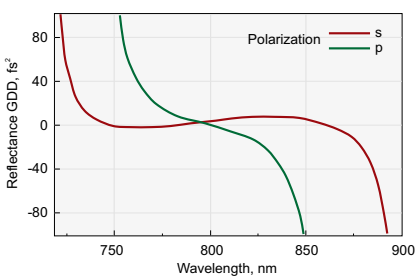
HR>99% @ 257-275 nm, AOI=45°



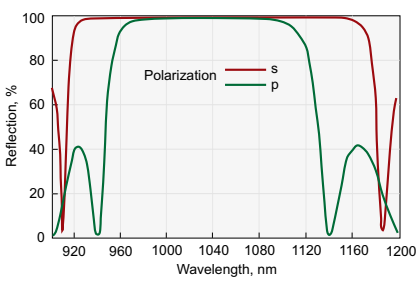
HR>99.5% @ 760-840 nm, AOI=45°



HRsp @ 1000-1060 GDD, AOI=45°



HRsp @ 760-840 GDD, AOI=45°



HR>99.5% @ 1000-1060 nm, AOI=45°

Wavelength, nm	AOI=0°			AOI=45°		
	R, % (s+p)/2	Catalogue number		R, % (s+p)/2	Catalogue number	
Size – Ø12.7 × 3 mm						
257 – 275	99.0	041-0266-i0		99.0	041-0266	
333 – 353	99.7	041-0343-i0		99.5	041-0343	
380 – 420	99.7	041-0400-i0		99.5	041-0400	
500 – 530	99.7	041-0515-i0		99.5	041-0515	
760 – 840	99.7	041-0800-i0		99.5	041-0800	
1000 – 1060	99.7	041-1030-i0		99.5	041-1030	
Size – Ø12.7 × 6 mm						
257 – 275	99.0	041-0266T6-i0		99.0	041-0266T6	
333 – 353	99.7	041-0343T6-i0		99.5	041-0343T6	
380 – 420	99.7	041-0400T6-i0		99.5	041-0400T6	
500 – 530	99.7	041-0515T6-i0		99.5	041-0515T6	
760 – 840	99.7	041-0800T6-i0		99.5	041-0800T6	
1000 – 1060	99.7	041-1030T6-i0		99.5	041-1030T6	
Size – Ø25.4 × 6 mm						
257 – 275	99.0	042-0266-i0		99.0	042-0266	
333 – 353	99.7	042-0343-i0		99.5	042-0343	
380 – 420	99.7	042-0400-i0		99.5	042-0400	
500 – 530	99.7	042-0515-i0		99.5	042-0515	
760 – 840	99.7	042-0800-i0		99.5	042-0800	
1000 – 1060	99.7	042-1030-i0		99.5	042-1030	
1400 – 1700	99.0	082-1417-i0		99.0	082-1417	
1900 – 2120	99.8	082-1921-i0		99.8	082-1921	
Size – Ø50.8 × 8 mm						
257 – 275	99.0	045-0266-i0		99.0	045-0266	
333 – 353	99.7	045-0343-i0		99.5	045-0343	
380 – 420	99.7	045-0400-i0		99.5	045-0400	
500 – 530	99.7	045-0515-i0		99.5	045-0515	
760 – 840	99.7	045-0800-i0		99.5	045-0800	
1000 – 1060	99.7	045-1030-i0		99.5	045-1030	
Size – Ø76.2 × 12.7 mm						
257 – 275	99.0	047-0266-i0		99.0	047-0266	
333 – 353	99.7	047-0343-i0		99.5	047-0343	
380 – 420	99.7	047-0400-i0		99.5	047-0400	
500 – 530	99.7	047-0515-i0		99.5	047-0515	
760 – 840	99.7	047-0800-i0		99.5	047-0800	
1000 – 1060	99.7	047-1030-i0		99.5	047-1030	

DUAL BAND MIRRORS

Substrate

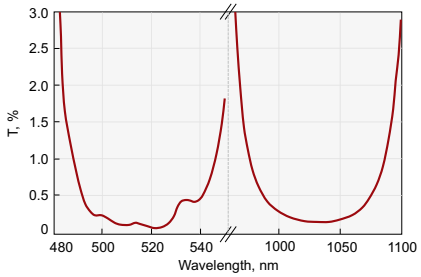
Material	UV grade Fused Silica or BK7 glas
S1 Surface Flatness	λ/10 at 633 nm
S1 Surface Quality	20 –10 scratch & dig (MIL-PRF-13830B)
S2 Surface Quality	Commercial polish
Diameter Tolerance	+0.00 mm; -0.12 mm
Thickness Tolerance	±0.25 mm
Wedge	< 3 min
Chamfer	0.3 mm at 45° typical

Coating

Coating	Electron beam multilayer dielectric
Angle of Incidence	0 or 45±3°
Designed for average polarization	R=(Rs+Rp)/2
Laser Damage Threshold	>50 mJ/cm², 50 fsec pulse, 50 Hz, 800 nm typical

DUAL BAND MIRRORS

Substrate material: **BK7 grade A**



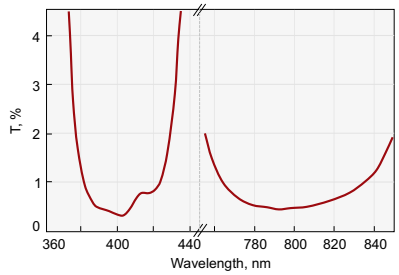
HR>99.5% @ 500-530 nm + 1000-1060 nm, AOI = 45°

Wavelength, nm	AOI=0°			AOI=45°		
	R, % (s+p)/2	Catalogue number		R, % (s+p)/2	Catalogue number	
Size – Ø12.7 × 3 mm						
390-410 + 780-820	99.7	051-4080-i0		99.5	051-4080	
500-530 + 1000-1060	99.7	051-5103-i0		99.5	051-5103	
Size – Ø12.7 × 6 mm						
390-410 + 780-820	99.7	051-4080T6-i0		99.5	051-4080T6	
500-530 + 1000-1060	99.7	051-5103T6-i0		99.5	051-5103T6	
Size – Ø25.4 × 6 mm						
390-410 + 780-820	99.7	052-4080-i0		99.5	052-4080	
500-530 + 1000-1060	99.7	052-5103-i0		99.5	052-5103	
Size – Ø50.8 × 8 mm						
390-410 + 780-820	99.7	055-4080-i0		99.5	055-4080	
500-530 + 1000-1060	99.7	055-5103-i0		99.5	055-5103	
Size – Ø76.2 × 12.7 mm						
390-410 + 780-820	99.7	057-4080-i0		99.5	057-4080	
500-530 + 1000-1060	99.7	057-5103-i0		99.5	057-5103	

DUAL BAND MIRRORS

Substrate material: **UV grade Fused Silica**

Recommended for high power laser applications operating in UV region.



HR>99% @ 400 nm + 800 nm, AOI = 45°

Wavelength, nm	AOI=0°			AOI=45°		
	R, % (s+p)/2	Catalogue number		R, % (s+p)/2	Catalogue number	
Size – Ø12.7 × 3 mm						
390-410 + 780-820	99.7	061-4080-i0		99.5	061-4080	
500-530 + 1000-1060	99.7	061-5103-i0		99.5	061-5103	
Size – Ø12.7 × 6 mm						
390-410 + 780-820	99.7	061-4080T6-i0		99.5	061-4080T6	
500-530 + 1000-1060	99.7	061-5103T6-i0		99.5	061-5103T6	
Size – Ø25.4 × 6 mm						
390-410 + 780-820	99.7	062-4080-i0		99.5	062-4080	
500-530 + 1000-1060	99.7	062-5103-i0		99.5	062-5103	
Size – Ø50.8 × 8 mm						
390-410 + 780-820	99.7	065-4080-i0		99.5	065-4080	
500-530 + 1000-1060	99.7	065-5103-i0		99.5	065-5103	
Size – Ø76.2 × 12.7 mm						
390-410 + 780-820	99.7	067-4080-i0		99.5	067-4080	
500-530 + 1000-1060	99.7	067-5103-i0		99.5	067-5103	

BROADBAND LOW GDD ULTRAFAST MIRRORS

Features

- High reflectivity and low group delay dispersion in broad region centered at 800 nm
- Rs > 99% @ 700 – 930 nm, |GDDs| < 30 fs² @ 700 – 930 nm
- Rp > 99% @ 730 – 870 nm, |GDDp| < 30 fs² @ 730 – 870 nm
- R > 99% @ 720 – 880 nm, |GDD| < 30 fs² @ 720 – 880 nm

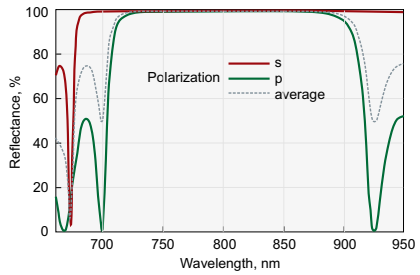
Specifications

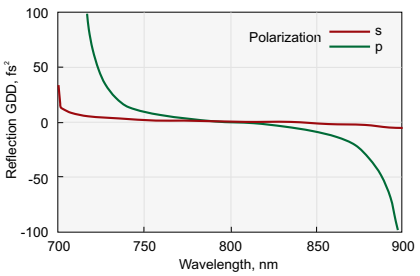
Coating	Hard Dielectric High Reflection or Ion Beam Sputtering
Angle of Incidence	0 or 45±3°
Designed for average polarization	R=(Rs+Rp)/2
Laser Damage Threshold	>100 mJ/cm², 50 fsec pulse, 50 Hz, 800 nm typical

Substrate

Material	UV grade Fused Silica or BK7 glas
S1 Surface Flatness	λ/10 at 633 nm
S1 Surface Quality	20 –10 scratch & dig (MIL-PRF-13830B)
S2 Surface Quality	Commercial polish
Diameter Tolerance	+0.00 mm; -0.12 mm
Thickness Tolerance	±0.25 mm
Wedge	< 3 min
Chamfer	0.3 mm at 45° typical

BROADBAND LOW GDD ULTRAFAST MIRRORS





HR>99% @ 720-880 nm, AOI=45°

Wavelength, nm	Diameter, mm	Thickness, mm	AOI = 0° R, % (s+p)/2	AOI = 0° Catalogue number	AOI = 45° R, % (s+p)/2	AOI = 45° Catalogue number
Substrate material: BK7 grade A						
720-880	12.7	3.0	99.0	071-7288-i0	99.0	071-7288
720-880	12.7	6.0	99.0	071-7288T6-i0	99.0	071-7288T6
720-880	25.4	6.0	99.0	072-7288-i0	99.0	072-7288
720-880	38.1	8.0	99.0	074-7288-i0	99.0	074-7288
720-880	50.8	8.0	99.0	075-7288-i0	99.0	075-7288
720-880	76.2	12.7	99.0	077-7288-i0	99.0	077-7288
720-880	101.6	15.0	99.0	078-7288-i0	99.0	078-7288
Substrate material: UV grade Fused Silica						
720-880	12.7	3.0	99.0	081-7288-i0	99.0	081-7288
720-880	12.7	6.0	99.0	081-7288T6-i0	99.0	081-7288T6
720-880	25.4	6.0	99.0	082-7288-i0	99.0	082-7288
720-880	38.1	8.0	99.0	084-7288-i0	99.0	084-7288
720-880	50.8	8.0	99.0	085-7288-i0	99.0	085-7288
720-880	76.2	12.7	99.0	087-7288-i0	99.0	087-7288
720-880	101.6	15.0	99.0	088-7288-i0	99.0	088-7288

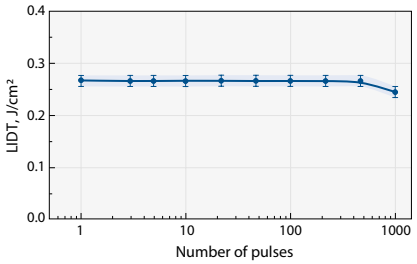
HIGH POWER IBS COATED LASER MIRRORS

Substrate

Material	UV grade fused silica
S1 Surface Flatness	λ/10 at 633 nm
S1 Surface Quality	20 – 10 scratch & dig (MIL-PRF-13830B)
S2 Surface Quality	Commercial polish
Diameter Tolerance	+0.00 mm / -0.12 mm
Thickness Tolerance	±0.25 mm
Wedge	< 3 min
Chamfer	0.3 mm at 45° typical

Coating

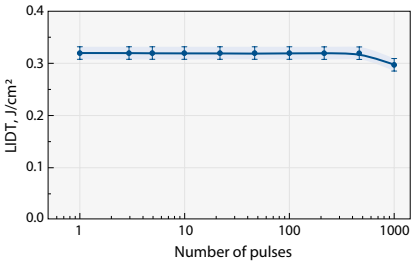
Technology	Ion Beam Sputtering (IBS)
Adhesion and Durability	Per MIL-C-675A, Insoluble in lab solvents
Clear Aperture	Exceeds central 85% of diameter
Coated Surface Flatness	λ/10 at 633 nm over clear aperture
Group Delay Dispersion	< 30 fs²



LIDT of High Power Laser Mirrors
@ 720-880 nm, AOI = 45°

Test conditions:

Wavelength	800 nm
Pulse duration	52.4 fs
Repetition rate	50 Hz
AOI	45°
Polarization	linear P
Beam diameter (1/e²)	(95.5 ± 0.9) µm



LIDT of High Power Laser Mirrors
@ 720-880 nm, AOI = 0°

Test conditions:

Wavelength	800 nm
Pulse duration	52.4 fs
Repetition rate	50 Hz
AOI	0°
Polarization	linear
Beam diameter (1/e²)	(95.5 ± 0.9) µm

Design wavelength range – 343 nm. LIDT > 0.4 J/cm², 200 fs pulse, 100 Hz, 1550 nm typical.

Wavelength, nm	AOI, deg	R, % (s+p)/2	Ø 12.7 x 6 mm		Ø 25.4 x 6 mm		Ø 50.8 x 12 mm	
			Catalogue number		Catalogue number		Catalogue number	
343	45	99.8	041-0343PHR		042-0343PHR		045-0343PHR	
343	0	99.8	041-0343PHR-i0		042-0343PHR-i0		045-0343PHR-i0	

Design wavelength – 500-530 nm. LIDT >0.15 J/cm², 50 fs pulse, 100 Hz, 515 nm typical.

Wavelength, nm	AOI, deg	R, % (s+p)/2	Ø 12.7 x 6 mm		Ø 25.4 x 6 mm		Ø 50.8 x 12 mm	
			Catalogue number		Catalogue number		Catalogue number	
500 – 530	45	99.9	041-0515T6HHR		042-0515HHR		045-0515T12HHR	
500 – 530	0	99.9	041-0515T6HHR-i0		042-0515HHR-i0		045-0515T12HHR-i0	

Design wavelength – 760-840 nm. LIDT >0.2 J/cm², 50 fs pulse, 100 Hz, 800 nm typical.

Wavelength, nm	AOI, deg	R, % (s+p)/2	Ø 12.7 x 6 mm		Ø 25.4 x 6 mm		Ø 50.8 x 12 mm	
			Catalogue number		Catalogue number		Catalogue number	
760 – 840	45	99.9	041-0800T6HHR		042-0800HHR		045-0800T12HHR	
760 – 840	0	99.9	041-0800T6HHR-i0		042-0800HHR-i0		045-0800T12HHR-i0	
760 – 840	0-45	99.9	041-7684T6HHR-i0-45		042-7684HHR-i0-45		045-4684T12HHR-i0-45	

Design wavelength – 760-840 nm. LIDT >0.3 J/cm², 50 fs pulse, 100 Hz, 800 nm typical.

Wavelength, nm	AOI, deg	R, % (s+p)/2	Ø 12.7 x 6 mm		Ø 25.4 x 6 mm		Ø 50.8 x 12 mm	
			Catalogue number		Catalogue number		Catalogue number	
760 – 840	45	99.9	041-0800T6UHHR		042-0800UHHR		045-0800T12UHHR	
760 – 840	0	99.9	041-0800T6UHHR-i0		042-0800UHHR-i0		045-0800T12UHHR-i0	

Design wavelength – 720-880 nm. LIDT >0.15 J/cm², 50 fs pulse, 100 Hz, 800 nm typical.

Wavelength, nm	AOI, deg	R, % (s+p)/2	Ø 12.7 x 6 mm		Ø 25.4 x 6 mm		Ø 50.8 x 12 mm		Ø 76.2 x 15 mm	
			Catalogue number		Catalogue number		Catalogue number		Catalogue number	
720 – 880	45	99.8	081-7288HHR		082-7288HHR		085-7288T12HHR		087-7288HHR	
720 – 880	0	99.9	081-7288HHR-i0		082-7288HHR-i0		085-7288T12HHR-i0		087-7288HHR-i0	

Design wavelength – 1000-1060 nm. LIDT >0.4 J/cm², 50 fs pulse, 100 Hz, 1030 nm typical.

Wavelength, nm	AOI, deg	R, % (s+p)/2	Ø 12.7 x 6 mm		Ø 25.4 x 6 mm		Ø 50.8 x 12 mm	
			Catalogue number		Catalogue number		Catalogue number	
1000 – 1060	45	99.9	041-1030T6HHR		042-1030HHR		045-1030T12HHR	
1000 – 1060	0	99.9	041-1030T6HHR-i0		042-1030HHR-i0		045-1030T12HHR-i0	

Design wavelength range – 1400-1700 nm. LIDT > 0.3 J/cm², 50 fs pulse, 100 Hz, 1550 nm typical.

Wavelength, nm	AOI, deg	R, % (s+p)/2	Ø 12.7 x 6 mm		Ø 25.4 x 6 mm		Ø 50.8 x 12 mm	
			Catalogue number		Catalogue number		Catalogue number	
1400 – 1700	45	99.8	081-1417		082-1417		085-1417	
1400 – 1700	0	99.8	081-1417-i0		082-1417-i0		085-1417-i0	

Design wavelength range – 1900-2120 nm. LIDT > 0.4 J/cm², 50 fs pulse, 100 Hz, 2000 nm typical.

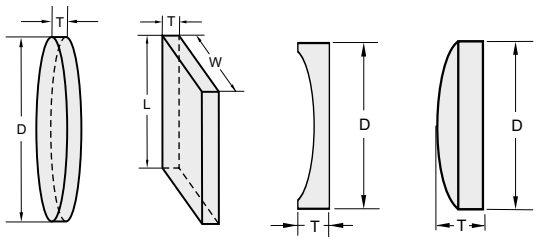
Wavelength, nm	AOI, deg	R, % (s+p)/2	Ø 12.7 x 6 mm		Ø 25.4 x 6 mm		Ø 50.8 x 12 mm	
			Catalogue number		Catalogue number		Catalogue number	
1900 – 2120	45	99.8	081-1921		082-1921		085-1921	
1900 – 2120	0	99.8	081-1921-i0		082-1921-i0		085-1921-i0	

ENHANCED SILVER MIRRORS

Features

- LIDT – 0.25 J/cm² at 800 nm, 50 Hz, 94 fsec pulses
- Round, square, flat or spherical mirrors available
- Reflectivity R>98.5% @ 600 – 1100 nm, R>99% @ 700 – 900 nm
- Operating angle of incidence from 0° to 45°
- Group Delay Dispersion < | 5 fs² |

Enhanced silver mirrors are designed for applications with femtosecond lasers. These mirrors feature high reflectivity R>98.5% in the wavelength range from 600 nm to 1100 nm and R>99% @ 700 – 900 nm. Mirrors are relatively insensitive to angle of incidence and can be used in applications with AOI ranging from 0° to 45°.



Drawings of flat round, flat rectangular and spherical mirrors

Flat Rectangular Mirrors. Substrate type: plano-plano

Width W, mm	Length L, mm	Thickness T, mm	Substrate material	Catalogue number
15.0	20.0	6	BK7	091-0325F
20.0	30.0	6	BK7	092-0325F
25.4	25.4	6	BK7	093-0325F
25.4	50.8	10	BK7	094-0325F
50.8	50.8	10	BK7	095-0325F
15.0	20.0	6	UVFS	091-3325F
20.0	30.0	6	UVFS	092-3325F
25.4	25.4	6	UVFS	093-3325F
25.4	50.8	10	UVFS	094-3325F
50.8	50.8	10	UVFS	095-3325F

Flat Round Mirrors. Substrate type: plano-plano

Diameter D, mm	Thickness T, mm	Substrate material	Catalogue number
Ø12.7	3	BK7	091-0025F
Ø12.7	6	BK7	091-0025FT6
Ø25.4	6	BK7	092-0025F
Ø50.8	8	BK7	095-0025F
Ø76.2	12.7	BK7	097-0025F
Ø101.6	15	BK7	098-0025F
Ø12.7	3	UVFS	091-3025F
Ø12.7	6	UVFS	091-3025FT6
Ø25.4	6	UVFS	092-3025F
Ø50.8	8	UVFS	095-3025F
Ø76.2	12.7	UVFS	097-3025F
Ø101.6	15	UVFS	098-3025F

Spherical Mirrors. Diameter, D = 12.7 mm.
Thickness (edge for plano-concave, center for plano-convex), T = 6.0 mm

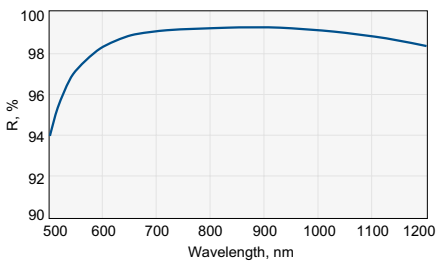
Radius, mm	Substrate type	Substrate material	Catalogue number
-50	Plano-concave	BK7	091-0125FR-50
-75	Plano-concave	BK7	091-0125FR-75
-100	Plano-concave	BK7	091-0125FR-100
-150	Plano-concave	BK7	091-0125FR-150
-200	Plano-concave	BK7	091-0125FR-200
-250	Plano-concave	BK7	091-0125FR-250
-300	Plano-concave	BK7	091-0125FR-300
-400	Plano-concave	BK7	091-0125FR-400
-500	Plano-concave	BK7	091-0125FR-500
-1000	Plano-concave	BK7	091-0125FR-1000
-1500	Plano-concave	BK7	091-0125FR-1500
-2000	Plano-concave	BK7	091-0125FR-2000
-50	Plano-concave	UVFS	091-3125FR-50
-75	Plano-concave	UVFS	091-3125FR-75
-100	Plano-concave	UVFS	091-3125FR-100
-150	Plano-concave	UVFS	091-3125FR-150
-200	Plano-concave	UVFS	091-3125FR-200
-250	Plano-concave	UVFS	091-3125FR-250
-300	Plano-concave	UVFS	091-3125FR-300
-400	Plano-concave	UVFS	091-3125FR-400
-500	Plano-concave	UVFS	091-3125FR-500
-1000	Plano-concave	UVFS	091-3125FR-1000
-1500	Plano-concave	UVFS	091-3125FR-1500
-2000	Plano-concave	UVFS	091-3125FR-2000

Radius, mm	Substrate type	Substrate material	Catalogue number
+50	Plano-convex	BK7	091-0225FR+50
+100	Plano-convex	BK7	091-0225FR+100
+150	Plano-convex	BK7	091-0225FR+150
+200	Plano-convex	BK7	091-0225FR+200
+300	Plano-convex	BK7	091-0225FR+300
+400	Plano-convex	BK7	091-0225FR+400
+500	Plano-convex	BK7	091-0225FR+500
+50	Plano-convex	UVFS	091-3225FR+50
+100	Plano-convex	UVFS	091-3225FR+100
+150	Plano-convex	UVFS	091-3225FR+150
+200	Plano-convex	UVFS	091-3225FR+200
+300	Plano-convex	UVFS	091-3225FR+300
+400	Plano-convex	UVFS	091-3225FR+400
+500	Plano-convex	UVFS	091-3225FR+500

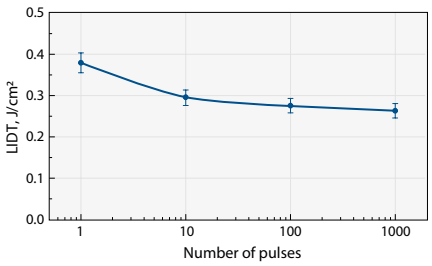
Spherical Mirrors. Diameter, D = 25.4 mm.
Thickness (edge for plano-concave, center for plano-convex), T = 6.0 mm

Radius, mm	Substrate type	Substrate material	Catalogue number	
-50	Plano-concave	BK7	092-0125FR-50	
-75	Plano-concave	BK7	092-0125FR-75	
-100	Plano-concave	BK7	092-0125FR-100	
-150	Plano-concave	BK7	092-0125FR-150	
-200	Plano-concave	BK7	092-0125FR-200	
-250	Plano-concave	BK7	092-0125FR-250	
-300	Plano-concave	BK7	092-0125FR-300	
-400	Plano-concave	BK7	092-0125FR-400	
-500	Plano-concave	BK7	092-0125FR-500	
-600	Plano-concave	BK7	092-0125FR-600	
-700	Plano-concave	BK7	092-0125FR-700	
-750	Plano-concave	BK7	092-0125FR-750	
-800	Plano-concave	BK7	092-0125FR-800	
-1000	Plano-concave	BK7	092-0125FR-1000	
-1500	Plano-concave	BK7	092-0125FR-1500	
-2000	Plano-concave	BK7	092-0125FR-2000	
-2500	Plano-concave	BK7	092-0125FR-2500	
-3000	Plano-concave	BK7	092-0125FR-3000	
-4000	Plano-concave	BK7	092-0125FR-4000	
-5000	Plano-concave	BK7	092-0125FR-5000	
-6000	Plano-concave	BK7	092-0125FR-6000	
-8000	Plano-concave	BK7	092-0125FR-8000	
-50	Plano-concave	UVFS	092-0125FR-50	
-75	Plano-concave	UVFS	092-0125FR-75	
-100	Plano-concave	UVFS	092-0125FR-100	
-150	Plano-concave	UVFS	092-0125FR-150	
-200	Plano-concave	UVFS	092-0125FR-200	
-250	Plano-concave	UVFS	092-0125FR-250	
-300	Plano-concave	UVFS	092-0125FR-300	
-400	Plano-concave	UVFS	092-0125FR-400	
-500	Plano-concave	UVFS	092-0125FR-500	
-600	Plano-concave	UVFS	092-3125FR-600	
-700	Plano-concave	UVFS	092-3125FR-700	
-750	Plano-concave	UVFS	092-3125FR-750	
-800	Plano-concave	UVFS	092-3125FR-800	
-1000	Plano-concave	UVFS	092-3125FR-1000	
-1500	Plano-concave	UVFS	092-3125FR-1500	
-2000	Plano-concave	UVFS	092-3125FR-2000	
-2500	Plano-concave	UVFS	092-3125FR-2500	
-3000	Plano-concave	UVFS	092-3125FR-3000	
-4000	Plano-concave	UVFS	092-3125FR-4000	
-5000	Plano-concave	UVFS	092-3125FR-5000	
-6000	Plano-concave	UVFS	092-3125FR-6000	
-8000	Plano-concave	UVFS	092-3125FR-8000	

Radius, mm	Substrate type	Substrate material	Catalogue number	
+50	Plano-convex	BK7	092-0225FR+50	
+100	Plano-convex	BK7	092-0225FR+100	
+150	Plano-convex	BK7	092-0225FR+150	
+200	Plano-convex	BK7	092-0225FR+200	
+300	Plano-convex	BK7	092-0225FR+300	
+400	Plano-convex	BK7	092-0225FR+400	
+500	Plano-convex	BK7	092-0225FR+500	
+600	Plano-convex	BK7	092-0225FR+600	
+800	Plano-convex	BK7	092-0225FR+800	
+1000	Plano-convex	BK7	092-0225FR+1000	
+1500	Plano-convex	BK7	092-0225FR+1500	
+2000	Plano-convex	BK7	092-0225FR+2000	
+4000	Plano-convex	BK7	092-0225FR+4000	
+5000	Plano-convex	BK7	092-0225FR+5000	
+50	Plano-convex	UVFS	092-3225FR+50	
+100	Plano-convex	UVFS	092-3225FR+100	
+150	Plano-convex	UVFS	092-3225FR+150	
+200	Plano-convex	UVFS	092-3225FR+200	
+300	Plano-convex	UVFS	092-3225FR+300	
+400	Plano-convex	UVFS	092-3225FR+400	
+500	Plano-convex	UVFS	092-3225FR+500	
+600	Plano-convex	UVFS	092-3225FR+600	
+800	Plano-convex	UVFS	092-3225FR+800	
+1000	Plano-convex	UVFS	092-3225FR+1000	
+1500	Plano-convex	UVFS	092-3225FR+1500	
+2000	Plano-convex	UVFS	092-3225FR+2000	
+4000	Plano-convex	UVFS	092-3225FR+4000	
+5000	Plano-convex	UVFS	092-3225FR+5000	



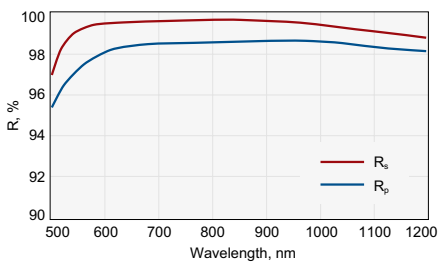
Reflectivity of enhanced silver mirrors, AOI=0°



LIDT of enhanced silver mirrors,
AOI=45° @ 800 nm, 100 fs, 100 Hz

Test conditions:

Wavelength	800 nm
Pulse duration	99.9 fs
Repetition rate	100 Hz
AOI	45°
Polarization	linear P
Beam diameter (1/e²)	(143 ± 2.3) µm



Reflectivity of enhanced silver mirrors, AOI=45°

Spherical Mirrors. Diameter, D = 50.8 mm.
Thickness (edge for plano-concave, center for plano-convex), T = 10.0 mm

Radius, mm	Substrate type	Substrate material	Catalogue number
-100	Plano-concave	BK7	095-0125FR-100
-150	Plano-concave	BK7	095-0125FR-150
-200	Plano-concave	BK7	095-0125FR-200
-250	Plano-concave	BK7	095-0125FR-250
-300	Plano-concave	BK7	095-0125FR-300
-400	Plano-concave	BK7	095-0125FR-400
-500	Plano-concave	BK7	095-0125FR-500
-600	Plano-concave	BK7	095-0125FR-600
-800	Plano-concave	BK7	095-0125FR-800
-1000	Plano-concave	BK7	095-0125FR-1000
-1500	Plano-concave	BK7	095-0125FR-1500
-2000	Plano-concave	BK7	095-0125FR-2000
-2500	Plano-concave	BK7	095-0125FR-2500
-3000	Plano-concave	BK7	095-0125FR-3000
-4000	Plano-concave	BK7	095-0125FR-4000
-5000	Plano-concave	BK7	095-0125FR-5000
-6000	Plano-concave	BK7	095-0125FR-6000
-8000	Plano-concave	BK7	095-0125FR-8000
-10000	Plano-concave	BK7	095-0125FR-10000
-100	Plano-concave	UVFS	095-3125FR-100
-150	Plano-concave	UVFS	095-3125FR-150
-200	Plano-concave	UVFS	095-3125FR-200
-250	Plano-concave	UVFS	095-3125FR-250
-300	Plano-concave	UVFS	095-3125FR-300
-400	Plano-concave	UVFS	095-3125FR-400
-500	Plano-concave	UVFS	095-3125FR-500
-600	Plano-concave	UVFS	095-3125FR-600
-800	Plano-concave	UVFS	095-3125FR-800
-1000	Plano-concave	UVFS	095-3125FR-1000
-1500	Plano-concave	UVFS	095-3125FR-1500

Radius, mm	Substrate type	Substrate material	Catalogue number
-2000	Plano-concave	UVFS	095-3125FR-2000
-2500	Plano-concave	UVFS	095-3125FR-2500
-3000	Plano-concave	UVFS	095-3125FR-3000
-4000	Plano-concave	UVFS	095-3125FR-4000
-5000	Plano-concave	UVFS	095-3125FR-5000
-6000	Plano-concave	UVFS	095-3125FR-6000
-8000	Plano-concave	UVFS	095-3125FR-8000
-10000	Plano-concave	UVFS	095-3125FR-10000
+100	Plano-convex	BK7	095-0225FR+100
+150	Plano-convex	BK7	095-0225FR+150
+200	Plano-convex	BK7	095-0225FR+200
+300	Plano-convex	BK7	095-0225FR+300
+400	Plano-convex	BK7	095-0225FR+400
+500	Plano-convex	BK7	095-0225FR+500
+600	Plano-convex	BK7	095-0225FR+600
+800	Plano-convex	BK7	095-0225FR+800
+1000	Plano-convex	BK7	095-0225FR+1000
+1500	Plano-convex	BK7	095-0225FR+1500
+2000	Plano-convex	BK7	095-0225FR+2000
+100	Plano-convex	UVFS	095-3225FR+100
+150	Plano-convex	UVFS	095-3225FR+150
+200	Plano-convex	UVFS	095-3225FR+200
+300	Plano-convex	UVFS	095-3225FR+300
+400	Plano-convex	UVFS	095-3225FR+400
+500	Plano-convex	UVFS	095-3225FR+500
+600	Plano-convex	UVFS	095-3225FR+600
+800	Plano-convex	UVFS	095-3225FR+800
+1000	Plano-convex	UVFS	095-3225FR+1000
+1500	Plano-convex	UVFS	095-3225FR+1500
+2000	Plano-convex	UVFS	095-3225FR+2000

Spherical Mirrors. Diameter, D = 76.2 mm.
Thickness (edge for plano-concave, center for plano-convex), T = 12.7 mm

Radius, mm	Substrate type	Substrate material	Catalogue number
-200	Plano-concave	BK7	097-0125FR-200
-300	Plano-concave	BK7	097-0125FR-300
-400	Plano-concave	BK7	097-0125FR-400
-500	Plano-concave	BK7	097-0125FR-500
-600	Plano-concave	BK7	097-0125FR-600
-800	Plano-concave	BK7	097-0125FR-800
-1000	Plano-concave	BK7	097-0125FR-1000
-2000	Plano-concave	BK7	097-0125FR-2000
-3000	Plano-concave	BK7	097-0125FR-3000
-200	Plano-concave	UVFS	097-3125FR-200
-300	Plano-concave	UVFS	097-3125FR-300
-400	Plano-concave	UVFS	097-3125FR-400
-500	Plano-concave	UVFS	097-3125FR-500
-600	Plano-concave	UVFS	097-3125FR-600
-800	Plano-concave	UVFS	097-3125FR-800
-1000	Plano-concave	UVFS	097-3125FR-1000
-2000	Plano-concave	UVFS	097-3125FR-2000
-3000	Plano-concave	UVFS	097-3125FR-3000

Spherical Mirrors. Diameter, D = 101.6 mm.
Thickness (edge for plano-concave, center for plano-convex), T = 15.0 mm

Radius, mm	Substrate type	Substrate material	Catalogue number
-300	Plano-concave	BK7	098-0125FR-300
-400	Plano-concave	BK7	098-0125FR-400
-500	Plano-concave	BK7	098-0125FR-500
-600	Plano-concave	BK7	098-0125FR-600
-800	Plano-concave	BK7	098-0125FR-800
-1000	Plano-concave	BK7	098-0125FR-1000
-2000	Plano-concave	BK7	098-0125FR-2000
-3000	Plano-concave	BK7	098-0125FR-3000
-300	Plano-concave	UVFS	098-3125FR-300
-400	Plano-concave	UVFS	098-3125FR-400
-500	Plano-concave	UVFS	098-3125FR-500
-600	Plano-concave	UVFS	098-3125FR-600
-800	Plano-concave	UVFS	098-3125FR-800
-1000	Plano-concave	UVFS	098-3125FR-1000
-2000	Plano-concave	UVFS	098-3125FR-2000
-3000	Plano-concave	UVFS	098-3125FR-3000

LASER HARMONIC SEPARATORS

Features

- Offered on Ø 0.5 or 1 inch UV FS substrates with surface flatness λ/10

Harmonic separators are dichroic beamsplitters that reflect one wavelength and transmit others. Reflectance is better than 99.5% for the wavelength of interest and transmittance is at least 90% for the rejected wavelengths. The rear surface of harmonic separators is antireflection coated.

If possible use shorter wavelength for reflection and longer wavelengths for transmission in order to have higher reflection/transmission coefficients.

Substrate

Material	UV grade Fused Silica
S1 Surface Flatness	λ/10 typical at 633 nm
S1 Surface Quality	20 –10 scratch & dig (MIL-PRF-13830B)
S2 Surface Flatness	λ/10 typical at 633 nm
S2 Surface Quality	20 –10 scratch & dig (MIL-PRF-13830B)
Diameter Tolerance	+0.00 mm; -0.12 mm
Thickness Tolerance	±0.25 mm
Parallelism	< 30 arcsec
Chamfer	0.3 mm at 45° typical

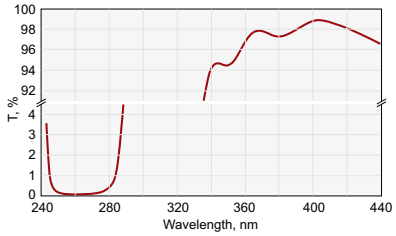
LASER HARMONIC SEPARATORS WITH HIGH TRANSMISSION

Coating

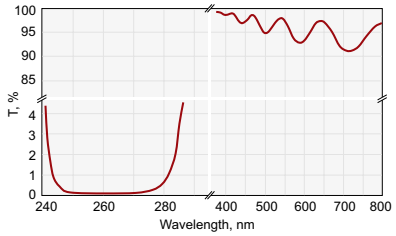
Technology	Ion beam sputtering
Adhesion and Durability	Per MIL-C-675A. Insoluble in lab solvents
Clear Aperture	Exceeds central 85% of diameter
Coated Surface Flatness	λ/10 at 633 nm over clear aperture
Back Side Antireflection Coated	AOI 45°, R<0.5%, (s+p)/2 AOI 0°, R<0.2%
Laser Damage Threshold	> 0.3 J/cm^2, 200 fs, 100 Hz, 343 nm, p-pol >0.7 J/cm^2, 10 ps, 50 kHz, 343 nm, p-pol

Reflected wavelength, nm	Reflection	Transmission	12.7 × 3 mm		25.4 × 6 mm		50.8 × 8 mm	
			Catalogue number		Catalogue number		Catalogue number	
AOI = 0 deg. Substrate material: UV grade Fused Silica								
343	R_{sp}>99.5%	T_{sp}>98% @ 515 nm + T_{sp}>99% @ 1030 nm	041-3530PHT		042-3530PHT		045-3530PHT	
380 – 420	R_{sp}>99.9%	T_{sp}>99% @ 720 – 880 nm			042-4800HT		045-4800HT	
505 – 525	R_{sp}>99.9%	T_{sp}>99% @ 1010 – 1050 nm	041-5130HT		042-5130HT		045-5130HT	
760 – 840	R_{sp}>99.9%	T_{ave}>95% @ 380 – 420 nm			042-0840HT		045-0840HT	
1015 – 1045	R_{sp}>99.9%	T_{sp}>98% @ 510 – 520 nm	041-6510HT		042-6510HT		045-6510HT	
AOI = 45 deg. Substrate material: UV grade Fused Silica								
343	R_{sp}>99.5%	T_{sp}>98% @ 515 nm + T_{sp}>99% @ 1030 nm	041-3535PHT		042-3535PHT		045-3535PHT	
380 – 420	R_{sp}>99.9%	T_{sp}>99% @ 720 – 880 nm			042-4805HT		045-4805HT	
505 – 525	R_{sp}>99.9%	T_{sp}>99% @ 1010 – 1050 nm	041-5135HT		042-5135HT		045-5135HT	
760 – 840	R_{sp}>99.9%	T_{ave}>95% @ 380 – 420 nm			042-0845HT		045-0845HT	
1015 – 1045	R_{sp}>99.9%	T_{sp}>98% @ 510 – 520 nm	041-6515HT		042-6515HT		045-6515HT	

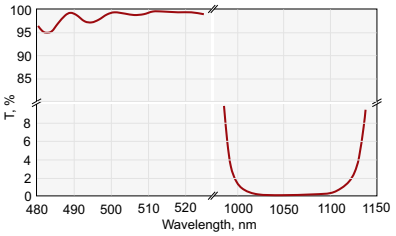
STANDARD LASER HARMONIC SEPARATORS



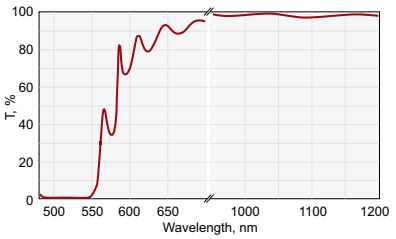
042-2405. HR>99.5% @ 257-275 nm + HT>95% @ 390-410 nm, AOI=45°



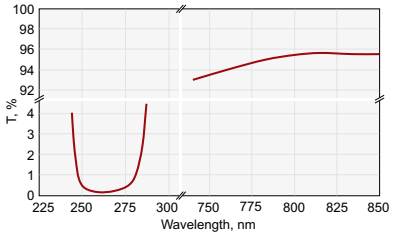
042-2485. HR>99.5% @ 257-275 nm + HT>90% @ 400+800 nm, AOI=45°



042-6515. HR>99.5% @ 1030 nm + HT>93% @ 515 nm, AOI=45°



042-5135. HR>99.5% @ 500-530 nm + HT>95% @ 1000-1060 nm, AOI=45°



042-2805. HR>99.5% @ 257-275 nm + HT>95% @ 780-820, AOI=45°

Coating

Technology	Electron beam multilayer dielectric
Adhesion and Durability	Per MIL-C-675A. Insoluble in lab solvents
Clear Aperture	Exceeds central 85% of diameter
Coated Surface Flatness	λ/10 at 633 nm over clear aperture
Back side antireflection coated	AOI 45°, R<0.5% AOI 0°, R<0.25%
Laser Damage Threshold	>100 mJ/cm^2, 50 fsec pulse, 50 Hz, 800 nm typical

Reflected wavelength, nm, R > 99.5%	Transmitted wavelength, nm	Trans-mission, %	Ø12.7x3 mm Catalogue number		Ø25.4x3 mm Catalogue number		Ø50.8x8 mm Catalogue number	
AOI = 0 deg. Substrate material: UV grade Fused Silica								
257 – 275	780 – 820	>95	**041-2800**		**042-2800**		**045-2800**	
257 – 275	390 – 410	>95	**041-2400**		**042-2400**		**045-2400**	
257 – 275	400 + 800	>90	**041-2480**		**042-2480**		**045-2480**	
390 – 410	780 – 820	>95	**041-4800**		**042-4800**		**045-4800**	
800	400	>93	**041-0840**		**042-0840**		**045-0840**	
333 – 353	1000 – 1060	>95	**041-3130**		**042-3130**		**045-3130**	
333 – 353	500 – 530	>95	**041-3450**		**042-3450**		**045-3450**	
333 – 353	515 + 1030	>90	**041-3530**		**042-3530**		**045-3530**	
500 – 530	1000 – 1060	>95	**041-5130**		**042-5130**		**045-5130**	
1030	515	>93	**041-6510**		**042-6510**		**045-6510**	
AOI = 45 deg. Substrate material: UV grade Fused Silica								
257 – 275	780 – 820	>95	**041-2805**		**042-2805**		**045-2805**	
257 – 275	390 – 410	>95	**041-2405**		**042-2405**		**045-2405**	
257 – 275	400 + 800	>90	**041-2485**		**042-2485**		**045-2485**	
390 – 410	780 – 820	>95	**041-4805**		**042-4805**		**045-4805**	
800	400	>93	**041-0845**		**042-0845**		**045-0845**	
333 – 353	1000 – 1060	>95	**041-3135**		**042-3135**		**045-3135**	
333 – 353	500 – 530	>95	**041-3455**		**042-3455**		**045-3455**	
333 – 353	515 + 1030	>90	**041-3535**		**042-3535**		**045-3535**	
500 – 530	1000 – 1060	>95	**041-5135**		**042-5135**		**045-5135**	
1030	515	>93	**041-6515**		**042-6515**		**045-6515**	

Related Products

Pellin-Broca Prisms.
See page 1.52

Adapter for Beamsplitter at 45° 840-0116.
Find more at EksmaOptics.com

Kinematic Mirror and Beamsplitter Mount 840-0020.
Find more at EksmaOptics.com

LASER OUTPUT COUPLERS

Features

- Low Group Delay Dispersion

An output coupler is a partially reflecting dielectric mirror used in a laser cavity. It transmits a part of the circulating intracavity power for generating a useful output from the laser.

A low transmission output coupler leads to low laser threshold and possibly to poor laser efficiency if the losses due to output coupling do not dominate other parasitic losses in the laser cavity. The output coupler transmission is often chosen to maximize the output power, although its optimum value may be lower or higher if there are other design purposes (minimizing intracavity intensities or suppressing Q-switching instabilities in a passively mode-locked laser).

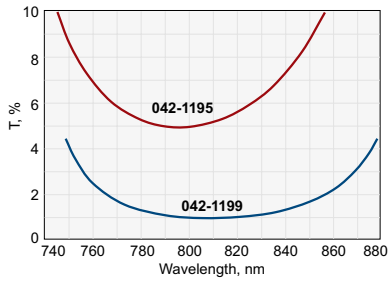
The standard substrates are parallel within 30 arcsec. If you need wedged substrates, please, choose from chapter Wedge Prisms (page 1.50).

Coating

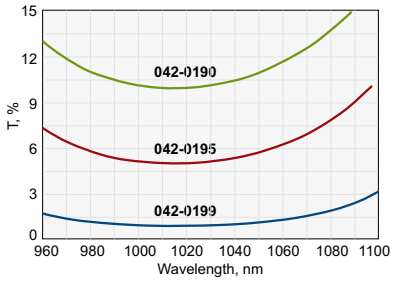
Technology	Electron beam multilayer dielectric
Adhesion and Durability	Per MIL-C-675A. Insoluble in lab solvents
Clear Aperture	Exceeds central 85% of diameter
Angle of Incidence	0 – 8°
Parallelism	30 arcsec
Back side antireflection coated	R < 0.25%
Laser Damage Threshold	>100 mJ/cm^2, 50 fsec pulse, 50 Hz, 800 nm typical

Substrate

Material	UV grade Fused Silica
S1 Surface Flatness	λ/10 typical at 633 nm
S1 Surface Quality	20–10 scratch & dig (MIL-PRF-13830B)
S2 Surface Flatness	λ/10 typical at 633 nm
S2 Surface Quality	20–10 scratch & dig (MIL-PRF-13830B)
Diameter Tolerance	+0.00 mm; -0.12 mm
Thickness Tolerance	±0.25 mm
Parallelism	< 30 arcsec
Chamfer	0.3 mm at 45° typical



042-1199. PR = 99±0.5% @ 800 nm, T = 1±0.5%
042-1195. PR = 95±2% @ 800 nm, T = 5±2%



042-0199. PR = 99±0.5% @ 1030 nm, T = 1±0.5%
042-0195. PR = 95±2% @ 1030 nm, T = 5±2%
042-0190. PR = 90±2% @ 1030 nm, T = 10±2%

Wavelength, nm	Reflection, %	Transmission, %	Ø12.7x3 mm Catalogue number		Ø25.4x6 mm Catalogue number		Ø50.8x8 mm Catalogue number	
Substrate material: UV grade Fused Silica								
1030	50±3	50±3	041-0150		042-0150		045-0150	
1030	60±3	40±3	041-0160		042-0160		045-0160	
1030	65±3	35±3	041-0165		042-0165		045-0165	
1030	70±3	30±3	041-0170		042-0170		045-0170	
1030	75±3	25±3	041-0175		042-0175		045-0175	
1030	80±3	20±3	041-0180		042-0180		045-0180	
1030	85±3	15±3	041-0185		042-0185		045-0185	
1030	90±2	10±2	041-0190		042-0190		045-0190	
1030	95±2	5±2	041-0195		042-0195		045-0195	
1030	97±1	3±1	041-0197		042-0197		045-0197	
1030	98±1	2±1	041-0198		042-0198		045-0198	
1030	99.0±0.5	1.0±0.5	041-0199		042-0199		045-0199	
800	50±3	50±3	041-1150		042-1150		045-1150	
800	60±3	40±3	041-1160		042-1160		045-1160	
800	65±3	35±3	041-1165		042-1165		045-1165	
800	70±3	30±3	041-1170		042-1170		045-1170	
800	75±3	25±3	041-1175		042-1175		045-1175	
800	80±3	20±3	041-1180		042-1180		045-1180	
800	85±3	15±3	041-1185		042-1185		045-1185	
800	90±2	10±2	041-1190		042-1190		045-1190	
800	95±2	5±2	041-1195		042-1195		045-1195	
800	97±1	3±1	041-1197		042-1197		045-1197	
800	98±1	2±1	041-1198		042-1198		045-1198	
800	99.0±0.5	1.0±0.5	041-1199		042-1199		045-1199	

Related Products

Uncoated Elliptical Mirrors
See page 1.8

Kinematic Mirror and Beamsplitter Mount 840-0020
Find more at EksmaOptics.com

LASER REAR MIRRORS

High reflectivity (R>99.8%) dielectric coatings with high laser damage threshold are applied on laser rear mirrors. UV FS substrates are recommended for high power laser applications.

Back side can be AR coated to avoid back reflection from second surface on request.

Coating

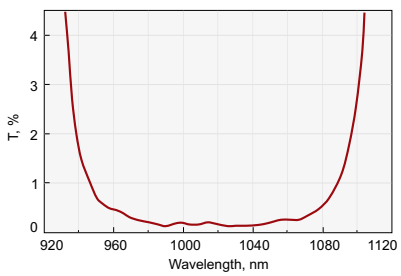
Technology	Electron beam multilayer dielectric
Adhesion and Durability	Per MIL-C-675A. Insoluble in lab solvents
Clear Aperture	Exceeds central 85% of diameter
Angle of Incidence	0 – 8° (normal)
Coating	Hard dielectric high reflection: R>99.7% at 800 nm and 1030 nm R>99% at 720 – 880 nm
Laser Damage Threshold	>100 mJ/cm^2, 50 fsec pulse, 50 Hz, 800 nm typical

Substrate

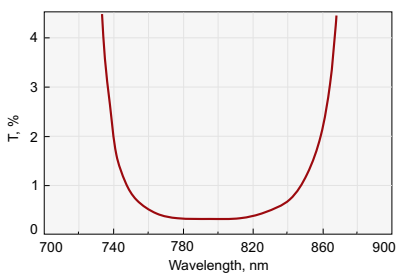
Material	UV grade Fused Silica or BK7 glass
S1 Surface Flatness	λ/10 at 633 nm
S1 Surface Quality	20 –10 scratch & dig (MIL-PRF-13830B)
S2 Surface Quality	Commercial polish
Diameter Tolerance	+0.00 mm; -0.12 mm
Thickness Tolerance	±0.25
Chamfer	0.3 mm at 45° typical

Wavelength, nm	Substrate type	Radius, mm	Substrate material BK7				Substrate material UVFS			
			Ø25.4×6 mm		Ø50.8×10 mm		Ø25.4×6 mm		Ø50.8×10 mm	
			Catalogue number		Catalogue number		Catalogue number		Catalogue number	
1030±30	Plano-plano	-∞	032-1030-i0		035-1030-i0 *		042-1030-i0		045-1030-i0 *	
1030±30	Plano-concave	-50	012-8005		015-8005		022-8005		025-8005	
1030±30	Plano-concave	-100	012-8010		015-8010		022-8010		025-8010	
1030±30	Plano-concave	-150	012-8015		015-8015		022-8015		025-8015	
1030±30	Plano-concave	-200	012-8020		015-8020		022-8020		025-8020	
1030±30	Plano-concave	-250	012-8025		015-8025		022-8025		025-8025	
1030±30	Plano-concave	-500	012-8050		015-8050		022-8050		025-8050	
1030±30	Plano-concave	-1000	012-8100		015-8100		022-8100		025-8100	
1030±30	Plano-concave	-2000	012-8200		015-8200		022-8200		025-8200	
1030±30	Plano-concave	-2500	012-8250		015-8250		022-8250		025-8250	
1030±30	Plano-concave	-4000	012-8400		015-8400		022-8400		025-8400	
1030±30	Plano-concave	-5000	012-8500		015-8500		022-8500		025-8500	
1030±30	Plano-convex	+100	012-9010		015-9010		022-9010		025-9010	
1030±30	Plano-convex	+200	012-9020		015-9020		022-9020		025-9020	
1030±30	Plano-convex	+500	012-9050		015-9050		022-9050		025-9050	
1030±30	Plano-convex	+1000	012-9100		015-9100		022-9100		025-9100	
1030±30	Plano-convex	+2000	012-9200		015-9200		022-9200		025-9200	
1030±30	Plano-convex	+4000	012-9400		015-9400		022-9400		025-9400	

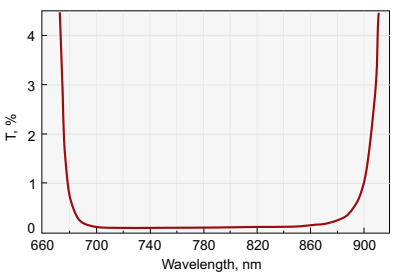
* Thickness of plano-plano rear mirrors of Ø50.8 is 8 mm.



HR>99.7% @ 1030±30 nm, AOI=0°



HR>99.7% @ 800±20 nm, AOI=0°



HR>99.0% @ 720 – 880 nm, AOI=0°

Wavelength, nm	Substrate type	Radius, mm	Substrate material BK7				Substrate material UVFS			
			Ø25.4×6 mm		Ø50.8×10 mm		Ø25.4×6 mm		Ø50.8×10 mm	
			Catalogue number		Catalogue number		Catalogue number		Catalogue number	
800±30	Plano-plano	-∞	032-0800-i0		035-0800-i0 *		042-0800-i0		045-0800-i0 *	
800±30	Plano-concave	-50	062-8005		065-8005		082-8005		085-8005	
800±30	Plano-concave	-100	062-8010		065-8010		082-8010		085-8010	
800±30	Plano-concave	-150	062-8015		065-8015		082-8015		085-8015	
800±30	Plano-concave	-200	062-8020		065-8020		082-8020		085-8020	
800±30	Plano-concave	-250	062-8025		065-8025		082-8025		085-8025	
800±30	Plano-concave	-500	062-8050		065-8050		082-8050		085-8050	
800±30	Plano-concave	-1000	062-8100		065-8100		082-8100		085-8100	
800±30	Plano-concave	-2000	062-8200		065-8200		082-8200		085-8200	
800±30	Plano-concave	-2500	062-8250		065-8250		082-8250		085-8250	
800±30	Plano-concave	-4000	062-8400		065-8400		082-8400		085-8400	
800±30	Plano-concave	-5000	062-8500		065-8500		082-8500		085-8500	
800±30	Plano-convex	+100	062-9010		065-9010		082-9010		085-9010	
800±30	Plano-convex	+200	062-9020		065-9020		082-9020		085-9020	
800±30	Plano-convex	+500	062-9050		065-9050		082-9050		085-9050	
800±30	Plano-convex	+1000	062-9100		065-9100		082-9100		085-9100	
800±30	Plano-convex	+2000	062-9200		065-9200		082-9200		085-9200	
800±30	Plano-convex	+4000	062-9400		065-9400		082-9400		085-9400	

* Thickness of plano-plano rear mirrors of Ø50.8 is 8 mm.

Wavelength, nm	Substrate type	Radius, mm	Substrate material BK7				Substrate material UVFS			
			Ø25.4×6 mm		Ø50.8×10 mm		Ø25.4×6 mm		Ø50.8×10 mm	
			Catalogue number		Catalogue number		Catalogue number		Catalogue number	
720 – 880	Plano-plano	-∞	072-7288-i0		075-7288-i0 *		082-7288-i0		085-7288-i0 *	
720 – 880	Plano-concave	-50	062-8005B		065-8005B		082-8005B		085-8005B	
720 – 880	Plano-concave	-100	062-8010B		065-8010B		082-8010B		085-8010B	
720 – 880	Plano-concave	-150	062-8015B		065-8015B		082-8015B		085-8015B	
720 – 880	Plano-concave	-200	062-8020B		065-8020B		082-8020B		085-8020B	
720 – 880	Plano-concave	-250	062-8025B		065-8025B		082-8025B		085-8025B	
720 – 880	Plano-concave	-500	062-8050B		065-8050B		082-8050B		085-8050B	
720 – 880	Plano-concave	-1000	062-8100B		065-8100B		082-8100B		085-8100B	
720 – 880	Plano-concave	-2000	062-8200B		065-8200B		082-8200B		085-8200B	
720 – 880	Plano-concave	-2500	062-8250B		065-8250B		082-8250B		085-8250B	
720 – 880	Plano-concave	-3000	062-8300B		065-8300B		082-8300B		085-8300B	
720 – 880	Plano-concave	-4000	062-8400B		065-8400B		082-8400B		085-8400B	
720 – 880	Plano-concave	-5000	062-8500B		065-8500B		082-8500B		085-8500B	
720 – 880	Plano-convex	+100	062-9010B		065-9010B		082-9010B		085-9010B	
720 – 880	Plano-convex	+200	062-9020B		065-9020B		082-9020B		085-9020B	
720 – 880	Plano-convex	+500	062-9050B		065-9050B		082-9050B		085-9050B	
720 – 880	Plano-convex	+600	062-9060B		065-9060B		082-9060B		085-9060B	
720 – 880	Plano-convex	+1000	062-9100B		065-9100B		082-9100B		085-9100B	
720 – 880	Plano-convex	+1500	062-9150B		065-9150B		082-9150B		085-9150B	
720 – 880	Plano-convex	+2000	062-9200B		065-9200B		082-9200B		085-9200B	
720 – 880	Plano-convex	+4000	062-9400B		065-9400B		082-9400B		085-9400B	

* Thickness of plano-plano rear mirrors of Ø50.8 is 8 mm.

Related Products

Uncoated Curved Windows

See page 1.6

Kinematic Mirror Mount 840-0010

Find more at EksmaOptics.com

Kinematic Mirror and Beamsplitter Mount 840-0020

Find more at EksmaOptics.com

LASER BEAMSPLITTERS

Beamsplitter splits average polarized laser beam in two beams separated 90° from each other. The standard substrate thickness is 3 mm. If you need thinner substrate, please, choose from chapter Precision Thin Round Windows (page 1.10).

Please contact us for wedged beamsplitters or choose wedged substrates from Wedge Prisms (page 1.50)

Coating

Technology	Electron beam multilayer dielectric
Adhesion and Durability	Per MIL-C-675A. Insoluble in lab solvents
Clear Aperture	Exceeds central 85% of diameter
Angle of Incidence	45±3°
Back side antireflection coated	R<0.5%

Substrate

Material	UV grade Fused Silica
S1 Surface Flatness	λ/10 typical at 633 nm
S1 Surface Quality	20–10 scratch & dig (MIL-PRF-13830B)
S2 Surface Flatness	λ/10 typical at 633 nm
S2 Surface Quality	20–10 scratch & dig (MIL-PRF-13830B)
Diameter Tolerance	+0.00 mm; -0.12 mm
Thickness Tolerance	±0.25 mm
Parallelism	< 30 arcsec
Chamfer	0.3 mm at 45° typical

Designed for average polarization: $R=(R_s+R_p)/2$ and $T=(T_s+T_p)/2$. Laser Damage Threshold: >100 mJ/cm^2, 50 fsec pulse, 50 Hz, 800 nm typical

Wavelength, nm	Reflection, %	Transmission, %	Substrate material	Ø12.7 × 3 mm		Ø25.4 × 3 mm		Ø50.8 × 8 mm	
				Catalogue number		Catalogue number		Catalogue number	
1030	20±3	80±3	UV FS	031-7420A		032-7420A		035-7420A	
1030	30±3	70±3	UV FS	031-7430A		032-7430A		035-7430A	
1030	50±3	50±3	UV FS	031-7450A		032-7450A		035-7450A	
1030	70±3	30±3	UV FS	031-7470A		032-7470A		035-7470A	
1030	80±3	20±3	UV FS	031-7480A		032-7480A		035-7480A	
515	20±3	80±3	UV FS	031-7520A		032-7520A		035-7520A	
515	30±3	70±3	UV FS	031-7530A		032-7530A		035-7530A	
515	50±3	50±3	UV FS	031-7550A		032-7550A		035-7550A	
515	70±3	30±3	UV FS	031-7570A		032-7570A		035-7570A	
515	80±3	20±3	UV FS	031-7580A		032-7580A		035-7580A	
343	20±3	80±3	UV FS	031-7620A		032-7620A		035-7620A	
343	30±3	70±3	UV FS	031-7630A		032-7630A		035-7630A	
343	50±3	50±3	UV FS	031-7650A		032-7650A		035-7650A	
343	70±3	30±3	UV FS	031-7670A		032-7670A		035-7670A	
343	80±3	20±3	UV FS	031-7680A		032-7680A		035-7680A	
800	20±3	80±3	UV FS	041-7720A		042-7720A		045-7720A	
800	30±3	70±3	UV FS	041-7730A		042-7730A		045-7730A	
800	50±3	50±3	UV FS	041-7750A		042-7750A		045-7750A	
800	70±3	30±3	UV FS	041-7770A		042-7770A		045-7770A	
800	80±3	20±3	UV FS	041-7780A		042-7780A		045-7780A	
400	20±3	80±3	UV FS	041-7820A		042-7820A		045-7820A	
400	30±3	70±3	UV FS	041-7830A		042-7830A		045-7830A	
400	50±3	50±3	UV FS	041-7850A		042-7850A		045-7850A	
400	70±3	30±3	UV FS	041-7870A		042-7870A		045-7870A	
400	80±3	20±3	UV FS	041-7880A		042-7880A		045-7880A	
266	20±3	80±3	UV FS	041-7920A		042-7920FA		045-7920A	
266	30±3	70±3	UV FS	041-7930A		042-7930FA		045-7930A	
266	50±3	50±3	UV FS	041-7950A		042-7950FA		045-7950A	
266	70±3	30±3	UV FS	041-7970A		042-7970FA		045-7970A	
266	80±3	20±3	UV FS	041-7980A		042-7980FA		045-7980A	

Designed for S- polarization. Laser Damage Threshold: >100 mJ/cm^2, 50 fsec pulse, 50 Hz, 800 nm typical

Wavelength, nm	Reflection, %	Transmission, %	Substrate material	Ø12.7 × 3 mm	Ø25.4 × 3 mm	Ø50.8 × 8 mm
				Catalogue number	Catalogue number	Catalogue number
1030	20±3	80±3	UV FS	031-7420S	032-7420S	035-7420S
1030	30±3	70±3	UV FS	031-7430S	032-7430S	035-7430S
1030	50±3	50±3	UV FS	031-7450S	032-7450S	035-7450S
1030	70±3	30±3	UV FS	031-7470S	032-7470S	035-7470S
1030	80±3	20±3	UV FS	031-7480S	032-7480S	035-7480S
515	20±3	80±3	UV FS	031-7520S	032-7520S	035-7520S
515	30±3	70±3	UV FS	031-7530S	032-7530S	035-7530S
515	50±3	50±3	UV FS	031-7550S	032-7550S	035-7550S
515	70±3	30±3	UV FS	031-7570S	032-7570S	035-7570S
515	80±3	20±3	UV FS	031-7580S	032-7580S	035-7580S
343	20±3	80±3	UV FS	031-7620S	032-7620S	035-7620S
343	30±3	70±3	UV FS	031-7630S	032-7630S	035-7630S
343	50±3	50±3	UV FS	031-7650S	032-7650S	035-7650S
343	70±3	30±3	UV FS	031-7670S	032-7670S	035-7670S
343	80±3	20±3	UV FS	031-7680S	032-7680S	035-7680S
800	20±3	80±3	UV FS	041-7720S	042-7720S	045-7720S
800	30±3	70±3	UV FS	041-7730S	042-7730S	045-7730S
800	50±3	50±3	UV FS	041-7750S	042-7750S	045-7750S
800	70±3	30±3	UV FS	041-7770S	042-7770S	045-7770S
800	80±3	20±3	UV FS	041-7780S	042-7780S	045-7780S
400	20±3	80±3	UV FS	041-7820S	042-7820S	045-7820S
400	30±3	70±3	UV FS	041-7830S	042-7830S	045-7830S
400	50±3	50±3	UV FS	041-7850S	042-7850S	045-7850S
400	70±3	30±3	UV FS	041-7870S	042-7870S	045-7870S
400	80±3	20±3	UV FS	041-7880S	042-7880S	045-7880S
266	20±3	80±3	UV FS	041-7920S	042-7920FS	045-7920S
266	30±3	70±3	UV FS	041-7930S	042-7930FS	045-7930S
266	50±3	50±3	UV FS	041-7950S	042-7950FS	045-7950S
266	70±3	30±3	UV FS	041-7970S	042-7970FS	045-7970S
266	80±3	20±3	UV FS	041-7980S	042-7980FS	045-7980S

Designed for P- polarization. Laser Damage Threshold: >100 mJ/cm^2, 50 fsec pulse, 50 Hz, 800 nm typical

Wavelength, nm	Reflection, %	Transmission, %	Substrate material	Ø12.7 × 3 mm	Ø25.4 × 3 mm	Ø50.8 × 8 mm
				Catalogue number	Catalogue number	Catalogue number
1030	20±3	80±3	UV FS	031-7420P	032-7420P	035-7420P
1030	30±3	70±3	UV FS	031-7430P	032-7430P	035-7430P
1030	50±3	50±3	UV FS	031-7450P	032-7450P	035-7450P
1030	70±3	30±3	UV FS	031-7470P	032-7470P	035-7470P
1030	80±3	20±3	UV FS	031-7480P	032-7480P	035-7480P
515	20±3	80±3	UV FS	031-7520P	032-7520P	035-7520P
515	30±3	70±3	UV FS	031-7530P	032-7530P	035-7530P
515	50±3	50±3	UV FS	031-7550P	032-7550P	035-7550P
515	70±3	30±3	UV FS	031-7570P	032-7570P	035-7570P
515	80±3	20±3	UV FS	031-7580P	032-7580P	035-7580P
343	20±3	80±3	UV FS	031-7620P	032-7620P	035-7620P
343	30±3	70±3	UV FS	031-7630P	032-7630P	035-7630P
343	50±3	50±3	UV FS	031-7650P	032-7650P	035-7650P
343	70±3	30±3	UV FS	031-7670P	032-7670P	035-7670P
343	80±3	20±3	UV FS	031-7680P	032-7680P	035-7680P
800	20±3	80±3	UV FS	041-7720P	042-7720P	045-7720P
800	30±3	70±3	UV FS	041-7730P	042-7730P	045-7730P
800	50±3	50±3	UV FS	041-7750P	042-7750P	045-7750P
800	70±3	30±3	UV FS	041-7770P	042-7770P	045-7770P
800	80±3	20±3	UV FS	041-7780P	042-7780P	045-7780P
400	20±3	80±3	UV FS	041-7820P	042-7820P	045-7820P
400	30±3	70±3	UV FS	041-7830P	042-7830P	045-7830P
400	50±3	50±3	UV FS	041-7850P	042-7850P	045-7850P
400	70±3	30±3	UV FS	041-7870P	042-7870P	045-7870P
400	80±3	20±3	UV FS	041-7880P	042-7880P	045-7880P
266	20±3	80±3	UV FS	041-7920P	042-7920FP	045-7920P
266	30±3	70±3	UV FS	041-7930P	042-7930FP	045-7930P
266	50±3	50±3	UV FS	041-7950P	042-7950FP	045-7950P
266	70±3	30±3	UV FS	041-7970P	042-7970FP	045-7970P
266	80±3	20±3	UV FS	041-7980P	042-7980FP	045-7980P

BROADBAND LASER BEAMSPLITTERS

Designed for S- polarization. Laser Damage Threshold: >50 mJ/cm², 50 fsec pulse, 50 Hz, 800 nm typical

Wavelength, nm	Reflection, %	Transmission, %	Substrate material	Ø25.4 × 3 mm		Ø50.8 × 6 mm	
				Catalogue number		Catalogue number	
720 – 880	8±1	92±1	UV FS	042-7708SB		045-7708SB	
720 – 880	20±5	80±5	UV FS	042-7720SB		045-7720SB	
720 – 880	30±5	70±5	UV FS	042-7730SB		045-7730SB	
720 – 880	40±5	60±5	UV FS	042-7740SB		045-7740SB	
720 – 880	50±5	50±5	UV FS	042-7750SB		045-7750SB	
720 – 880	60±5	40±5	UV FS	042-7760SB		045-7760SB	
720 – 880	70±5	30±5	UV FS	042-7770SB		045-7770SB	
720 – 880	80±5	20±5	UV FS	042-7780SB		045-7780SB	
720 – 880	90±3	10±3	UV FS	042-7790SB		045-7790SB	
720 – 880	95±2	5±2	UV FS	042-7795SB		045-7795SB	

Designed for P- polarization. Laser Damage Threshold: >50 mJ/cm², 50 fsec pulse, 50 Hz, 800 nm typical

Wavelength, nm	Reflection, %	Transmission, %	Substrate material	Ø25.4 × 3 mm		Ø50.8 × 6 mm	
				Catalogue number		Catalogue number	
750 – 850	10±2	90±2	UV FS	042-7708PB		045-7708PB	
750 – 850	20±5	80±5	UV FS	042-7720PB		045-7720PB	
750 – 850	25±5	75±5	UV FS	042-7725PB		045-7725PB	
750 – 850	30±5	70±5	UV FS	042-7730PB		045-7730PB	
750 – 850	40±5	60±5	UV FS	042-7740PB		045-7740PB	
750 – 850	50±5	50±5	UV FS	042-7750PB		045-7750PB	
750 – 850	60±5	40±5	UV FS	042-7760PB		045-7760PB	
750 – 850	70±5	30±5	UV FS	042-7770PB		045-7770PB	
750 – 850	75±5	25±5	UV FS	042-7775PB		045-7775PB	
750 – 850	80±5	20±5	UV FS	042-7780PB		045-7780PB	
750 – 850	85±3	15±3	UV FS	042-7785PB		045-7785PB	
750 – 850	90±3	10±3	UV FS	042-7790PB		045-7790PB	
750 – 850	95±2	5±2	UV FS	042-7795PB		045-7795PB	

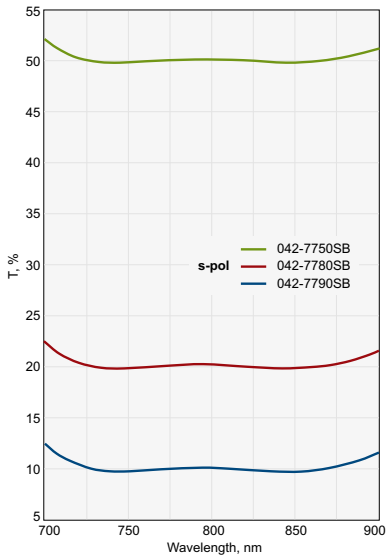
Related Products

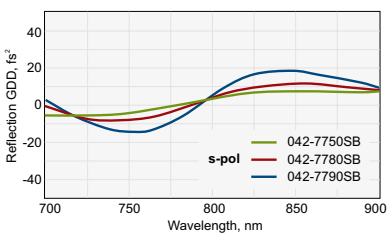
Uncoated Elliptical Mirrors
See page 1.8

Kinematic Mirror and Beamsplitter Mount 840-0030-02
Find more at EksmaOptics.com

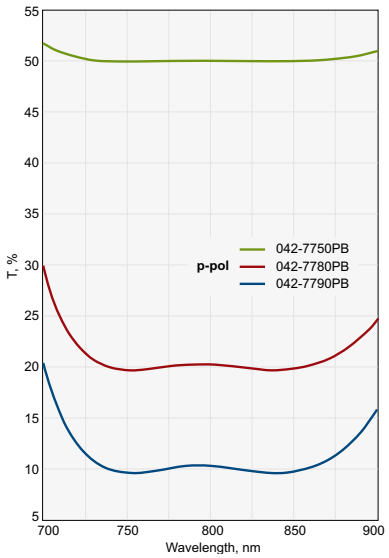
Adapter for Beamsplitter at 45° 840-0116
Find more at EksmaOptics.com

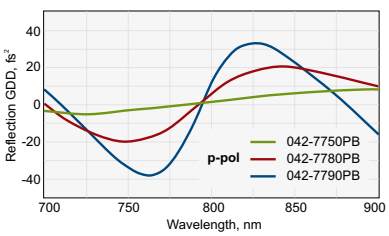
Flipping Mirror / Beamsplitter Mount 840-0155
Find more at EksmaOptics.com





042-7750SB. Rs=50±5% @ 720–880 nm, AOI=45°
042-7780SB. Rp=80±5% @ 720–880 nm, AOI=45°
042-7790SB. Rp=90±3% @ 720–880 nm, AOI=45°





042-7750PB. Rp=50±5% @ 750–850 nm, AOI=45°
042-7780PB. Rp=80±5% @ 750–850 nm, AOI=45°
042-7790PB. Rp=90±3% @ 750–850 nm, AOI=45°

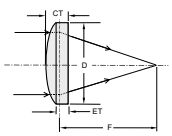
THIN LENSES

Features

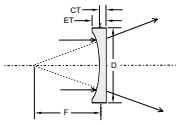
- Very thin: edge thickness varies from 0.5~1.9 mm
- Centre thickness varies from 1~3 mm
- Plano-Convex or Plano-Concave type
- Uncoated,
  AR coated @ 333-353 nm, AR coated @ 380-420 nm,
  AR coated @ 500-530 nm, AR coated @ 515+1030 nm,
  AR coated @ 760-840 nm, AR coated @ 1000-1060 nm,
  BBAR @ 700-900 nm, UBBAR @ 350-900 nm

Specifications

Material	UV FS
Surface quality	40 – 20 scratch & dig (MIL-PRF-13830B)
Clear aperture	90% of the diameter
Diameter tolerance	+0.00; -0.12 mm
Thickness tolerance	±0.2 mm
Surface irregularity	λ/8 @ 633 nm
Concentricity	3 arcmin
Paraxial focal length	±2% @ 800 nm



Plano-convex lens



Plano-concave lens

THIN PLANO-CONCAVE LENSES, Ø12.7 mm

Uncoated lenses. Material – UVFS

Focal Length, mm @ 800 nm	Centre Thickness CT, mm	Edge Thickness ET, mm	Radius, mm	Catalogue number	
-20	1	3.5	-9.1	112-1104ET	
-30	1	2.5	-13.6	112-1106ET	
-40	1	2.1	-18.1	112-1108ET	
-50	1	1.9	-22.7	112-1109ET	
-60	1	1.7	-27.2	112-1110ET	
-75	1	1.5	-34.0	112-1112ET	
-80	1	1.5	-36.3	112-1113ET	
-100	1	1.4	-45.3	112-1115ET	
-125	1	1.3	-56.7	112-1117ET	
-150	1	1.2	-68.0	112-1119ET	

THIN PLANO-CONCAVE LENSES, Ø25.4 mm

Uncoated lenses. Material – UVFS

Focal Length, mm @ 800 nm	Centre Thickness CT, mm	Edge Thickness ET, mm	Radius, mm	Catalogue number	
-50	1.5	5.4	-22.7	112-1205ET	
-75	1.5	4.0	-34.0	112-1209ET	
-100	1.5	3.3	-45.4	112-1211ET	
-125	1.5	3.0	-56.7	112-1215ET	
-150	1.5	2.7	-68.0	112-1217ET	
-200	1.5	2.4	-90.7	112-1219ET	
-250	1.5	2.3	-113.3	112-1221ET	
-300	1.5	2.1	-136.0	112-1223ET	
-500	1.5	1.9	-226.7	112-1233ET	

THIN PLANO-CONVEX LENSES, Ø12.7 mm

Uncoated lenses. Material – UVFS

Focal Length, mm @ 800 nm	Centre Thickness CT, mm	Edge Thickness ET, mm	Radius, mm	Catalogue number	
30	2.5	1.0	13.6	110-1106ET	
40	1.8	0.7	18.1	110-1108ET	
50	1.9	1.0	22.7	110-1109ET	
75	1.8	1.2	34.0	110-1111ET	
100	1.5	0.9	45.3	110-1115ET	
125	1.4	1.0	56.7	110-1117ET	
150	1.5	1.2	68.0	110-1119ET	
175	1.2	1.0	79.3	110-1121ET	
200	1.2	1.0	90.7	110-1123ET	
250	1.1	1.0	113.3	110-1126ET	
300	1.1	1.0	136.0	110-1129ET	
400	1.1	1.0	181.3	110-1133ET	
450	1.1	1.0	204.0	110-1135ET	
500	1.1	1.0	226.7	110-1137ET	

THIN PLANO-CONVEX LENSES, Ø25.4 mm

Uncoated lenses. Material – UVFS

Focal Length, mm @ 800 nm	Centre Thickness CT, mm	Edge Thickness ET, mm	Radius, mm	Catalogue number	
50	4.9	1.0	22.7	110-1205ET	
75	3	0.5	34.0	110-1209ET	
80	3	0.7	36.3	110-1210ET	
100	2.5	0.7	45.3	110-1211ET	
125	2	0.6	56.7	110-1216ET	
150	2	0.8	68.0	110-1217ET	
200	2	1.1	90.7	110-1219ET	
250	2	1.3	113.3	110-1221ET	
300	2	1.4	136.0	110-1223ET	
350	2	1.5	158.7	110-1225ET	
400	2	1.6	181.3	110-1227ET	
450	2	1.6	204.0	110-1231ET	
500	2	1.6	226.7	110-1233ET	
1000	1.5	1.3	453.3	110-1245ET	
1500	1.4	1.3	680.0	110-1255ET	
2000	1.4	1.3	906.6	110-1265ET	
3000	1.4	1.3	1360.1	110-1267ET	

THIN PLANO-CONVEX LENSES, Ø50.8 mm

Uncoated lenses. Material – UVFS

Focal Length, mm @ 800 nm	Centre Thickness CT, mm	Edge Thickness ET, mm	Radius, mm	Catalogue number	
75	14	2.5	34.0	110-1505ET	
100	10.3	2.5	45.3	110-1509ET	
150	7.4	2.5	68.0	110-1511ET	
200	6.1	2.5	90.7	110-1515ET	
300	4.9	2.5	136.0	110-1519ET	
400	4.3	2.5	181.3	110-1523ET	
500	3.9	2.5	226.7	110-1527ET	
1000	3.2	2.5	453.3	110-1545ET	
1500	3	2.5	680.0	110-1550ET	
2000	2.9	2.5	906.6	110-1555ET	
3000	2.7	2.5	1360.0	110-1566ET	
4000	2.7	2.5	1813.3	110-1568ET	
5000	2.6	2.5	2266.6	110-1567ET	
6000	2.6	2.5	2719.9	110-1570ET	

AVAILABLE STANDARD COATINGS FOR THIN LENSES

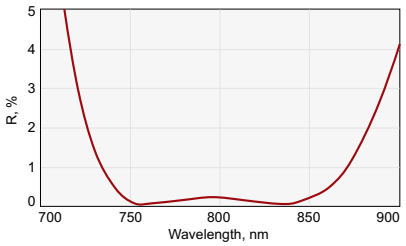
Specifications

Technology	Electron beam multilayer dielectric
Adhesion and Durability	Per MIL-C-675A. Insoluble in lab solvents
Clear Aperture	Exceeds central 85% of diameter
Angle of Incidence	0°
Coated Surface Flatness	λ/10 at 633 nm over clear aperture

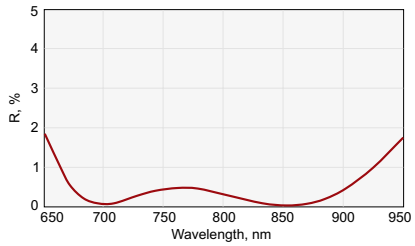
Available Coatings

Wavelength	Reflection per surface	Laser Damage Threshold *	Coating suffix	
760 – 840 nm	R<0.5%	100 mJ/cm²	**AR800**	
700 – 900 nm	R<0.5%	50 mJ/cm²	**ARB800**	
350 – 900 nm	R<1.5%	50 mJ/cm²	**ARB625**	
1000 – 1060 nm	R<0.3%	100 mJ/cm²	**AR1030**	
500 – 530 nm	R<0.4%	100 mJ/cm²	**AR515**	
380 – 420 nm	R<0.5%	100 mJ/cm²	**AR400**	
333 – 353 nm	R<0.5%	100 mJ/cm²	**AR343**	
515 + 1030 nm	R<0.5%	100 mJ/cm²	**ARD1030**	

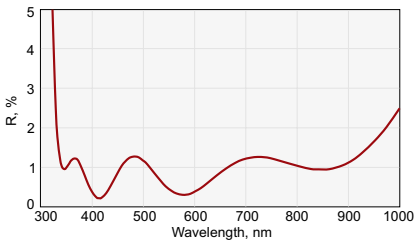
* Measured at design wavelength, 50 fs, 50 Hz.



Reflectivity @ 760-840 nm



Reflectivity @ 700-900 nm



Reflectivity @ 350-900 nm

AVAILABLE IBS COATINGS FOR THIN LENSES

Specifications

Technology	Ion Beam Sputtering (IBS)
Adhesion and Durability	Per MIL-C-675A. Insoluble in lab solvents
Clear Aperture	Exceeds central 85% of diameter
Angle of Incidence	0°
Coated Surface Flatness	λ/10 at 633 nm over clear aperture

Available Coatings

Wavelength	Reflection per surface	Laser Damage Threshold *	Coating suffix	
760 – 840 nm	R<0.1%	100 mJ/cm²	**AR800HT**	
700 – 900 nm	R<0.1%	100 mJ/cm²	**ARB800HT**	
380 – 420 nm	R<0.2%	50 mJ/cm²	**AR400HT**	
400 + 800 nm	R<0.2%	50 mJ/cm²	**ARD800HT**	
1000 – 1060 nm	R<0.1%	100 mJ/cm²	**AR1030HT**	
500 – 530 nm	R<0.1%	50 mJ/cm²	**AR515HT**	
333 – 353 nm	R<0.2%	25 mJ/cm²	**AR343HT**	
515 + 1030 nm	R<0.1%	50 mJ/cm²	**ARD1030HT**	

* Measured at design wavelength, 50 fs, 50 Hz.

Ordering of Coated Thin Lenses

Please choose the coating and add its suffix to the lens code.

Example:

UVFS Thin Plano-Convex Lens, focal length 75 mm, coated AR / AR @ 760-840 nm
Code: **110-1209ET** + **AR800**,
Lens code | Coating code

AR COATED LENS KITS

Large Spherical Lens Kit

LARGE UV FS SPHERICAL LENS KIT (40 pcs.)

Coating	Catalogue number	
BBAR @ 210 – 400 nm, R<2%	140-1240-AR210-400	
BBAR @ 350 – 900 nm, R<1.5%	140-1240-AR350-900	
BBAR @ 760 – 840 nm, R<0.4%	140-1240-AR760-840	
BBAR @ 700 – 900 nm, R<0.8%	140-1240-AR700-900	
BBAR @ 650 – 1100 nm, R<1%	140-1240-AR650-1100	
AR @ 266 nm, R<0.4%	140-1240-AR266	
AR @ 1030 nm, R<0.25%	140-1240-AR1030	
AR @ 515 nm, R<0.25%	140-1240-AR515	
AR @ 343 nm, R<0.3%	140-1240-AR343	
AR @ 258 nm, R<0.4%	140-1240-AR258	

Lens kits contain different types of spherical (plano-convex, biconvex, plano-concave, biconcave) or cylindrical (plano-convex, plano-concave) lenses with various focal lengths. Kits are packed into foam lined plastic boxes for safe handling and storage. Kits are available with laser line and broadband multilayer anti-reflection coatings.

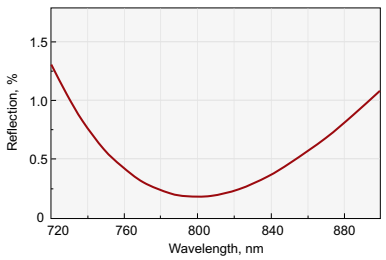
Spherical lens kits consist of 40 (large kit) or 15 (small kit) Ø25.4 mm lenses made of UVFS.

Cylindrical lens kits consist of 12 rectangular lenses (25.4 × 50.8 mm) made of UVFS.

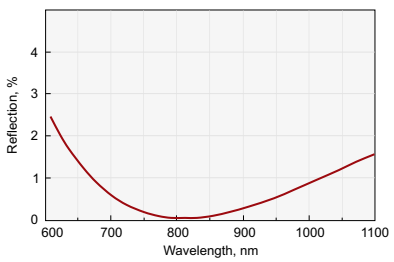
Large UV FS Spherical Lens Kit

Type	Dia, mm	F, mm	Catalogue number
pl/cx	25.4	30	110-1203E
pl/cx	25.4	50	110-1205E
pl/cx	25.4	75	110-1209E
pl/cx	25.4	80	110-1210E
pl/cx	25.4	100	110-1211E
pl/cx	25.4	125	110-1216E
pl/cx	25.4	150	110-1217E
pl/cx	25.4	200	110-1219E
pl/cx	25.4	250	110-1221E
pl/cx	25.4	300	110-1223E
pl/cx	25.4	350	110-1225E
pl/cx	25.4	400	110-1227E
pl/cx	25.4	500	110-1233E
pl/cx	25.4	600	110-1235E
pl/cx	25.4	750	110-1239E
pl/cx	25.4	1000	110-1245E
bi/cx	25.4	25	111-1204E
bi/cx	25.4	40	111-1207E
bi/cx	25.4	50	111-1210E
bi/cx	25.4	75	111-1214E

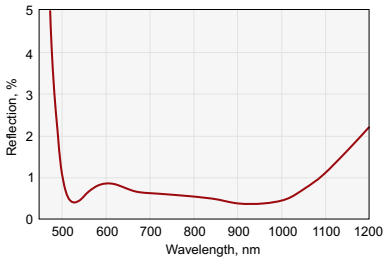
Type	Dia, mm	F, mm	Catalogue number
bi/cx	25.4	100	111-1218E
bi/cx	25.4	150	111-1222E
bi/cx	25.4	200	111-1226E
bi/cx	25.4	250	111-1230E
bi/cx	25.4	300	111-1234E
bi/cx	25.4	400	111-1238E
bi/cx	25.4	500	111-1240E
bi/cx	25.4	1000	111-1260E
pl/cv	25.4	-50	112-1205E
pl/cv	25.4	-75	112-1209E
pl/cv	25.4	-100	112-1211E
pl/cv	25.4	-150	112-1217E
pl/cv	25.4	-200	112-1219E
pl/cv	25.4	-300	112-1223E
bi/cv	25.4	-25	114-1204E
bi/cv	25.4	-50	114-1208E
bi/cv	25.4	-75	114-1212E
bi/cv	25.4	-100	114-1216E
bi/cv	25.4	-150	114-1220E
bi/cv	25.4	-200	114-1224E



R<0.5% @ 760-840 nm, AOI= 0°



R<0.8% @ 700-900 nm, AOI= 0°



R<1.5% @ 500-1100 nm, AOI=0°

SMALL UV FS SPHERICAL LENS KIT (15 pcs.)

Coating	Code	
BBAR @ 210 – 400 nm, R<2%	140-1215-AR210-400	
BBAR @ 350 – 900 nm, R<1.5%	140-1215-AR350-900	
BBAR @ 760 – 840 nm, R<0.4%	140-1215-AR760-840	
BBAR @ 700 – 900 nm, R<0.8%	140-1215-AR700-900	
BBAR @ 650 – 1100 nm, R<1%	140-1215-AR650-1100	
AR @ 266 nm, R<0.4%	140-1215-AR266	
AR @ 1030 nm, R<0.25%	140-1215-AR1030	
AR @ 515 nm, R<0.25%	140-1215-AR515	
AR @ 343 nm, R<0.3%	140-1215-AR343	
AR @ 258 nm, R<0.4%	140-1215-AR258	

Small UV FS Spherical Lens Kit

Type	Dia, mm	F, mm	Catalogue number
pl/cx	25.4	30	110-1203E
pl/cx	25.4	50	110-1205E
pl/cx	25.4	75	110-1209E
pl/cx	25.4	100	110-1211E
pl/cx	25.4	125	110-1216E
pl/cx	25.4	150	110-1217E
pl/cx	25.4	200	110-1219E
pl/cx	25.4	300	110-1223E

Type	Dia, mm	F, mm	Catalogue number
pl/cx	25.4	500	110-1233E
pl/cx	25.4	1000	110-1245E
pl/cv	25.4	-50	112-1205E
pl/cv	25.4	-75	112-1209E
pl/cv	25.4	-100	112-1211E
pl/cv	25.4	-125	112-1215E
pl/cv	25.4	-150	112-1217E

UV FS CYLINDRICAL LENS KIT (12 pcs.)

Coating	Catalogue number	
AR @ 210 – 400nm, R<2%	140-1212-ARB300	
AR @ 350 – 900nm, R<1.5%	140-1212-ARB625	
AR @ 515 + 1030nm, R<0.5%	140-1212-ARD1030	
AR @ 700 – 900nm, R<0.5%	140-1212-ARB800	
AR @ 650 – 1100nm, R<0.7%	140-1212-ARB825	
AR @ 1000 – 1060nm, R<0.3%	140-1212-AR1030	
AR @ 515 + 1030nm, R<0.1%	140-1212-ARD1030HT	
AR @ 700 – 900nm, R<0.1%	140-1212-ARB800HT	
AR @ 900 – 1100nm, R<0.1%	140-1212-ARB1000HT	

UV FS Cylindrical Lens Kit

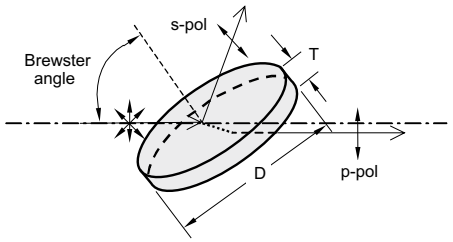
Type	Size, mm	F, mm	Catalogue number
pl/cx	25.4 × 50.8	50	120-1205E
pl/cx	25.4 × 50.8	75	120-1210E
pl/cx	25.4 × 50.8	100	120-1215E
pl/cx	25.4 × 50.8	150	120-1220E
pl/cx	25.4 × 50.8	200	120-1225E
pl/cx	25.4 × 50.8	300	120-1230E
pl/cx	25.4 × 50.8	500	120-1235E

Type	Size, mm	F, mm	Catalogue number
pl/cx	25.4 × 50.8	1000	120-1240E
pl/cv	25.4 × 50.8	-50	122-1205E
pl/cv	25.4 × 50.8	-75	122-1210E
pl/cv	25.4 × 50.8	-100	122-1215E
pl/cv	25.4 × 50.8	-150	122-1220E

THIN FILM POLARIZERS (56° Angle of Incidence)

Thin film polarizers separate s- and p- polarization components. Due to their high laser damage threshold, thin film polarizers can be used as an alternative to Glan-Taylor laser polarizing prisms or cube polarizing beamsplitters.

Femtoline thin film laser polarizers are designed for use in high energy lasers. They can be used for Yb:KYW/KGW or Ti:Sapphire laser fundamental wavelengths or their harmonics, as well as intracavity Q-switch hold-off polarizers. The most efficient way to use these polarizers is at Brewster's angle – 56 ± 2°.



Specifications

Material	BK7, UV FS
Surface quality	20 – 10 scratch & dig (MIL-PRF-13830B)
Transmitted wavefront distortion	λ/10 @ 633 nm
Angle of incidence (AOI)	56 ± 2°
Laser damage threshold	>100 mJ/cm², 50 fsec pulse, 50 Hz, 800 nm typical

THIN FILM POLARIZERS WITH HIGH EXTINCTION RATIO

Round Polarizers. Material – UV FS. Tp > 98%, Ts < 0.1%.
Extinction ratio for transmitted light Tp/Ts: >1000:1

Wavelength, nm	Diameter D, mm	Thickness T, mm	Catalogue number	
343	25.4	3	420-1242HE	
515	25.4	3	420-1244HE	
800	25.4	3	420-1256HE	
780 – 820	25.4	3	420-1266HE	
1030	25.4	3	420-1248HE	

Rectangular Polarizers. Material – UV FS. Tp > 98%, Ts < 0.1%.
Extinction ratio for transmitted light Tp/Ts: >1000:1

Wavelength, nm	Rectangular dimensions		Thickness T, mm	Catalogue number	
	Length, mm	Width, mm			
1030	20	15	6	420-1478HE	
1030	30	20	6	420-1578HE	

HIGH TRANSMISSION THIN FILM POLARIZERS

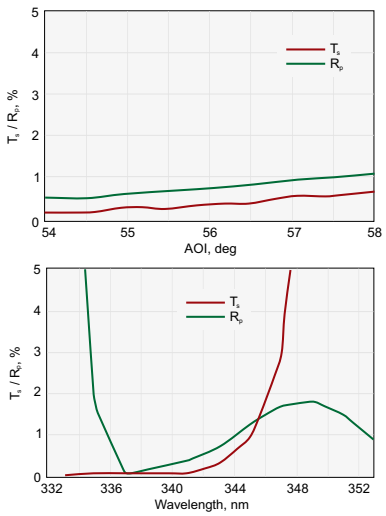
Round Polarizers. Material – UV FS. Rs / Tp > 99.5 / 99.0%.
Extinction ratio for transmitted light Tp/Ts >200:1

Wavelength, nm	Diameter D, mm	Thickness T, mm	Catalogue number	
343	25.4	3.0	420-1242HT	
515	25.4	3.0	420-1244HT	
800	25.4	3.0	420-1256HT	
1030	25.4	3.0	420-1248HT	

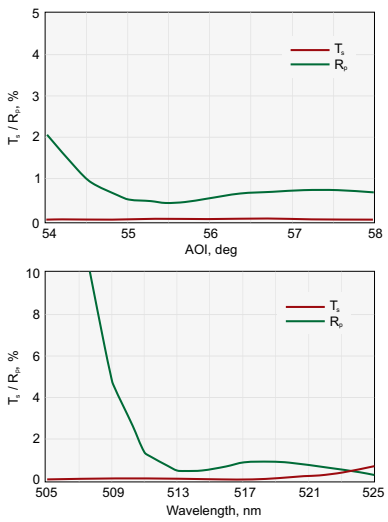
ULTRA HIGH TRANSMISSION THIN FILM POLARIZERS

Round Polarizers. Material – UV FS. Ts < 0.2%, Rp < 0.2%.
Extinction ratio for transmitted light Tp/Ts >500:1

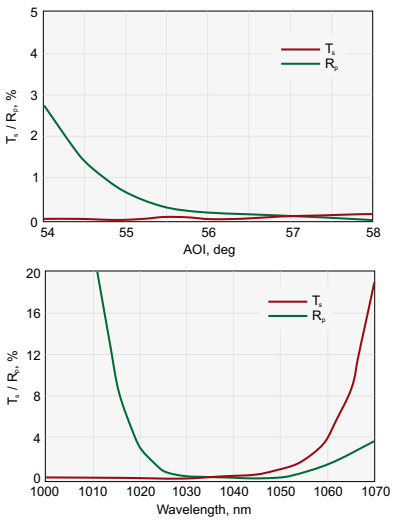
Wavelength, nm	Diameter D, mm	Thickness T, mm	Catalogue number	
800	25.4	3.0	420-1256UHT	
1030	25.4	3.0	420-1248UHT	



420-1242HT.
High Transmission @ 343 nm,
Rs/Tp > 99.5/99.0 %, AOI=56°

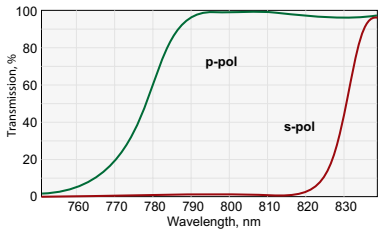


420-1244HT.
High Transmission @ 515 nm,
Rs/Tp > 99.5/99.0 %, AOI=56°

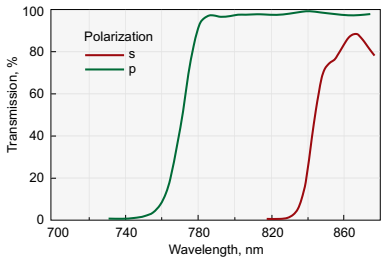


420-1248HT.
High Transmission @ 1030 nm,
Rs/Tp > 99.5/99.0 %, AOI=56°

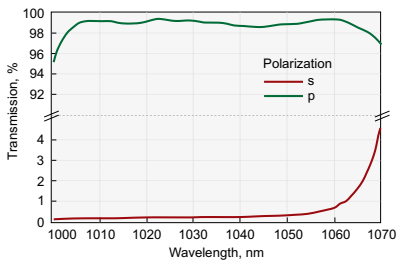
STANDARD THIN FILM POLARIZERS



420-0126E.
Transmission @ 800 nm,
Rs/Tp > 99.5/95.0 %, AOI=56°



420-0266E.
Transmission @ 780-820 nm,
Rs/Tp > 99.5/95.0 %, AOI=56°



420-0268E.
Transmission @ 1010-1050 nm,
Rs/Tp > 99.5/95.0 %, AOI=56°

Please contact us if you need thin film laser polarizers of other wavelengths or other types of substrates.

Round Polarizers. Material – BK7. Rs / Tp > 99.5 / 95.0%.
Extinction ratio for transmitted light Tp/Ts >200:1

Wavelength, nm	Diameter D, mm	Thickness T, mm	Catalogue number	
515	12.7	3.0	420-0114E	
800	12.7	3.0	420-0126E	
780-820	12.7	3.0	420-0136E	
1030	12.7	3.0	420-0118E	
1010-1050	12.7	3.0	420-0138E	
515	25.4	3.0	420-0244E	
800	25.4	3.0	420-0256E	
780-820	25.4	3.0	420-0266E	
1030	25.4	3.0	420-0248E	
1010-1050	25.4	3.0	420-0268E	
515	50.8	6.0	420-0514E	
800	50.8	6.0	420-0506E	
780-820	50.8	6.0	420-0526E	
1030	50.8	6.0	420-0518E	
1010-1050	50.8	6.0	420-0528E	

Rectangular Polarizers. Material – BK7. Rs / Tp > 99.5 / 95.0%.
Extinction ratio for transmitted light Tp/Ts >200:1

Wavelength, nm	Rectangular dimensions		Thickness T, mm	Catalogue number
	Length, mm	Width, mm		
515	28.6	14.3	3.0	420-0274
800	28.6	14.3	3.0	420-0286
780-820	28.6	14.3	3.0	420-0296
1030	28.6	14.3	3.0	420-0278
1010-1050	28.6	14.3	3.0	420-0298

Round Polarizers. Material – UV FS. Rs / Tp > 99.5 / 95.0%.
Extinction ratio for transmitted light Tp/Ts >200:1

Wavelength, nm	Diameter D, mm	Thickness T, mm	Catalogue number	
343	12.7	3.0	420-1112E	
400	12.7	3.0	420-1123E	
515	12.7	3.0	420-1114E	
800	12.7	3.0	420-1126E	
780-820	12.7	3.0	420-1136E	
1030	12.7	3.0	420-1118E	
1010-1050	12.7	3.0	420-1138E	
343	25.4	3.0	420-1242E	
400	25.4	3.0	420-1253E	
515	25.4	3.0	420-1244E	
800	25.4	3.0	420-1256E	
780-820	25.4	3.0	420-1266E	
1030	25.4	3.0	420-1248E	
1010-1050	25.4	3.0	420-1268E	
343	50.8	6.0	420-1512E	
400	50.8	6.0	420-1503E	
515	50.8	6.0	420-1514E	
800	50.8	6.0	420-1506E	
780-820	50.8	6.0	420-1526E	
1030	50.8	6.0	420-1518E	
1010-1050	50.8	6.0	420-1528E	

Rectangular Polarizers. Material – UV FS. Rs / Tp > 99.5 / 95.0%.
Extinction ratio for transmitted light Tp/Ts >2 00:1

Wavelength, nm	Rectangular dimensions		Thickness T, mm	Catalogue number
	Length, mm	Width, mm		
343	28.6	14.3	3.0	420-1272
400	28.6	14.3	3.0	420-1283
515	28.6	14.3	3.0	420-1274
800	28.6	14.3	3.0	420-1286
780-820	28.6	14.3	3.0	420-1296
1030	28.6	14.3	3.0	420-1278
1010-1050	28.6	14.3	3.0	420-1298

Related Products

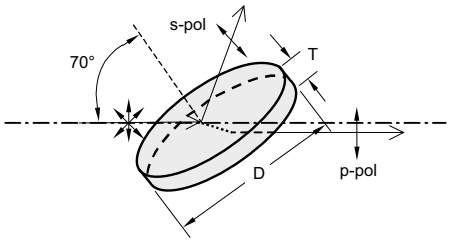
Glan Laser Polarizing, Wollaston Prisms
See page 1.62

Adapters for Polarizer at 56° 840-0117, 840-0118
Find more at EksmaOptics.com

Variable Attenuators for Linearly Polarized Laser Beam 990-0070
See page 4.31

THIN FILM POLARIZERS (70° Angle of Incidence)

Broadband thin film polarizers separate the s- and p-polarization components in broad region at 70° angle of incidence (AOI). These polarizers are designed to be used in high energy laser systems, typically as extracavity attenuators for femtosecond lasers. Polarizers are made form UV fused silica and feature a high laser damage threshold – up to 50 mJ/cm², 50 fsec pulse, 50 Hz, 800 nm typical.



Specifications

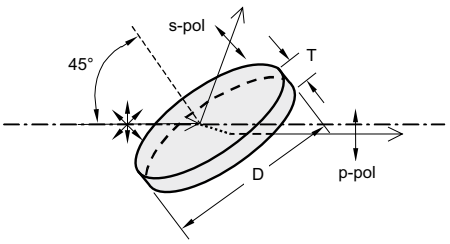
Substrate material	UV FS
Surface quality	20 – 10 scratch & dig (MIL-PRF-13830B)
Transmitted wavefront distortion	λ/10 @ 633 nm
Clear aperture	>90% of diameter
Angle of incidence (AOI)	70 ± 2°
Parallelism	<30 arcsec

Rectangular Polarizers. Material – UV FS. Rs / Tp > 99.5 / 95.0%.
Extinction ratio for transmitted light Tp/Ts >200:1

Centre wavelength, nm	Operating wavelength region, nm	Rectangular dimensions		Thickness T, mm	Catalogue number	
		Length, mm	Width, mm			
800	750 – 850	60.0	20.0	4.0	**420-1696BBi70**	
1030	980 – 1080	60.0	20.0	4.0	**420-1698BBi70**	

THIN FILM POLARIZERS (45° Angle of Incidence)

These thin film polarizers separate or combine the s- and p-polarization components at 45° angle of incidence. They are designed for use in high energy lasers. Polarizers are made from UV FS and feature high laser damage threshold reaching 10 J/cm² at 1064 nm.



Specifications

Substrate material	UV FS
Surface quality	20 – 10 scratch & dig (MIL-PRF-13830B)
Transmitted wavefront distortion	λ/10 @ 633 nm
Clear aperture	>90% of diameter
Angle of incidence (AOI)	45 ± 2°
Parallelism	<30 arcsec

TF POLARIZERS WITH HIGH EXTINCTION RATIO

Round Polarizers. Material – UV FS. Tp > 98%, Ts < 0.1%.
Extinction ratio for transmitted light Tp/Ts: >1000:1

Wavelength, nm	Diameter D, mm	Thickness T, mm	Catalogue number	
343	25.4	3	**420-1242i45HE**	
515	25.4	3	**420-1244i45HE**	
1030	25.4	3	**420-1248i45HE**	
343	50.8	6	**420-1512i45HE**	
515	50.8	6	**420-1514i45HE**	
1030	50.8	6	**420-1518i45HE**	

STANDARD THIN FILM POLARIZERS

Round Polarizers. Material – UV FS. Rs / Tp > 99.5 / 95.0%.
Extinction ratio for transmitted light Tp/Ts >200:1

Wavelength, nm	Diameter D, mm	Thickness T, mm	Catalogue number	
343	25.4	3	**420-1242i45**	
515	25.4	3	**420-1244i45**	
1030	25.4	3	**420-1248i45**	
343	50.8	6	**420-1512i45**	
515	50.8	6	**420-1514i45**	
1030	50.8	6	**420-1518i45**	

QUARTZ RETARDATION WAVEPLATES

Quartz Retardation Plates are made of material enabling linear birefringence. These plates are made of high quality optical grade crystalline quartz, featuring high damage threshold. Retardation plates rotate polarization's direction (λ/2) or convert linear into circular polarization or vice versa (λ/4). Quartz retardation plates are supplied mounted and AR coated.

ZERO ORDER OPTICALLY CONTACTED WAVEPLATES

Features

- Easily aligned
- Temperature insensitive
- Moderately insensitive to wavelength

Zero order plates are comprised of two different plates cut parallel to their optical axis. This construction makes plates less dependent on temperature. The plates are polished to different thicknesses enabling one to achieve required retardation difference. These component plates have orthogonal optic axis directions, so that the roles of the ordinary and extraordinary rays are interchanged in passing from one plate to another. The thickness of the plate determines the phase shift between the ordinary and extraordinary beams for any specific wavelength.

Specifications

Material	Single crystal quartz
Optical axis	normal to facet on circumference of retarder
Surface quality	20 – 10 scratch & dig (MIL-PRF-13830B)
Wavefront distortion	λ/10 @ 633 nm
Parallelism	< 10 arcsec
AR coating	R < 0.5%
Laser damage threshold	> 10 mJ/cm², 50 fsec pulse, 800 nm typical

Ø12.7 mm waveplates. Clear aperture Ø11 mm, unmounted

Center wavelength, nm	AR coating range, nm	Retardation λ/2		Retardation λ/4	
		Catalogue number		Catalogue number	
1030	1000-1060	460-4208D12		460-4408D12	
800	760-840	460-4215D12		460-4415D12	
780	740-820	460-4220D12		460-4420D12	
515	500-530	460-4232D12		460-4432D12	
400	380-420	460-4235D12		460-4435D12	
343	333-353	460-4241D12		460-4441D12	
266	257-275	460-4245D12		460-4445D12	
257	250-265	460-4246D12		460-4446D12	

Ø20 mm waveplates. Clear aperture Ø17 mm, mounted into Ø25.4 mm ring holder

Center wavelength, nm	AR coating range, nm	Retardation λ/2		Retardation λ/4	
		Catalogue number		Catalogue number	
1030	1000-1060	460-4208		460-4408	
800	760-840	460-4215		460-4415	
780	740-820	460-4220		460-4420	
515	500-530	460-4232		460-4432	
400	380-420	460-4235		460-4435	
343	333-353	460-4241		460-4441	
266	257-275	460-4245		460-4445	
257	250-265	460-4246		460-4446	

Related Products

Achromatic Air-Spaced Waveplates
See page 1.67

Polarizer Holder 840-0180
Find more at EksmaOptics.com

High Precision Rotation Polarizer, Waveplate Mount 840-0186
Find more at EksmaOptics.com

ZERO ORDER AIR-SPACED WAVEPLATES

Features

- For high power laser applications

Specifications

Material	Single crystal quartz
Optical axis	normal to facet on circumference of retarder
Clear aperture	Ø17 mm
Ring mount outer diameter	25.4 +0.0 / -0.12 mm
Wavefront distortion	λ/10 @ 633 nm
Surface quality	20 – 10 scratch & dig (MIL-PRF-13830B)
Parallelism	< 10 arcsec
AR coating	R < 0.5%
Laser damage threshold	100 mJ/cm², 50 fsec pulse, 800 nm typical

Housing Accessories

Polarizer Holder 840-0180

Find more at EksmaOptics.com

Center wavelength, nm	AR coating range, nm	Retardation λ/2		Retardation λ/4	
		Catalogue number		Catalogue number	
1030	1000-1060	464-4208		464-4408	
800	760-840	464-4215		464-4415	
780	740-820	464-4220		464-4420	
515	500-530	464-4232		464-4432	
400	380-420	464-4235		464-4435	
343	333-353	464-4241		464-4441	
266	257-275	464-4245		464-4445	
257	250-265	464-4246		464-4446	

ZERO ORDER DUAL WAVELENGTH WAVEPLATES

When optical axis is turned by 45 degrees to input polarization, the waveplate rotates polarization of Ti:Sapphire laser fundamental (800 nm) by 90 degrees and the polarization of Ti:Sapphire second harmonic (400 nm) remains the same.

Specifications

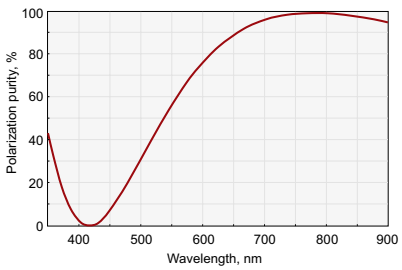
Material	Single crystal quartz
Optical axis	normal to facet on circumference of retarder
Clear aperture	Ø17 mm
Ring mount outer diameter	25.4 +0.0/-0.12 mm
Surface quality	20 – 10 scratch & dig (MIL-PRF-13830B)
Wavefront distortion	λ/10 @ 633 nm
Parallelism	<10 arcsec
AR coating	R<0.5%

Description	AR coated	Laser Damage Threshold	Application	Catalogue number	
optically contacted λ/2@800 nm + λ@400 nm	800+400 nm	>10 mJ/cm², 50 fsec pulse, 800 nm typical	Ti:Sapphire	465-4211	
air-spaced λ/2@800 nm + λ@400 nm	800+400 nm	100 mJ/cm², 50 fsec pulse, 800 nm typical	Ti:Sapphire	466-4211	
optically contacted λ/2@1030 nm + λ@515 nm	1030+515 nm	>10 mJ/cm², 50 fsec pulse, 1030 nm typical	Yb:KGW/KYW	465-4212	
air-spaced λ/2@1030 nm + λ@515 nm	1030+515 nm	100 mJ/cm², 50 fsec pulse, 1030 nm typical	Yb:KGW/KYW	466-4212	

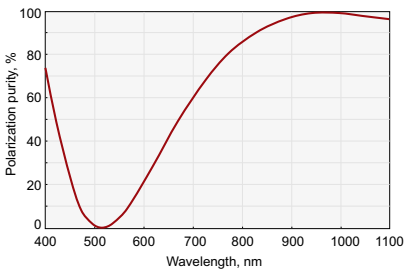
Housing Accessories

Polarizer Holder 840-0180

Find more at EksmaOptics.com



Polarization purity of zero order dual waveplate.
λ/2@800 nm + λ/400 nm



Polarization purity of zero order dual waveplate.
λ/2@1030 nm + λ/515 nm

LOW ORDER WAVEPLATES

Features

- Thinner than multiple order

Low order plates are less temperature sensitive and temperature dependent than multiple order plates. These plates are suitable for high and low power applications.

Specifications

Material	Single crystal quartz
Optical axis	normal to facet on circumference of retarder
Surface quality	20 – 10 scratch & dig (MIL-PRF-13830B)
Wavefront distortion	λ/10 @ 633 nm
Parallelism	< 10 arcsec
AR coating	R < 0.5%
Laser damage threshold	100 mJ/cm², 50 fsec pulse, 800 nm typical

Ø12.7 mm waveplates. Clear aperture Ø11 mm, unmounted

Wavelength, nm	Retardation λ/2		Retardation λ/4	
	Catalogue number		Catalogue number	
1030	461-4208D12		461-4408D12	
800	461-4215D12		461-4415D12	
780	461-4220D12		461-4420D12	
515	461-4232D12		461-4432D12	

Ø20 mm waveplates. Clear aperture Ø17 mm, mounted into Ø25.4 mm ring holder

Wavelength, nm	Retardation λ/2		Retardation λ/4	
	Catalogue number		Catalogue number	
1030	461-4208		461-4408	
800	461-4215		461-4415	
780	461-4220		461-4420	
515	461-4232		461-4432	
400	461-4235		461-4435	
343	461-4241		461-4441	

Related Products

Low Order Plates of other wavelengths

See page 1.68

High Precision Rotation Polarizer, Waveplate Mount 840-0186

Find more at EksmaOptics.com

MULTIPLE ORDER DUAL WAVELENGTH WAVEPLATES

Specifications

Material	Single crystal quartz
Optical axis	normal to facet on circumference of retarder
Wavefront distortion	λ/10 @ 633 nm
Clear aperture	Ø17 mm
Ring mount outer diameter	25.4 +0.0 / -0.12 mm
Surface quality	20 – 10 scratch & dig (MIL-PRF-13830B)
Parallelism	< 10 arcsec
AR coating	R < 0.5%
Nominal thickness of waveplate	0.2 – 1.2 mm
Laser damage threshold	>100 mJ/cm², 50 fsec pulse, 800 nm typical

Retardation and Wavelength	Catalogue number	
λ @ 800 nm + λ/2 @ 400 nm	463-4121	
λ @ 800 nm + λ/4 @ 400 nm	463-4141	
λ/2 @ 800 nm + λ @ 400 nm	463-4211	
λ/2 @ 800 nm + λ/2 @ 400 nm	463-4221	
λ/2 @ 800 nm + λ/4 @ 400 nm	463-4241	
λ/4 @ 800 nm + λ @ 400 nm	463-4411	
λ/4 @ 800 nm + λ/2 @ 400 nm	463-4421	
λ/4 @ 800 nm + λ/4 @ 400 nm	463-4441	

Related Products

Dual Wavelength Plates of other wavelengths

See page 1.70

High Precision Rotation Polarizer, Waveplate Mount 840-0186

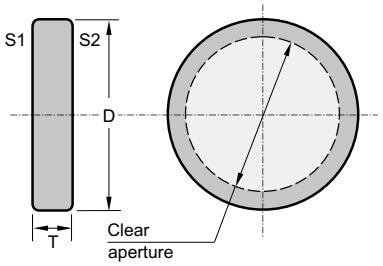
Find more at EksmaOptics.com

POLARIZATION PLANE ROTATORS

Features

- Made of crystalline quartz
- Intended to rotate a beam polarization plane strictly to an appropriate angle using circular birefringent effect

Compared to a waveplate, a rotator has an intrinsic advantage, being independent of rotation around its own optical axis. It needs no adjustment, only to be installed normal to incident radiation. A polarization plane rotator is normally used for the specific wavelength. It is only slightly dependent on ambient temperature.



Polarization plane rotators for any wavelength from 200 to 2300 nm are available.

Specifications

Material	Single crystal quartz
Optical axis	Normal to faces S1, S2 of rotator
Clear aperture	Ø17 mm
Ring mount outer diameter	25.4 +0.0/-0.12 mm
Surface quality	20 – 10 scratch & dig (MIL-PRF-13830B)
Wavefront distortion	λ/10 @ 633 nm
Parallelism	< 10 arcsec
AR coating	R < 0.5%
Laser damage threshold	100 mJ/cm², 50 fsec pulse, 800 nm typical

Center wavelength, nm	Rotation angle of polarization plane, deg	AR coating range, nm	Catalogue number	
1030	45	1000-1060	**470-4904**	
1030	90	1000-1060	**470-4909**	
800	45	760-840	**470-4804**	
800	90	760-840	**470-4809**	
780	45	740-820	**470-4784**	
780	90	740-820	**470-4789**	
515	45	500-530	**470-4514**	
515	90	500-530	**470-4519**	
400	45	380-420	**470-4044**	
400	90	380-420	**470-4049**	
343	45	333-353	**470-4344**	
343	90	333-353	**470-4349**	
266	45	257-275	**470-4264**	
266	90	257-275	**470-4269**	
257	45	250-265	**470-4254**	
257	90	250-265	**470-4259**	

Related Products

Polarization plane rotators of other wavelengths
See page 1.71

Kinematic Mirror and Beamsplitter Mount 840-0020
Find more at EksmaOptics.com

Kinematic Positioning Mount 840-0193
Find more at EksmaOptics.com

GROUP VELOCITY DELAY COMPENSATION PLATES

Features

- Made of calcite crystals
- Designed for different GVD compensation ranges
- Clear aperture Ø12 mm

Group Velocity Delay (GVD) compensation plates are designed for specified ranges of time delay compensation between two different wavelength pulses with orthogonal polarizations. A compensation plate can be adjusted for the precisely desired delay by angular tuning - changing the angle of incidence (AOI) of the laser beams to the plate. The recommended AOI tuning range of the plate is from -10° to +10°.

Standard GVD compensation plates are rectangular (full aperture 16 x 14 mm) with a clear aperture of Ø12 mm. They are supplied mounted into Ø25.4 mm (1") ring holders. Calcite plates with clear apertures up to Ø20 mm can be produced on special requests.

The optical axis of calcite plates is at the particular orientation, which is not parallel to the faces of the plate. Thus walk-off effect for e-polarized beam and displacement of both beams at non-zero AOI should be considered in the actual application conditions. The plane of optical axis is parallel to the long 16 mm edge of the calcite plate and is marked on the ring holder.

Time delay compensators for custom wavelengths, specific delay values, as well as plates made of Alpha-BBO crystals are available on request.

Specifications

Material	Natural Calcite
Clear aperture	Ø12 mm
Ring mount outer diameter	25.4 +0.0 / -0.12 mm
Surface quality	40 – 20 scratch & dig (MIL-PRF-13830B)
Wavefront distortion	λ/4@ 633 nm
Parallelism	<3 arc min
AR coating	R<0.5% 760-840 nm and R<1% at 380-420 nm R<0.5% at 500-530 +1000-1060 nm

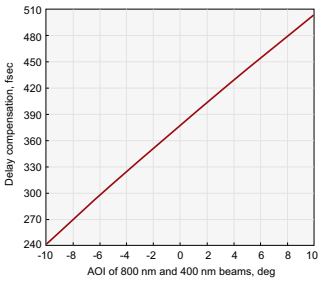
Group velocity delay between 800 nm and 400 nm pulses in compensation plates at different angle of incidence.
400 nm pulse („e" pol) is faster than 800 nm pulse („o" pol).

Standard Calcite plates

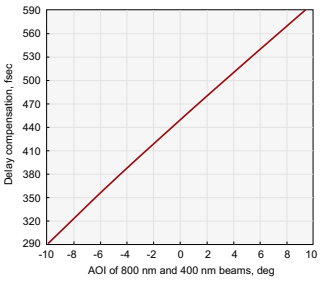
for delay compensation between 800 nm ("o" polarization) and 400 nm ("e" polarization) pulses

Delay compensation range*	Coatings	Catalogue number	
310 – 450 fsec	BBAR @ 800+400 nm	225-2113	
370 – 520 fsec	BBAR @ 800+400 nm	225-2114	
440 – 630 fsec	BBAR @ 800+400 nm	225-2115	

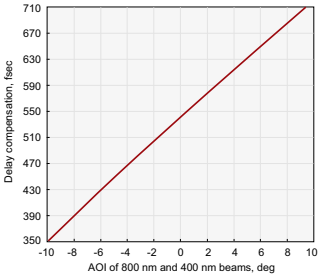
* GVD compensation range at Angle Of Incidence from -10° to +10°.



225-2113



225-2114



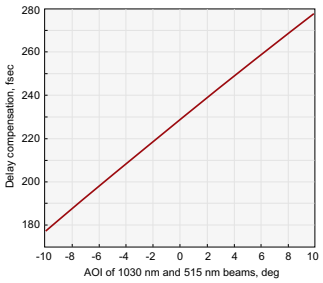
225-2115

Standard Calcite plates

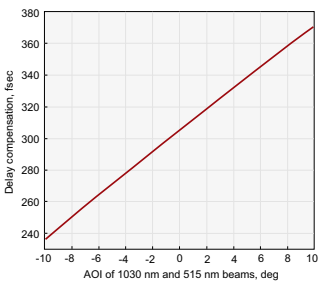
For delay compensation between 1030 nm ("o" polarization) and 515 nm ("e" polarization) pulses

Delay compensation range*	Coatings	Catalogue number	
177 – 278 fs	BBAR @ 1030+515 nm	225-2210	
236 – 370 fs	BBAR @ 1030+515 nm	225-2211	
295 – 463 fs	BBAR @ 1030+515 nm	225-2212	
378 – 593 fs	BBAR @ 1030+515 nm	225-2213	

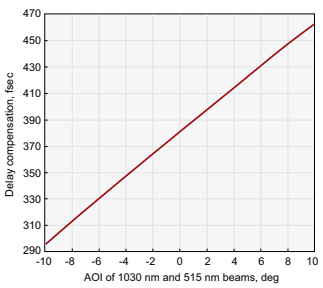
* GVD compensation range at angle of incidence from -10° to +10°.



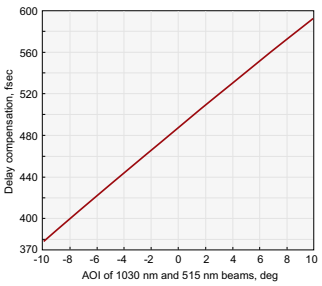
225-2210.



225-2211



225-2212



225-2213

CRYSTAL WINDOWS FOR WHITE LIGHT (CONTINUUM) GENERATION

The interaction of intense laser pulses with transparent media (the crystals with cubic structure are more effective) can result in vast spectral broadening, ranging from the infrared to the ultraviolet spectral region. This continuum or white-light generation is a well-established phenomenon. Femtosecond laser induced white light has been the source of ultrashort coherent radiation for numerous applications: time-resolved broadband pump–probe spectroscopy, optical pulse compression, and optical parametric amplification.

Specifications

Material	undoped YAG, orientation [111]
Clear aperture	>90% of diameter
Diameter tolerance	+0.00 / -0.13 mm
Thickness tolerance	±0.2 mm
Surface quality	20 – 10 scratch & dig
Transmitted wavefront distortion	λ/4 – λ/10 @ 633 nm
Parallelism	<30 arcsec
Coating	uncoated

Standard YAG windows

Material	Diameter, mm	Thickness, mm	Transmitted wavefront distortion	Catalogue number	
YAG	12.7	1.0	λ/4	555-7121	
YAG	12.7	2.0	λ/4	555-7122	
YAG	12.7	3.0	λ/10	555-7123	
YAG	12.7	4.0	λ/10	555-7124	
YAG	12.7	5.0	λ/10	555-7125	
YAG	12.7	6.0	λ/10	555-7126	
YAG	12.7	8.0	λ/10	555-7128	
YAG	12.7	10.0	λ/10	555-7129	
YAG	25.4	1.0	λ/4	555-7251	
YAG	25.4	2.0	λ/4	555-7252	
YAG	25.4	3.0	λ/10	555-7253	
YAG	25.4	4.0	λ/10	555-7254	

Specifications

Material	sapphire, orientation c-cut [111]
Clear aperture	>90% of diameter
Diameter tolerance	+0.00 / -0.13 mm
Thickness tolerance	±0.2 mm
Surface quality	60 – 40 scratch & dig
Transmitted wavefront distortion	<1 λ @ 633 nm
Parallelism	<3 arcmin
Coating	uncoated

Standard Sapphire windows

Material	Diameter, mm	Thickness, mm	Transmitted wavefront distortion	Catalogue number	
Sapphire	12.7	0.5	1 λ	550-7120	
Sapphire	12.7	1.0	1 λ	550-7121	
Sapphire	12.7	2.0	1 λ	550-7122	
Sapphire	12.7	3.0	1 λ	550-7123	
Sapphire	12.7	4.0	1 λ	550-7124	
Sapphire	12.7	5.0	1 λ	550-7125	
Sapphire	12.7	6.0	1 λ	550-7126	
Sapphire	12.7	8.0	1 λ	550-7128	
Sapphire	20.0	0.5	1 λ	550-7200	
Sapphire	20.0	1.0	1 λ	550-7201	
Sapphire	20.0	1.5	1 λ	550-7215	
Sapphire	20.0	2.0	1 λ	550-7202	
Sapphire	25.4	0.5	1 λ	550-7250	
Sapphire	25.4	1.0	1 λ	550-7251	
Sapphire	25.4	2.0	1 λ	550-7252	
Sapphire	25.4	3.0	1 λ	550-7253	
Sapphire	25.4	4.0	1 λ	550-7254	
Sapphire	25.4	5.0	1 λ	550-7255	
Sapphire	25.4	6.0	1 λ	550-7256	
Sapphire	25.4	8.0	1 λ	550-7258	

Specifications

Material	single crystal CaF_2, orientation [001]
Clear aperture	>90% of diameter
Diameter tolerance	+0.00 / -0.13 mm
Thickness tolerance	±0.2 mm
Surface quality	40 – 20 scratch & dig
Transmitted wavefront distortion	λ/4 @ 633 nm
Parallelism	<1 arcmin
Coating	uncoated

Standard CaF_2 windows

Material	Diameter, mm	Thickness, mm	Transmitted wavefront distortion	Catalogue number	
CaF_2	12.7	3.0	λ/4	531-5123	
CaF_2	12.7	4.0	λ/4	531-5124	
CaF_2	25.4	1.0	λ/4	531-5251	
CaF_2	25.4	2.0	λ/4	531-5252	
CaF_2	25.4	3.0	λ/4	531-5253	
CaF_2	25.4	4.0	λ/4	531-5254	
CaF_2	25.4	5.0	λ/4	531-5255	

VARIABLE ATTENUATOR FOR FEMTOSECOND LINEARLY POLARIZED LASER BEAM 990-0070

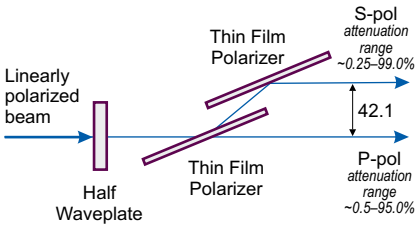
Features

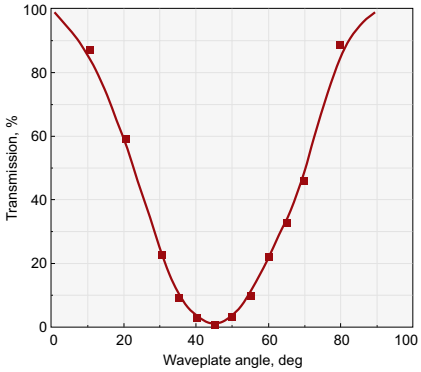
- Divides laser beam into two parallel beams of manually adjustable intensity ratio
- Large dynamic range
- Transmitted beam shift ~ 0.5 mm
- High Optical damage threshold
- Weight – 0.35 kg

Note: Movable base ***820-0090***, Rod Holder ***820-0050-02*** and standard rod should be ordered seperately.

This variable attenuator/beamsplitter consists of special design opto-mechanical Adapter and precision opto-mechanical Holder 840-0197. Two Thin Film Brewster type polarizers, which reflect s-polarized light while transmitting p-polarized light, are housed into Adapter. Quartz Half Waveplates are housed in rotating holder 840-0197.

The intensity ratio of those two beams may be continuously varied without alteration of other beam parameters by rotating the waveplate. The intensity of either exit beam, or their intensity ratio, can be controlled over a wide dynamic range. P-polarization could be selected for maximum transmission, or high-purity s-polarization could be reflected when maximum attenuation of the transmitted beam takes place. The holder 840-0197 allows to adjust Angle Of Incidence of the Thin Film Brewster type polarizers by ±2° and to get the maximum polarization contrast.





Specifications

Aperture diameter	17 mm
Damage threshold	>10 mJ/cm², 50 fs pulse at 800 nm, typical
for high power laser applications	>100 mJ/cm², 50 fs pulse at 800 nm, typical
Time dispersion	t<4 fs for 100 fs Ti:Sapphire laser pulses
Polarization Contrast (after 1st polarizer)	>1:200
Polarization Contrast (after 2nd polarizer)	>1:500

Wavelength, nm	Catalogue number	
257	990-0070-257	
266	990-0070-266	
343	990-0070-343	
400	990-0070-400	
390-410	990-0070-400B	
515	990-0070-515	
505-525	990-0070-515B	
800	990-0070-800	
780-820	990-0070-800B	
1030	990-0070-1030	
1010-1050	990-0070-1030B	

Zero order optically contacted half waveplate is housed in rotating holder for high power femtosecond applications (Laser damage threshold: >10 mJ/cm², 50 fs pulse at 800 nm, typical).

For High Power Laser Applications

Wavelength, nm	Catalogue number	
257	990-0070-257H	
266	990-0070-266H	
343	990-0070-343H	
400	990-0070-400H	
390-410	990-0070-400HB	
515	990-0070-515H	
505-525	990-0070-515HB	
800	990-0070-800H	
780-820	990-0070-800HB	
1030	990-0070-1030H	
1010-1050	990-0070-1030HB	

Zero Order Air-Spaced half waveplate is housed in rotating holder for high power femtosecond applications (Laser damage threshold: >100 mJ/cm², 50 fs pulse at 800 nm, typical).

Related Products

Femtoline Zero Order Optically Contacted/Air-Spaced Plates
See page 4.25

Femtoline Thin Film Laser Polarizers
See page 4.22

Neutral Density Filters
See page 1.14

Motorized Variable Attenuator for Linearly Polarized Laser Beam 990-0070M
See page 5.10

Beam dumps 990-0800, 990-0820
See page 5.19

BROADBAND VARIABLE ATTENUATOR FOR FEMTOSECOND LASER PULSES 990-0070HBBI70

Features

- Divides laser beam into two parallel beams of manually adjustable intensity ratio
- Large dynamic range
- Transmitted beam shift ~ 2.6 mm
- High optical damage threshold

990-0070-800HBBi70

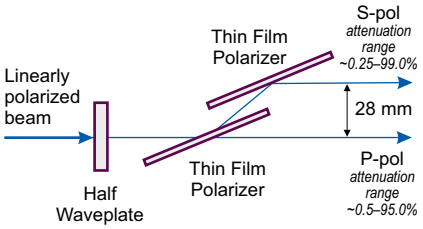
990-0070-800HBBi70M

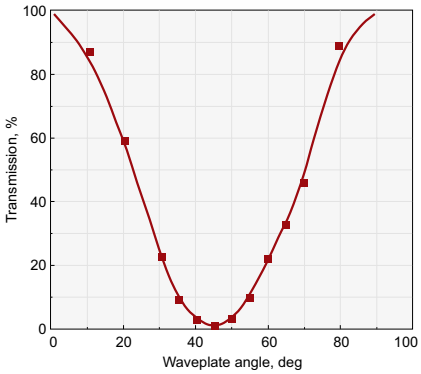
This variable attenuator/beamsplitter consists of a special design opto-mechanical adapter and a precision opto-mechanical holder 840-0197. Two thin film polarizers, operating at AOI=70° and reflecting s-polarized light while transmitting p-polarized light, are housed into the adapter. A quartz zero order air-spaced half waveplate is housed into the rotating holder 840-0197.

The intensity ratio of outgoing two parallel beams may be continuously varied without alteration of other beam parameters by rotating the waveplate. The intensity of the exit beam or outgoing beams intensity ratio can be controlled over a wide dynamic range.

P-polarized beam is transmitted straightly with a 2.6 mm shift and s-polarized beam (after 2 reflections) is parallel to the outgoing p-polarized beam, just separated by 28 mm.

The 840-0197 holder allows to adjust angle of incidence of the thin film polarizers by ±2° and to achieve the maximum polarization contrast.





Specifications

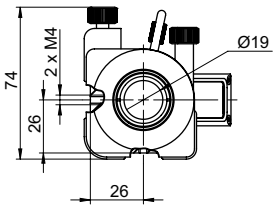
Aperture diameter	12 mm
Operating bandwidth	100 nm
Damage treshold	50 mJ/cm² pulsed at 800 nm, 50 fsec, 50 Hz
Polarization contrast (after 1st polarizer)	>1:200
Polarization contrast (after 2nd polarizer)	>1:500

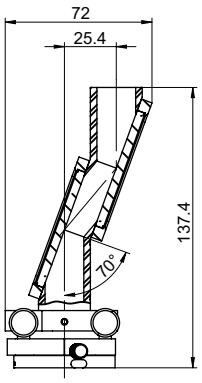
Manual attenuators

Wavelength, nm	Catalogue number	
750-850	990-0070-800HBBi70	
980-1080	990-0070-1030HBBi70	

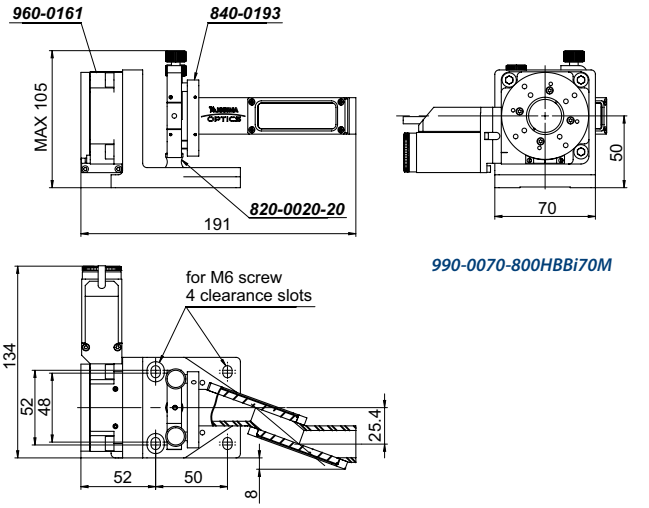
Motorized attenuators

Wavelength, nm	Catalogue number	
750-850	990-0070-800HBBi70M	
980-1080	990-0070-1030HBBi70M	





990-0070-800HBBi70



990-0070-800HBBi70M

Related Products

Neutral Density Filters
See page 1.15

Femtoline Zero Order Optically Contacted / Air-Spaced Plates
See page 4.25

Femtoline Thin Film Laser Polarizers
See page 4.22

VARIABLE ATTENUATOR FOR FEMTOSECOND LINEARLY POLARIZED LASER BEAM 990-0071

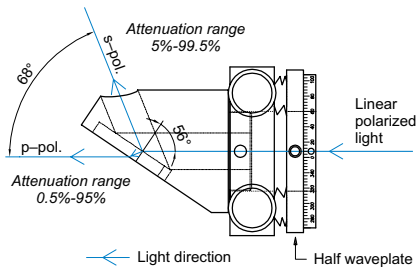
Features

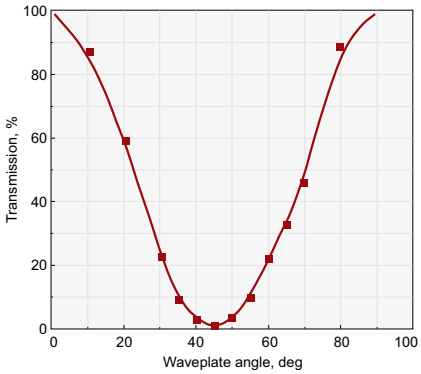
- Divides laser beam into two beams of manually adjustable intensity ratio separated by 68° angle
- Large dynamic range
- Transmitted beam shift ~0.5 mm
- High Optical damage threshold
- Weight – 0.25 kg

Note: Solid Base Height Extender ***820-0210*** and Standard Rod ***820-0020-20*** should be ordered separately

This variable attenuator/beamsplitter consists of special design opto-mechanical adapter for polarizer at 56° 840-0117A or 840-0118A and precision opto-mechanical holder 840-0197. Thin Film Brewster type polarizer, which reflect s-polarized light at 56° while transmitting p-polarized light, is housed into adapter for polarizer at 56°. Quartz Half Waveplates are housed in rotating holder 840-0197.

The intensity ratio of those two beams may be continuously varied without alteration of other beam parameters by rotating the waveplate. The intensity of either exit beam, or their intensity ratio, can be controlled over a wide dynamic range. P-polarization could be selected for maximum transmission, or high-purity s-polarization could be reflected when maximum attenuation of the transmitted beam takes place. The holder 840-0197 allows to adjust Angle Of Incidence of the Thin Film Brewster type polarizer by ±2° and to get the maximum polarization contrast.





Specifications

Aperture diameter	10 mm
Damage threshold	>10 mJ/cm², 50 fs pulse at 800 nm, typical
for high power laser applications	>100 mJ/cm², 50 fs pulse, 800 nm typical
Time dispersion	t<4 fs for 100 fs Ti:Sapphire laser pulses
Polarization Contrast	>1:200

Wavelength, nm	Catalogue number	
257	990-0071-257	
266	990-0071-266	
343	990-0071-343	
400	990-0071-400	
390-410	990-0071-400B	
515	990-0071-515	
505-525	990-0071-515B	
800	990-0071-800	
780-820	990-0071-800B	
1030	990-0071-1030	
1010-1050	990-0071-1030B	

Zero order optically contacted half waveplate is housed in rotating holder 840-0197 (laser damage threshold: >10 mJ/cm², 50 fs pulse at 800 nm, typical).

For High Power Laser Applications

Wavelength, nm	Catalogue number	
257	990-0071-257H	
266	990-0071-266H	
343	990-0071-343H	
400	990-0071-400H	
390-410	990-0071-400HB	
515	990-0071-515H	
505-525	990-0071-515HB	
800	990-0071-800H	
780-820	990-0071-800HB	
1030	990-0071-1030H	
1010-1050	990-0071-1030HB	

Zero Order Air-Spaced half waveplate is housed in rotating holder 840-0197 (laser damage threshold: >100 mJ/cm², 50 fs pulse at 800 nm, typical).

Related Products

Neutral Density Filters
See page 1.15

Femtoline Zero Order Optically Contacted / Air-Spaced Plates
See page 4.25

Femtoline Thin Film Laser Polarizers
See page 4.22

Motorized Variable Attenuator for Linearly Polarized Laser Beam 990-0071M
See page 5.13

VARIABLE ATTENUATOR FOR FEMTOSECOND LASER PULSES 990-0072

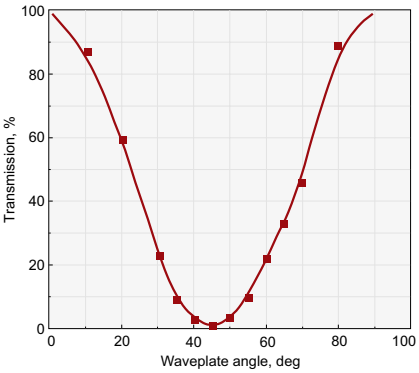
Features

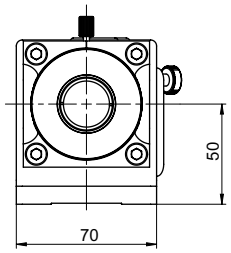
- Divides laser beam into two beams of manually adjustable intensity ratio separated by 68° angle
- Large dynamic range
- Trasmitted beam shift ~1 mm
- High optical damage threshold
- Motorized version 990-0072M available online

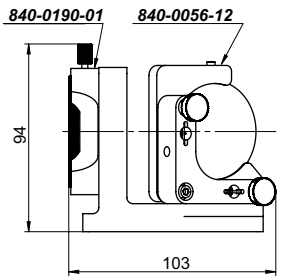
This variable attenuator/beamsplitter consists of Polarizer Holder 840-0190-01 and Kinematic Mirror/Beamsplitter Mount 840-0056-12. UVFS Thin Film Brewster type polarizer diameter 50.8 mm, which reflect s-polarized light while transmitting p-polarized light, is housed into Beamsplitter Mount 840-0056-12. A quartz Zero Order (optically contacted) Half Waveplate diameter 25.4 mm (for femtosecond applications) or Zero Order Air-Spaced Half Waveplate (for high power applications) is housed in rotating polarizer holder 840-0190-01 and placed in the incident linearly polarized laser beam.

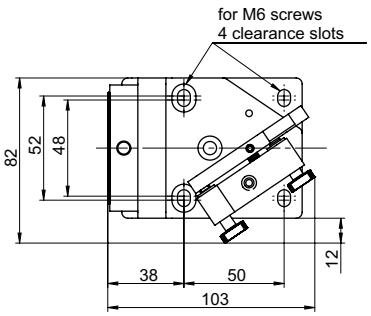
The intensity ratio of those two separted and different polarized beams may be continuously varied without alteration of other beam parameters by rotating the waveplate. The intensity of either exit beam, or their intensity ratio, can be controlled over a wide dynamic range. P-polarization could be selected for maximum transmission, or high-purity s-polarization could be reflected when maximum attenuation of the transmitted beam takes place.

The holder 840-0056-12 allows to adjust Angle Of Incidence of the Thin Film Brewster type polarizers by ±4.5° and to get the maximum extinction contrast. The mounts are on rods, rod holders and Movable Base 820-0090. The optical axis height from the table top can be adjusted in the range 78-88mm. Other height can be offered as custom changing the standard rods and rod holders into higher.









Specifications

Clear Aperture diameter	22 mm
Damage threshold	>10 mJ/cm², 50 fs pulse at 800 nm, typical
for high power applications	>100 mJ/cm², 50 fs pulse at 800 nm, typical
Polarization Contrast	>1:200
Transmitted beam shift	~ 1 mm
Weight	0.45 kg

Wavelength, nm	Catalogue number	
266	990-0072-266	
343	990-0072-343	
400	990-0072-400	
515	990-0072-515	
800	990-0072-800	
780-820	990-0072-800B	
1030	990-0072-1030	
1010-1050	990-0072-1030B	

A quartz Zero Order (optically contacted) Half Waveplate Ø25.4 mm is housed in rotating holder 840-0190-01.

For High Power Laser Applications

Wavelength, nm	Catalogue number	
266	990-0072-266H	
343	990-0072-343H	
400	990-0072-400H	
515	990-0072-515H	
800	990-0072-800H	
780-820	990-0072-800HB	
1030	990-0072-1030H	
1010-1050	990-0072-1030HB	

A quartz Zero Order Air-Spaced Half Waveplate clear aperture Ø22mm is housed in rotating holder 840-0190-01.

Related Products

Neutral Density Filters
See page 1.15

Femtoline Thin Film Laser Polarizers
See page 4.22

Femtoline Zero Order Optically Contacted / Air-Spaced Plates
See page 4.25

Motorized Variable Attenuator for Linearly Polarized Laser Beam 990-0072M
Find more at EksmaOptics.com

VARIABLE ATTENUATOR FOR FEMTOSECOND LASER PULSES 990-0073

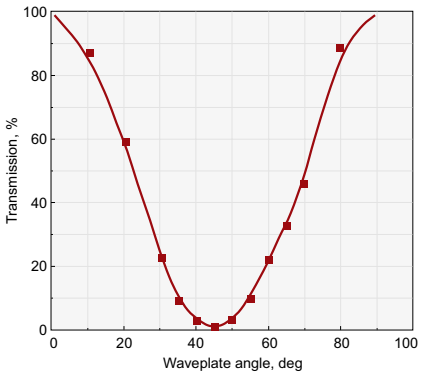
Features

- Divides laser beam into two beams of manually adjustable intensity ratio separated by 68° angle
- Large dynamic range
- Trasmitted beam shift ~1.4 mm
- High optical damage threshold

This variable attenuator/beamsplitter consists of Polarizer Holder 840-0180-A2 and Kinematic Mirror/Beamsplitter Mount 840-0056-13. UVFS Thin Film Brewster type polarizer Ø76.2 mm, which reflect s-polarized light while transmitting p-polarized light, is housed into Beamsplitter Mount 840-0056-13. A quartz Zero Order (optically contacted) Half Waveplate Ø40 mm or Zero Order Air-Spaced Half Waveplate Ø40 mm is housed in rotating polarizer holder 840-0180-A2 and placed in the incident linearly polarized laser beam.

The intensity ratio of those two separated and different polarized beams may be continuously varied without alteration of other beam parameters by rotating the waveplate. The intensity of either exit beam, or their intensity ratio, can be controlled over a wide dynamic range. P-polarization could be selected for maximum transmission, or high-purity s-polarization could be reflected when maximum attenuation of the transmitted beam takes place.

The holder 840-0056-13 allows to adjust Angle Of Incidence of the Thin Film Brewster type polarizers by ±4.5° and to get the maximum extinction contrast. The mounts are on rods, rod holders and Movable Base 820-0090. The optical axis height from the table top can be adjusted in the range 92-98 mm. Other height can be offered as custom changing the standard rods and rod holders into higher.



Specifications

Clear Aperture diameter	36 mm
Damage threshold	>10 mJ/cm², 50 fs pulse at 800 nm, typical
for high power applications	>100 mJ/cm², 50 fs pulse at 800 nm, typical
Polarization Contrast	>1:200
Transmitted beam shift	~ 1.4 mm
Weight	0.6 kg

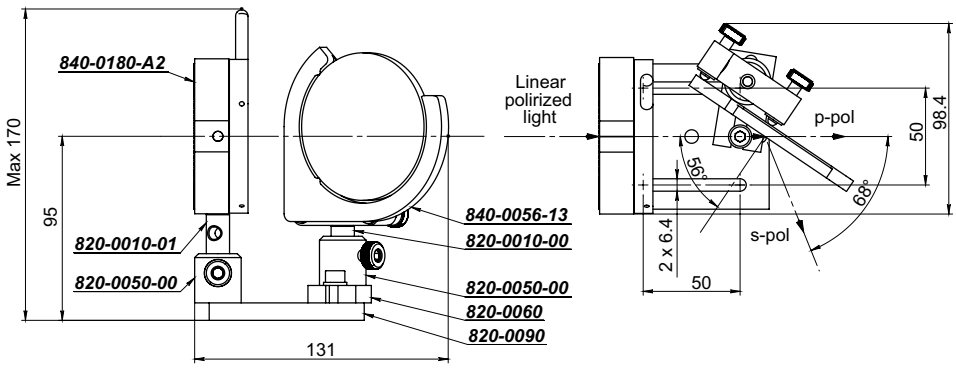
Wavelength, nm	Catalogue number	
266	990-0073-266	
343	990-0073-343	
400	990-0073-400	
515	990-0073-515	
800	990-0073-800	
780-820	990-0073-800B	
1030	990-0073-1030	
1010-1050	990-0073-1030B	

A quartz Zero Order (optically contacted) Half Waveplate Ø40 mm is housed in rotating holder 840-0180-A2.

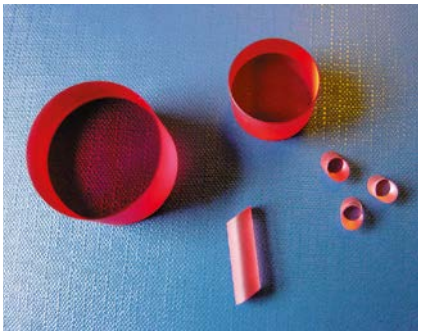
For High Power Laser Applications

Wavelength, nm	Catalogue number	
266	990-0073-266H	
343	990-0073-343H	
400	990-0073-400H	
515	990-0073-515H	
800	990-0073-800H	
780-820	990-0073-800HB	
1030	990-0073-1030H	
1010-1050	990-0073-1030HB	

A quartz Zero Order Air-Spaced Half Waveplate Ø40 mm is housed in rotating holder 840-0180-A2.

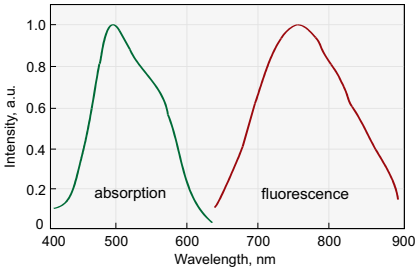


Ti:Sapphire (TITANIUM DOPED SAPPHIRE – $Ti:Al_2O_3$) LASER LINE AND HARMONICS



Ti:Sapphire laser crystal is used as a gain medium for tunable lasers and femtosecond solid-state lasers. Lasers based on Ti:Sapphire crystal are mainly used to generate ultrashort – femtosecond pulses.

The lasing band of Ti:Sapphire is 660-1050 nm, while common pump wavelength is frequency doubled Nd:YAG laser line at 532 nm or Argon Ion laser lines at 490-514 nm. The peak of emission in Ti:Sapphire is at 790-800 nm wavelength.



Material physical and laser properties

Chemical formula	$Ti^{3+}:Al_2O_3$
Crystal structure	Hexagonal
Lattice constants	a=4.748, c=12.957
Density	3.98 g/cm^3
Mohs hardness	9
Thermal conductivity	0.11 cal/(°C×sec×cm)
Specific heat	0.10 cal/g
Melting point	2050 °C
Laser action	4-Level Vibronic
Fluorescence lifetime	3.2 µsec (T=300K)
Tuning range	660–1050 nm
Absorbtion range	400–600 nm
Emission peak	795 nm
Absorption peak	488 nm
Refractive index	1.76 @ 800 nm

Standard product specifications

Orientation	optical axis C normal to rod axis
Ti_2O_3 concentration	0.03–0.25 wt %
Figure of Merit	> 150
Size	up to 15 mm dia and up to 30 mm length
End configurations	flat/flat or Brewster/Brewster
End flatness	λ/10 @ 633 nm
Parallelism	10 arcsec
Surface finishing	10-5 scratch & dig
Wavefront distortion	λ/4 inch

Note: To inquire or order a finished Ti:Sa laser rod, please provide detailed specifications. Dopant concentration, size of crystal and end configuration are essential specifications.

FREQUENCY CONVERSION OF Ti:Sapphire LASER WAVELENGTHS

Frequency doubling and tripling allow access to the green, blue and ultraviolet spectral regions. While the frequency conversion by Optical Parametric Generation offers wide tuning range in the near-infrared spectral region, it is often sufficient to tune the Ti:sapphire wavelength for tuning the OPO, rather than tuning the OPO itself, e.g. by actively affecting the phase-matching conditions. Further wavelength extension to mid infrared range is possible by Difference Frequency Generation employing signal and idler wavelength pulses obtained from OPO.

Crystals selection for Ti:Sapphire laser frequency conversion

Thin BBO crystals for SHG @ 800 nm	→	350 – 450 nm range
Thin BBO crystals for THG @ 800 nm	→	230 – 300 nm range
Thin BBO crystals for OPG/OPA @ pump 800 nm	→	1050 – 2300 nm range
Thin BBO crystals for OPG/OPA @ pump 400 nm	→	480 – 2300 nm range
$AgGaS_2$ crystals for DFG	→	2500 – 12000 nm range

THIN BBO CRYSTALS FOR SHG AND THG OF Ti:Sapphire LASER WAVELENGTH

Free Standing BBO Crystals

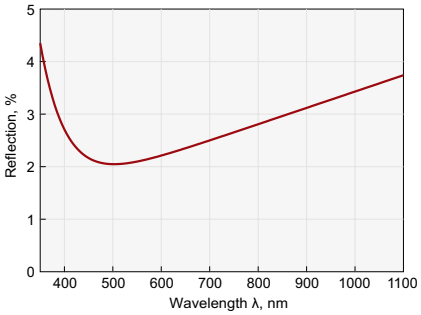
The crystals down to 100 µm can be supplied as free standing crystals not attached to the support. However, ring mounts are highly recommended for safe handling of these thin crystals. Minimum aperture of free standing BBO is 5×5 mm, maximum aperture is 22×22 mm. The tolerance is ±50 µm for crystals of thickness down to 300 µm and ±20 µm for crystals of thickness down to 100 µm.

Optically contacted crystals

BBO crystals less than 100 µm thickness can be supplied optically contacted on UV Fused Silica substrate sizes 10×10×1 mm or 12×12×2 mm. Other sizes of substrates are also available on request. Minimum aperture of optically contacted BBO is 5×5 mm, maximum aperture is 10×10 mm. The tolerance of crystal thickness is +10/-5 microns.

Protective Coatings for BBO crystals

P-protective coating – is a single or two layer antireflection coating made at specified wavelength range. Typical reflection values are R<2% in the mid range, R<4% at the edges. P coating is highly recommended for ultrashort pulse applications and features low dispersion and very high laser damage threshold.



Typical P-coating for BBO SHG@800 nm application

Standard specifications of ultrathin BBO crystals

Flatness	λ/8 @ 633 nm
Parallelism	< 20 arcsec
Perpendicularity	< 5 arcmin
Angle tolerance	< 30 arcmin
Aperture tolerance	± 0.1 mm
Surface quality	10 – 5 scratch & dig (MIL-PRF-13830B)
Clear aperture	>90% of full aperture
Laser damage threshold	>200 GW/cm^2, 133 fsec pulse, 800 nm typical, 50 Hz

EKSMA OPTICS recommends the following thickness BBO crystals depending on application and fundamental wavelength pulse duration, assuming it is spectrum limited Gausian pulse.

Application	Pulse duration, fs	Thickness, mm
Type 1, SHG @ 800 nm, Θ=29.2°, φ=90°	10	0.05
	20	0.1
	50	0.2
	100	0.5
	200	1
Type 1, THG @ 800 nm, Θ=44,3°, φ=90°	10	0.01
	20	0.02
	50	0.05
	100	0.1
	200	0.2

BBO FOR SHG @ 800 nm

BBO crystal. Thickness = 0.05 mm*

Aperture, mm	UV FS support size, mm	θ, deg	φ, deg	Coating	Catalogue number	
6×6	10×10×2	29.2	90	P/P @ 400-800 nm	BBO-600H	
8×8	10×10×2	29.2	90	P/P @ 400-800 nm	BBO-800H	
10×10	12×12×2	29.2	90	P/P @ 400-800 nm	BBO-1000H	

* All BBO crystals of thickness less than 100 µm are optically contacted onto UV FS support.
All crystals are mounted into open ring holders.

SHG BBO crystals. Thickness = 0.1 mm

Aperture, mm	θ, deg	φ, deg	Coating	Catalogue number	
6×6	29.2	90	P/P @ 400-800 nm	BBO-601H	
8×8	29.2	90	P/P @ 400-800 nm	BBO-801H	
10×10	29.2	90	P/P @ 400-800 nm	BBO-1001H	
12×12	29.2	90	P/P @ 400-800 nm	BBO-1201H	
15×15	29.2	90	P/P @ 400-800 nm	BBO-1501H	
20×20	29.2	90	P/P @ 400-800 nm	BBO-2001H	
22×22	29.2	90	P/P @ 400-800 nm	BBO-2201H	

SHG BBO crystal. Thickness = 0.2 mm

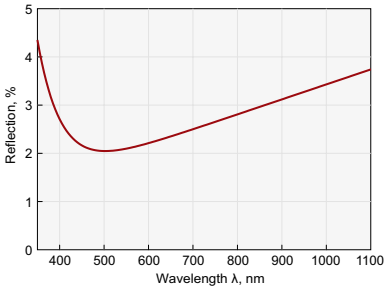
Aperture, mm	θ, deg	φ, deg	Coating	Catalogue number	
6×6	29.2	90	P/P @ 400-800 nm	BBO-602H	
8×8	29.2	90	P/P @ 400-800 nm	BBO-802H	
10×10	29.2	90	P/P @ 400-800 nm	BBO-1002H	
12×12	29.2	90	P/P @ 400-800 nm	BBO-1202H	
15×15	29.2	90	P/P @ 400-800 nm	BBO-1502H	
20×20	29.2	90	P/P @ 400-800 nm	BBO-2002H	
22×22	29.2	90	P/P @ 400-800 nm	BBO-2202H	

SHG BBO crystal. Thickness = 0.5 mm

Aperture, mm	θ, deg	φ, deg	Coating	Catalogue number	
6×6	29.2	90	P/P @ 400-800 nm	BBO-603H	
8×8	29.2	90	P/P @ 400-800 nm	BBO-803H	
10×10	29.2	90	P/P @ 400-800 nm	BBO-1003H	
12×12	29.2	90	P/P @ 400-800 nm	BBO-1203H	
15×15	29.2	90	P/P @ 400-800 nm	BBO-1503H	
20×20	29.2	90	P/P @ 400-800 nm	BBO-2003H	
22×22	29.2	90	P/P @ 400-800 nm	BBO-2203H	

SHG BBO crystal. Thickness = 1 mm

Aperture, mm	θ, deg	φ, deg	Coating	Catalogue number	
6×6	29.2	90	P/P @ 400-800 nm	BBO-604H	
8×8	29.2	90	P/P @ 400-800 nm	BBO-804H	
10×10	29.2	90	P/P @ 400-800 nm	BBO-1004H	
12×12	29.2	90	P/P @ 400-800 nm	BBO-1204H	
15×15	29.2	90	P/P @ 400-800 nm	BBO-1504H	
20×20	29.2	90	P/P @ 400-800 nm	BBO-2004H	
22×22	29.2	90	P/P @ 400-800 nm	BBO-2204H	



P-protective coating curve of Type 1
(θ=29.2°, φ=90°) BBO crystal used for SHG@800 nm

SHG BBO crystal. Thickness = 2 mm

Aperture, mm	θ, deg	φ, deg	Coating	Catalogue number	
6×6	29.2	90	P/P @ 400-800 nm	BBO-605H	
8×8	29.2	90	P/P @ 400-800 nm	BBO-805H	
10×10	29.2	90	P/P @ 400-800 nm	BBO-1005H	
12×12	29.2	90	P/P @ 400-800 nm	BBO-1205H	
15×15	29.2	90	P/P @ 400-800 nm	BBO-1505H	
20×20	29.2	90	P/P @ 400-800 nm	BBO-2005H	
22×22	29.2	90	P/P @ 400-800 nm	BBO-2205H	

Housing Accessories

Ring Holders
for Nonlinear Crystals
See page 2.26

Positioning Mount
840-0199 for
Nonlinear Crystal
Housing
See page 2.27

BBO FOR THG @ 800 nm

BBO crystal. Thickness = 0.01 mm, optically contacted

Aperture, mm	UV FS support size, mm	θ, deg	φ, deg	Coating	Catalogue number	
6×6	10×10×2	44.3	90	P/P @ 400-800/266	BBO-606H	
8×8	10×10×2	44.3	90	P/P @ 400-800/266	BBO-806H	
10×10	12×12×2	44.3	90	P/P @ 400-800/266	BBO-1006H	

BBO crystal. Thickness = 0.02 mm, optically contacted

Aperture, mm	UV FS support size, mm	θ, deg	φ, deg	Coating	Catalogue number	
6×6	10×10×2	44.3	90	P/P @ 400-800/266	BBO-607H	
8×8	10×10×2	44.3	90	P/P @ 400-800/266	BBO-807H	
10×10	12×12×2	44.3	90	P/P @ 400-800/266	BBO-1007H	

BBO crystal. Thickness = 0.05 mm, optically contacted

Aperture, mm	UV FS support size, mm	θ, deg	φ, deg	Coating	Catalogue number	
6×6	10×10×2	44.3	90	P/P @ 400-800/266	BBO-608H	
8×8	10×10×2	44.3	90	P/P @ 400-800/266	BBO-808H	
10×10	12×12×2	44.3	90	P/P @ 400-800/266	BBO-1008H	

THG BBO crystal. Thickness = 0.1 mm

Aperture, mm	θ, deg	φ, deg	Coating	Catalogue number	
6×6	44.3	90	P/P @ 400-800/266	BBO-609H	
8×8	44.3	90	P/P @ 400-800/266	BBO-809H	
10×10	44.3	90	P/P @ 400-800/266	BBO-1009H	
12×12	44.3	90	P/P @ 400-800/266	BBO-1209H	
15×15	44.3	90	P/P @ 400-800/266	BBO-1509H	
20×20	44.3	90	P/P @ 400-800/266	BBO-2009H	
22×22	44.3	90	P/P @ 400-800/266	BBO-2209H	

THG BBO crystal. Thickness = 0.2 mm

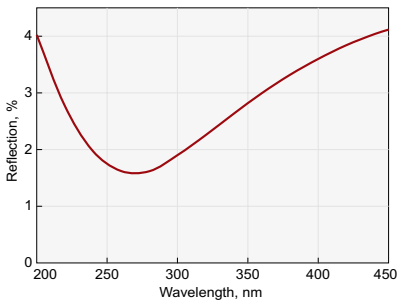
Aperture, mm	θ, deg	φ, deg	Coating	Catalogue number	
6×6	44.3	90	P/P @ 400-800/266	BBO-610H	
8×8	44.3	90	P/P @ 400-800/266	BBO-810H	
10×10	44.3	90	P/P @ 400-800/266	BBO-1010H	
12×12	44.3	90	P/P @ 400-800/266	BBO-1210H	
15×15	44.3	90	P/P @ 400-800/266	BBO-1510H	
20×20	44.3	90	P/P @ 400-800/266	BBO-2010H	
22×22	44.3	90	P/P @ 400-800/266	BBO-2210H	

THG BBO crystal. Thickness = 0.5 mm

Aperture, mm	θ, deg	φ, deg	Coating	Catalogue number	
6×6	44.3	90	P/P@400-800/266	BBO-611H	
8×8	44.3	90	P/P@400-800/266	BBO-811H	
10×10	44.3	90	P/P@400-800/266	BBO-1011H	
12×12	44.3	90	P/P@400-800/266	BBO-1211H	
15×15	44.3	90	P/P@400-800/266	BBO-1511H	
20×20	44.3	90	P/P@400-800/266	BBO-2011H	
22×22	44.3	90	P/P@400-800/266	BBO-2211H	

THG BBO crystal. Thickness = 1 mm

Aperture, mm	θ, deg	φ, deg	Coating	Catalogue number	
6×6	44.3	90	P/P @ 400-800/266	BBO-612H	
8×8	44.3	90	P/P @ 400-800/266	BBO-812H	
10×10	44.3	90	P/P @ 400-800/266	BBO-1012H	
12×12	44.3	90	P/P @ 400-800/266	BBO-1212H	
15×15	44.3	90	P/P @ 400-800/266	BBO-1512H	
20×20	44.3	90	P/P @ 400-800/266	BBO-2012H	
22×22	44.3	90	P/P @ 400-800/266	BBO-2212H	



P-protective coating curve of Type 1 (θ=44.3°, φ=90°)
BBO crystal's exit face used for THG@800 nm

Related Products

Zero Order Dual Wavelength Plates
See page 4.26

Ring Holders
for Nonlinear Crystals
See page 2.26

Positioning
Mount 840-0199
for Nonlinear
Crystal Housing
See page 2.27

FEMTOKITS FOR THIRD HARMONIC GENERATION OF FEMTOSECOND Ti:Sapphire LASER

Kits consist of set of components required for efficient third harmonic generation of femtosecond Ti:Sapphire laser. The schemes of the third harmonic generation in basic and extended Femtokits are presented below.

BASIC FEMTOKIT FK SERIES

The thickness of SHG BBO crystal, THG BBO crystal and group delay compensation plate is different in each kit and is optimal for certain pulse duration of fundamental harmonic to avoid harmonic pulses broadening.

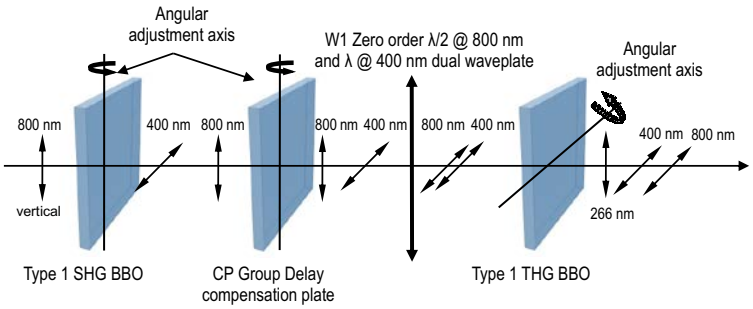
Basic Femtokit FK series includes:

- Type 1 SHG BBO crystal with 6×6 mm aperture, P-coated @ 400-800 nm,
- Type 1 THG BBO crystal with 6×6 mm aperture, P-coated @ 400-800/266 nm,
- Calcite plate for group velocity delay compensation CP, AR coated @ 800+400 nm,
- Zero order dual waveplate W1, optically contacted, AR coated @ 800+400 nm,
- All above four components are mounted in to 1 inch ring holders for convenient handling.

Fundamental pulse duration	Basic FemtoKit FK Series		Basic Mounted FemtoKit FK Series	
	Catalogue number		Catalogue number	
150 – 250 fsec	FK-800-200		FK-800-200-M	
120 – 150 fsec	FK-800-130		FK-800-130-M	
70 – 120 fsec	FK-800-100		FK-800-100-M	
30 – 70 fsec	FK-800-050		FK-800-050-M	
15 – 30 fsec	FK-800-020		FK-800-020-M	

Non-standard kits with larger apertures of BBO crystals and thicknesses optimal for other pulse durations are available on request.

Mounted Femtokit FK Series



EXTENDED FEMTOKIT FKE SERIES

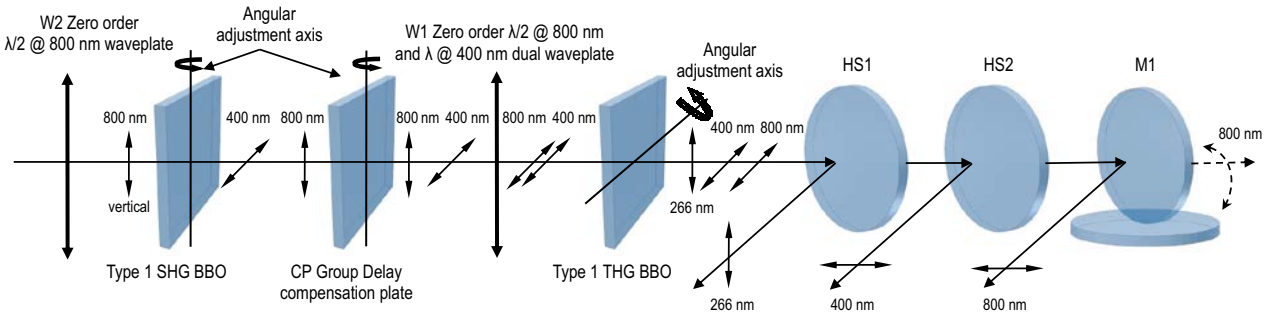
Up to 50% SHG conversion efficiency which was achieved in 0.5 mm SHG BBO crystal with Ti:Sapphire Super Spitfire laser operating at 1 kHz, 130 fs, 20-100 μJ @ 800 nm and effective beam diameter 0.9 mm. THG efficiency was reached up to 8% from fundamental using FKE-800-100 Femtokit.

Extended Femtokit FKE series includes:

- All components from basic kit,
- Additional zero order waveplate W2, optically contacted, AR coated @ 800 nm,
- Harmonic Separator HS1 HR @ 266 nm and HT @ 800+400 nm at AOI=45 deg,
- Harmonic Separator HS2 HR @ 400 nm and HT @ 800 nm at AOI=45 deg,
- Laser mirror M1, HR at 800 nm at AOI=45 deg.

Fundamental pulse duration	Extended FemtoKit FKE Series		Extended Mounted FemtoKit FKE Series	
	Catalogue number		Catalogue number	
150 – 250 fsec	FKE-800-200		FKE-800-200-M	
120 – 150 fsec	FKE-800-130		FKE-800-130-M	
70 – 120 fsec	FKE-800-100		FKE-800-100-M	
30 – 70 fsec	FKE-800-050		FKE-800-050-M	
15 – 30 fsec	FKE-800-020		FKE-800-020-M	

Non-standard kits with larger apertures of BBO crystals and thicknesses optimal for other pulse durations are available on request.



Extended Mounted Femtokit FKE Series

THIN $AgGaS_2$ CRYSTALS FOR DFG → 2.5 – 1.3 µm

Standard specifications

Flatness	λ/6 @ 633 nm
Parallelism	< 20 arcsec
Perpendicularity	< 10 arcmin
Angle tolerance	< 30 arcmin
Aperture tolerance	± 0.1 mm
Surface quality	10 – 5 scratch & dig (MIL-PRF-13830B)
Clear aperture	> 90% of full aperture

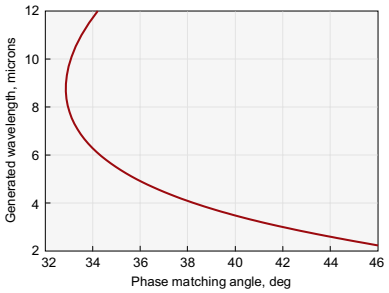
BBAR COATED $AgGaS_2$ CRYSTALS

BBAR coating – is multilayer dialectric antireflection coating made at specified wavelength range. Standard coating is designed to reduce reflection losses at input side at 1.1 – 2.6 micron range and output side at 2.6 – 11 micron range.

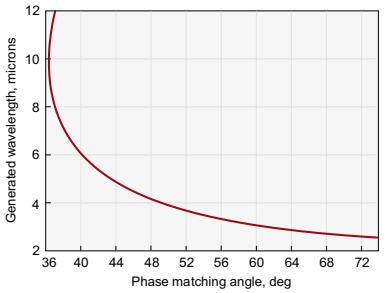
Typical reflection values are R<0.5% in the mid range, and up to reflection values of uncoated crystal at the edges of given ranges. BBAR coating is designed to minimise dispersion of ultrashort pulses and also features high damage threshold.

Size, mm			Orientation		Coating	Application	Catalogue number	
W	H	L	θ	φ				
5	5	1	39	45	BBAR/BBAR @ 1.1-2.6 / 2.6-11 µm	DFG @ 1.2-2.4 µm -> 2.4-11 µm	AGS-401H	
6	6	2	50	0	BBAR/BBAR @ 1.1-2.6 / 2.6-11 µm	DFG @ 1.2-2.4 µm -> 2.4-11 µm	AGS-402H	
5	5	0.4	34	45	BBAR/BBAR @ 3-6 / 1.5-3 µm	SHG @ 3-6 µm, Type 1	AGS-403H	
5	5	0.4	39	45	BBAR/BBAR @ 1.1-2.6 / 2.6-11 µm	DFG @ 1.2-2.4 µm -> 2.4-11 µm	AGS-404H	
8	8	0.4	39	45	BBAR/BBAR @ 1.1-2.6 / 2.6-11 µm	DFG @ 1.2-2.4 µm -> 2.4-11 µm	AGS-801H	
8	8	1	39	45	BBAR/BBAR @ 1.1-2.6 / 2.6-11 µm	DFG @ 1.2-2.4 µm -> 2.4-11 µm	AGS-802H	

Crystals are mounted into open ring holders (see page 2.26).



Type 1 DFG (e-o=o) in AGS. DFG of signal and idler generated in BBO pumped at 800 nm



Type 2 DFG (e-o=e) in AGS. DFG of signal and idler generated in BBO pumped at 800 nm

Housing Accessories

Ring Holders for Nonlinear Crystals

See page 2.26

Positioning Mount 840-0199 for Nonlinear Crystal Housing

See page 2.27

Yb:KGW AND Yb:KYW CRYSTALS LASER LINES AND HARMONICS

Yb:KGW and Yb:KYW crystals have broad emission bandwidths and are used as lasing materials to generate ultrashort (~100 – 200 fs) high power pulses. Direct pump of Yb:KGW/KYW crystals with laser diodes operating at 981 nm supports compact laser systems. Yb:KGW/KYW laser generates pulses at 1023 – 1060 nm wavelength range. Also Yb:KGW and Yb:KYW can be used as ultrashort pulse amplifiers.

We believe that Yb:KGW and Yb:KYW are some of the best materials for high power thin disk lasers generating femtosecond pulses.

Features

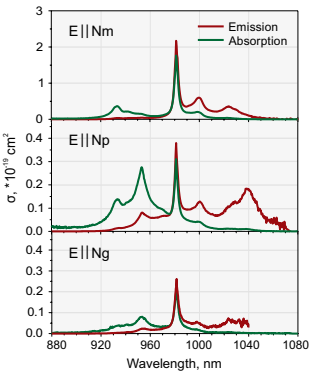
- High absorption coefficient at 981 nm
- High stimulated emission cross section
- Low laser threshold
- Extremely low quantum defect $\lambda_{pump} / \lambda_{se}$
- Broad polarized output at 1023–1060 nm
- High slope efficiency with diode pumping (~ 60%)
- High Yb doping concentration

Custom manufacturing capabilities

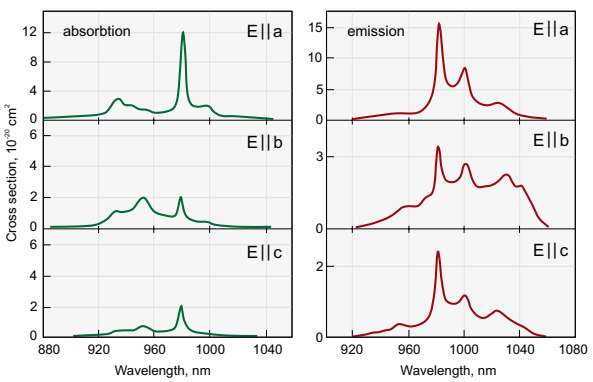
- Various shapes (slabs, rods, cubes, disks)
- Different dopant levels
- Diversified coatings
- Attractive prices for introductory quantities to OEMs

Properties of Yb:KGW and Yb:KYW

Name	Yb:KGW	Yb:KYW
Yb^{3+} concentration	0.5–5%	0.5–100%
Crystal structure	monoclinic	monoclinic
Point group	C2/c	C2/c
Lattice parameters	a=8.095 Å, b=10.43 Å, c=7.588 Å, β=94.43°	a=8.05 Å, b=10.35 Å, c=7.54 Å, β=94°
Thermal expansion	α_a=4×10^{-6}/°C, α_b=3.6×10^{-6}/°C, α_c=8.5×10	—
Thermal conductivity	K_a=2.6 W/mK, K_b=3.8 W/mK, K_c=3.4 W/mK	—
Density	7.27 g/cm^3	6.61 g/cm^3
Mohs' hardness	4–5	4–5
Melting temperature	1075 °C	—
Transmission range	0.35–5.5 µm	0.35–5.5 µm
Refractive indices (λ=1.06 µm)	n_g=2.037, n_p=1.986, n_m=2.033	—
Thermo-optic coefficients @ 1064 nm	$\partial n_p/\partial T$= -15.7×10^{-6} K^{-1} $\partial n_m/\partial T$= -11.8×10^{-6} K^{-1} $\partial n_g/\partial T$= -17.3×10^{-6} K^{-1}	*For 20% Yb:KYW* $\partial n_p/\partial T$= -13.08×10^{-6} K^{-1} $\partial n_m/\partial T$= -7.61×10^{-6} K^{-1} $\partial n_g/\partial T$= -11.83×10^{-6} K^{-1}
Laser wavelength	1023–1060 nm	1025–1058 nm
Fluorescence lifetime	0.3 ms	0.3 ms
Stimulated emission cross section (**E**‖a)	2.6×10^{-20} cm^2	3×10^{-20} cm^2
Absorption peak and bandwidth	α_a=26 cm^{-1}, λ=981 nm, Δλ=3.7 nm	α_a=40 cm^{-1}, λ=981 nm, Δλ=3.5 nm
Absorption cross section	1.2×10^{-19} cm^2	1.33×10^{-19} cm^2
Lasing threshold	35 mW	70 mW
Stark levels energy (in cm^{-1}) of the $^2F_{5/2}$ manifolds of Yb^{3+} @ 77K	10682, 10471, 10188	10695, 10476, 10187
Stark levels energy (in cm^{-1}) of the $^2F_{7/2}$ manifolds of Yb^{3+} @ 77K	535, 385, 163, 0	568, 407, 169, 0



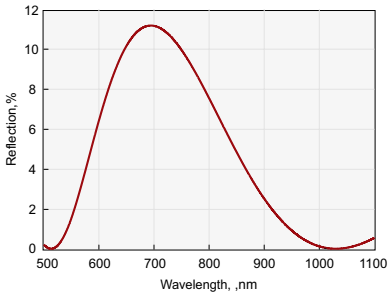
Absorption and stimulated emission cross sections of Yb:KYW



Absorption and emission spectrae of Yb(5%):KGW

BBO AND LBO CRYSTALS FOR Yb:KGW/KYW FREQUENCY CONVERSION

EKSMA OPTICS recommends the following thickness BBO and LBO crystals for Yb:KGW/KYW frequency conversion depending on fundamental wavelength pulse duration, assuming it is spectrum limited Gausian pulse.



Typical AR@1030+515 nm coating for LBO or BBO SHG@1030 nm application

BBO crystals

Pulse duration	BBO SHG @ 1030 nm	BBO THG @ 1030 nm	BBO 4HG @ 1030 nm
50 fs	0.5 mm	0.15 mm	0.1 mm
100 fs	1 mm	0.25 mm	0.15 mm
150 fs	1.5 mm	0.4 mm	0.2 mm
200 fs	2 mm	0.55 mm	0.3 mm

LBO crystals

Pulse duration	LBO SHG @ 1030 nm
50 fs	0.9 mm
100 fs	1.9 mm
150 fs	2.8 mm
200 fs	3.7 mm

Note:
LBO crystals can be supplied with Clear Aperture up to 50 mm diameter.

LBO FOR SHG @ 1030 nm

SHG LBO crystals. Type 1, Thickness = 0.9 mm

Aperture, mm	θ, deg	φ, deg	Coating	Catalogue number	
6×6	90	13.8	AR/AR @ 515+1030 nm	LBO-601H	
8×8	90	13.8	AR/AR @ 515+1030 nm	LBO-801H	
10×10	90	13.8	AR/AR @ 515+1030 nm	LBO-1001H	

SHG LBO crystals. Type 1, Thickness = 1.9 mm

Aperture, mm	θ, deg	φ, deg	Coating	Catalogue number	
6×6	90	13.8	AR/AR @ 515+1030 nm	LBO-602H	
8×8	90	13.8	AR/AR @ 515+1030 nm	LBO-802H	
10×10	90	13.8	AR/AR @ 515+1030 nm	LBO-1002H	

SHG LBO crystals. Type 1, Thickness = 2.8 mm

Aperture, mm	θ, deg	φ, deg	Coating	Catalogue number	
6×6	90	13.8	AR/AR @ 515+1030 nm	LBO-603H	
8×8	90	13.8	AR/AR @ 515+1030 nm	LBO-803H	
10×10	90	13.8	AR/AR @ 515+1030 nm	LBO-1003H	

SHG LBO crystals. Type 1, Thickness = 3.7 mm

Aperture, mm	θ, deg	φ, deg	Coating	Catalogue number	
6×6	90	13.8	AR/AR @ 515+1030 nm	LBO-604H	
8×8	90	13.8	AR/AR @ 515+1030 nm	LBO-804H	
10×10	90	13.8	AR/AR @ 515+1030 nm	LBO-1004H	

BBO FOR SHG @ 1030 nm

SHG BBO crystals. Type 1, Thickness = 0.5 mm

Aperture, mm	θ, deg	φ, deg	Coating	Catalogue number	
6×6	23.4	90	AR/AR @ 515+1030 nm	BBO-651H	
8×8	23.4	90	AR/AR @ 515+1030 nm	BBO-851H	
10×10	23.4	90	AR/AR @ 515+1030 nm	BBO-1051H	

SHG BBO crystals. Type 1, Thickness = 1.0 mm

Aperture, mm	θ, deg	φ, deg	Coating	Catalogue number	
6×6	23.4	90	AR/AR @ 515+1030 nm	BBO-652H	
8×8	23.4	90	AR/AR @ 515+1030 nm	BBO-852H	
10×10	23.4	90	AR/AR @ 515+1030 nm	BBO-1052H	

SHG BBO crystals. Type 1, Thickness = 1.5 mm

Aperture, mm	θ, deg	φ, deg	Coating	Catalogue number	
6×6	23.4	90	AR/AR @ 515+1030 nm	BBO-653H	
8×8	23.4	90	AR/AR @ 515+1030 nm	BBO-853H	
10×10	23.4	90	AR/AR @ 515+1030 nm	BBO-1053H	

SHG BBO crystals. Type 1, Thickness = 2.0 mm

Aperture, mm	θ, deg	φ, deg	Coating	Catalogue number	
6×6	23.4	90	AR/AR @ 515+1030 nm	BBO-654H	
8×8	23.4	90	AR/AR @ 515+1030 nm	BBO-854H	
10×10	23.4	90	AR/AR @ 515+1030 nm	BBO-1054H	

BBO FOR THG @ 1030 nm

Aperture, mm	Thickness, mm	θ, deg	φ, deg	Coating	Catalogue number	
6×6	0.15	32.5	90	AR/AR @ 1030+515/343 nm	BBO-631H	
6×6	0.25	32.5	90	AR/AR @ 1030+515/343 nm	BBO-632H	
6×6	0.4	32.5	90	AR/AR @ 1030+515/343 nm	BBO-633H	
6×6	0.55	32.5	90	AR/AR @ 1030+515/343 nm	BBO-634H	

BBO FOR 4HG @ 1030 nm

Aperture, mm	Thickness, mm	θ, deg	φ, deg	Coating	Catalogue number	
6×6	0.1	50	90	P/P @ 515/257 nm	BBO-641H	
6×6	0.15	50	90	P/P @ 515/257 nm	BBO-642H	
6×6	0.2	50	90	P/P @ 515/257 nm	BBO-643H	
6×6	0.3	50	90	P/P @ 515/257 nm	BBO-644H	

Optical Systems

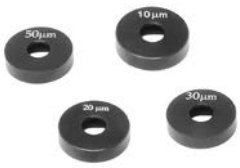
Table of Contents

Compact Variable Laser Power Attenuator ***990-0076***
page 5.17

Precision Spatial Filter
990-1000
Find more at EksmaOptics.com

Y-Z Positioner for lens, pinholes and objectives ***990-0100, 990-0200***
Find more at EksmaOptics.com

Y-Z Positioners for lens, pinholes and objectives ***990-0050, 990-0051***
Find more at EksmaOptics.com



Precision Pinholes
Find more at EksmaOptics.com

Unmounted Iris Diaphragms
Find more at EksmaOptics.com

Mounted Iris Diaphragms
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Mounts for iris diaphragms
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Motorized Iris Diaphragms ***995 Series***
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Motorized Iris Diaphragms
996 Series
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Motorized Iris Diaphragms
997 Series
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Variable Wheel Attenuator
990-0604
Find more at EksmaOptics.com

Closed Variable Wheel Attenuator
990-0704
Find more at EksmaOptics.com

Filters Holder with 90° Flip
990-0400
page 5.18

Motorized Variable Two Wheels Attenuators ***991-0602***
Find more at EksmaOptics.com

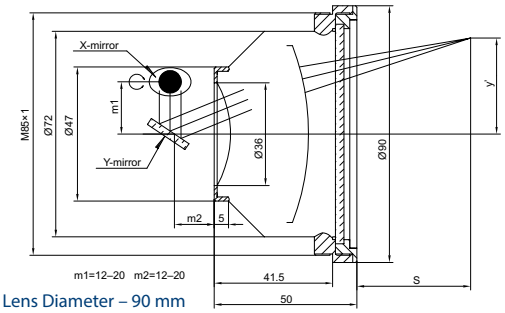
Motorized Closed Variable Two Wheels Attenuators ***991-0702***
Find more at EksmaOptics.com

Air-cooled Beam Dump ***990-0800***
page 5.19

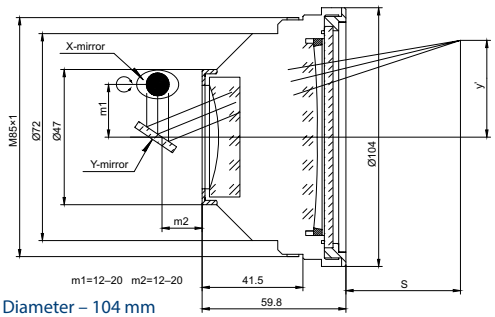
Water-cooled Beam Dump ***990-0820***
page 5.19

F-THETA LENS

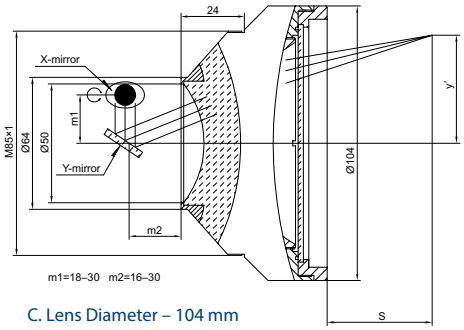
F-Theta lenses are designed to provide a flat field on the image plane for scanning and engraving applications where a high power laser and a set of rotating mirrors are used to scan across a given field.



A. Lens Diameter – 90 mm



B. Lens Diameter – 104 mm



C. Lens Diameter – 104 mm

BEST MIRROR PLACES m1/m2 – 16/16 mm, screw size – M85×1

Wavelength – 1064 nm, Lens Diameter – 90 mm

Focus length, mm	Working distance S, mm	Max. scan area, mm²	Max. scan angle, θ max	Input beam diameter, mm	Spot size, µm	Drawing	Catalogue number
100	114	70×70	±28°	12	16	A	150-1001
160	232	140×140	±28°	12	26	A	150-1601
210	287	145×145	±28°	12	34	A	150-2101
254	284	175×175	±28°	12	31	A	150-2541
290	355	200×200	±28°	12	31	A	150-2901
330	465	220×220	±28°	12	40	A	150-3301
420	467	300×300	±28°	12	50	A	150-4201

Wavelength – 532 nm, Lens Diameter – 90 mm

Focus length, mm	Working distance S, mm	Max. scan area, mm²	Max. scan angle, θ max	Input beam diameter, mm	Spot size, µm	Drawing	Catalogue number
100	114	70×70	±28°	12	16	A	150-1002
160	180	110×110	±28°	12	16	A	150-1602

Wavelength – 355 nm

Focus length, mm	Working distance S, mm	Max. scan area, mm²	Max. scan angle, θ max	Input beam diameter, mm	Spot size, µm	Drawing	Catalogue number
100	136	70×70	±25°	7	10	B	150-1003D1
160	186	110×110	±25°	7	15	B	150-1603

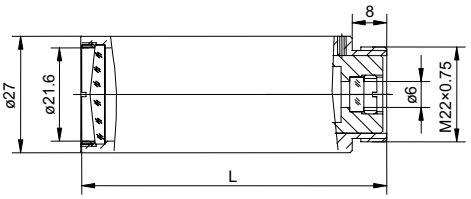
BEST MIRROR PLACES m1/m2 – 24/24 mm, screw size – M85×1

Wavelength – 1064 nm, Lens Diameter – 104 mm

Focus length, mm	Working distance S, mm	Max. scan area, mm²	Max. scan angle, θ max	Input beam diameter, mm	Spot size, µm	Drawing	Catalogue number
163	185	110×110	±28°	20	17	C	151-1631
210	255	150×150	±28°	20	24	C	151-2101
254	285	175×175	±28°	20	31	C	151-2541
420	467	300×300	±28°	20	55	C	151-4201
650	697	400×400	±25°	20	85	C	151-6501

COMPACT BEAM EXPANDER

A laser beam expander is designed to increase the diameter of a collimated input beam to a larger collimated output beam. EKSMA OPTICS offers compact Galilean type beam expanders for 1064 nm, 532 nm and 355 nm wavelengths. Compact beam expander has the possibility to be adjusted for the input beam divergence angle to obtain collimated, divergent or focused beam at the output.



Specifications

Lens material	AR coated Fused Silica Lenses
Screw Size	M22×0.75

Wavelength, nm	Expansion ratio	Beam expander size L, mm	Transmission, %	Catalogue number	
1064	2X	51	>96	160-0021	
1064	2.5X	51	>96	160-0251	
1064	3X	68	>96	160-0031	
1064	4X	75	>96	160-0041	
1064	5X	73	>96	160-0051	
1064	6X	75	>96	160-0061	
1064	8X	77	>96	160-0081	
1064	10X	70	>96	160-0101	
532	2X	51	>96	160-0022	
532	2.5X	51	>96	160-0252	
532	3X	68	>96	160-0032	
532	4X	75	>96	160-0042	
532	5X	73	>96	160-0052	
532	6X	75	>96	160-0062	
532	8X	77	>96	160-0082	
532	10X	70	>96	160-0102	
355	4X	75	>96	160-0043	
355	6X	75	>96	160-0063	
355	8X	68	>96	160-0083	
355	10X	71	>96	160-0103	

Compact beam expanders of other expansion ratio are available upon request.

Related Product

Large Rod Small Mounting Clamp (aluminium) 810-0062A

Find more at EksmaOptics.com

ZOOM BEAM EXPANDER

Features

- Adjustable 1X – 8X or 2X – 8X expansion ratio
- Adjustable divergence
- Galilean design

Compact Galilean type zoom beam expanders are designed for Nd:YAG fundamental and harmonic wavelengths: 1064 nm, 532 nm and 355 nm. Zoom beam expanders provide 1X – 8X or 2X – 8X continuous magnification with adjustable focus to correct for laser beam divergence.

Wavelength, nm	Expantion ratio	Input Clear Aperture, mm	Output Clear Aperture, mm	Length, mm	Catalogue number	
1064	1x-8x	12	33	162	165-1181	
1064	2x-8x	12	33	143.3	165-1281	
532	1x-8x	12	33	162	165-1185	
532	2x-8x	12	33	139.9	165-1285	
355	1x-8x	12	33	162	165-1183	
355	2x-8x	12	33	158.5	165-1283	

Visit our e-shop www.eksmaoptics.com and find the drawings of all zoom beam expanders.

Related Product

Universal Adjustable Optics Mount 830-0035

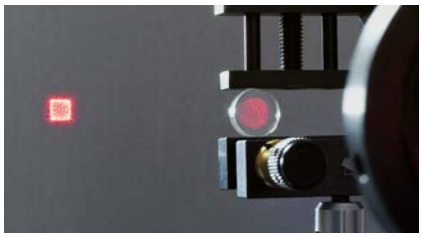
Find more at EksmaOptics.com

TOP HAT BEAM SHAPING LENSES – FBS

Features

- Transforms Gaussian beams into flat-top beams
- Different shapes of Top Hat spots - round, square, line
- Easy to integrate into existing beam paths

FBS Series beam shapers are designed to transform collimated Gaussian beams into small and homogeneous Top Hat spots of square, round or line shapes. FBS beam shapers should be used in setup with focusing optics, and the working distance of a Top Hat beam shaper is determined by the focal length of the focusing optics.



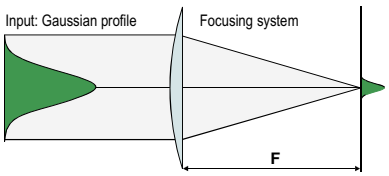
Specifications

Material	UV Fused Silica
Transmission	>99%
Diameter	25.4 mm
Thickness	3 mm
Laser Damage Threshold	10 J/cm^2 @ 1064 nm, 10 ns 5 J/cm^2 @ 532 nm, 10 ns 3 J/cm^2 @ 355 nm, 10 ns

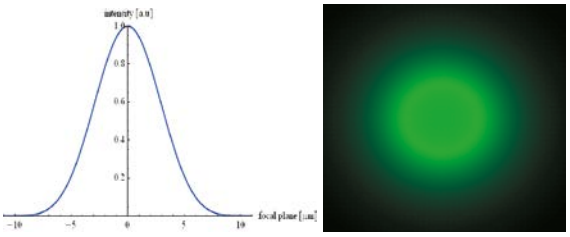
Operation Requirements

Input beam	Gaussian beam (TEM$_{00}$), $M^2 < 1.4$
Input beam diameter	Fixed, ±5% tolerance
Operation wavelength	Fixed
Optical setup	Clear apertures along beam path at least 2.2x larger than the beam size @ 1/e^2

Without FBS Beam Shaper

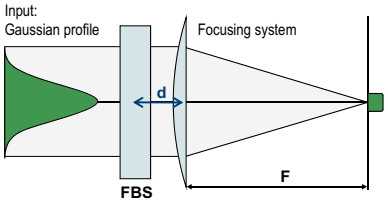


Gaussian-profile at focal plane

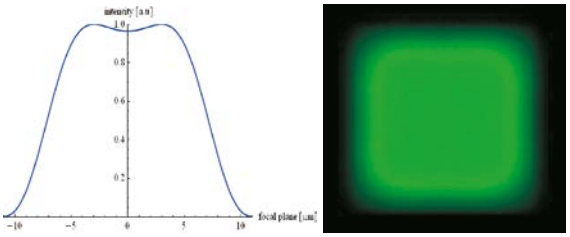


Diffraction limited Gaussian profile

With FBS Beam Shaper

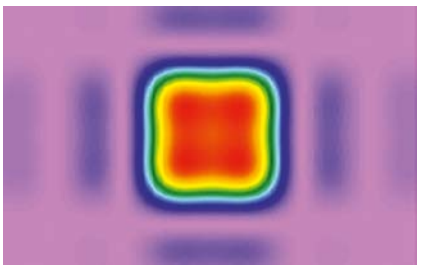


Top-Hat-profile at focal plane



Near diffraction limited Top Hat profile

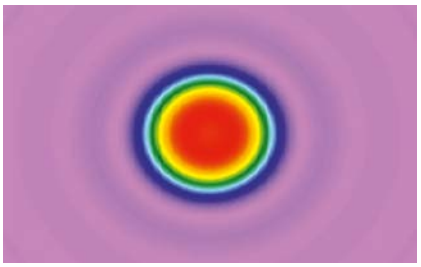
FBS2 – Square Top Hat Profile



Spot Geometry

Top Hat width	approximately 2 × λ ×(f/d), with f = focal length, d = beam diameter @ 1/e²
Efficiency	up to 90%
Homogeneity	ca. ± 2.5% (rel. to average intensity of the Top Hat plateau)
Side modes (strongest)	~16.5x weaker than line plateau (< 1.5% of input energy)
Depth of focus (DOF)	~60% of the Rayleigh length

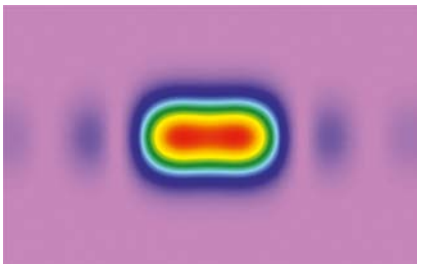
FBSR – Round Top Hat Profile



Spot Geometry

Top Hat diameter	approximately 2 × λ × (f/d), with f = focal length, d = beam diameter @ 1/e²
Efficiency	up to 95%
Homogeneity	ca. ± 2.5% (rel. to average intensity of the Top Hat plateau)
Side modes (strongest)	~70x weaker than line plateau (< 1.5% of input energy)
Depth of focus (DOF)	~30% of the Rayleigh length

FBSL – Line Top Hat Profile



Spot Geometry

Line length (Top Hat)	approximately 2 × λ × (f/d), with f = focal length, d = beam diameter @1/e²
Line width (Gaussian)	Similar to the diameter of Gaussian spot in the same optical configuration
Efficiency	up to 92.5%
Homogeneity	ca. ± 2.5% (rel. to average intensity of the Top Hat plateau)
Side modes (strongest)	~15x weaker than line plateau (< 1.7% of input energy)
Depth of focus (DOF)	~50% of the Rayleigh length

Ordering information

FBS2-1064-1.0

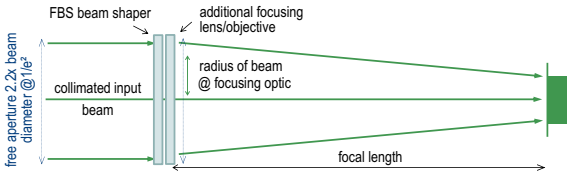
Model name:
- FBS2 – Square profile
- FBSR – Round profile
- FBSL – Line profile

Operation wavelength:
- 1064 nm
- 1030 nm
- 532 nm
- 515 nm
- 355 nm
- 343 nm

Input beam diameter (@ 1/e²):
- From 1.0 to 6.0 mm, increment: 0.5 mm

There are different possibilities to integrate the FBS beam shaper into an optical setup.

1. Beam shaper directly in front of a focusing optic/objective

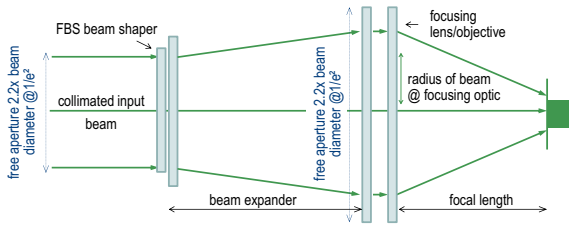


By introducing the FBS beam shaper into the beam path in front of a lens/objective the initial diffraction limited Gaussian spot will be transformed into a homogeneous Top-Hat profile.

When a Gaussian TEM_{00} input beam with a diameter of 5 mm @ $1/e^2$ is used the diameter of the free aperture along the total beam path have to be at least 11 mm (better 13 mm).

If for example a wavelength with 532 nm, a Gaussian TEM_{00} input beam with a diameter of 5 mm@$1/e^2$ and a focusing lens with f=160 mm is used, ones will get a homogeneous Top Hat profile with a diameter of 34 µm.

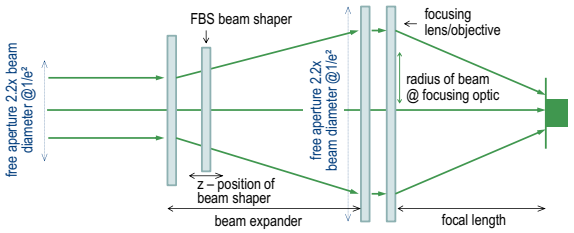
2. Beam shaper in front of a beam expander



There is also the possibility to introduce the FBS beam shaper into the beam path in front of a beam expander. This leads to a higher numerical aperture of the focused beam and to a smaller Top Hat profile.

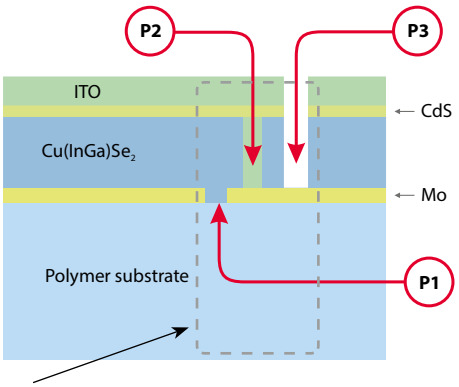
Example: A Gaussian beam with a diameter of 5 mm@$1/e^2$ illuminates the FBS beam shaper and is afterwards increased by a beam expander to a beam diameter of 8 mm. With an focusing optic with f=50 mm the user can generate a Top Hat with a diameter of 7 µm. The needed free aperture increases with the expanded beam. For a beam with a diameter of 8 mm the free aperture has to be at least 18 mm.

3. Beam shaper within a beam expander



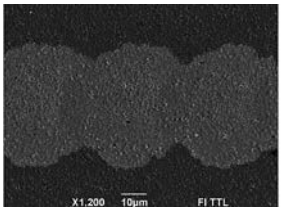
A further and even more flexible possibility is to introduce the FBS beam shaper into the beam path within a beam expander. The user has the possibility for an easy "fine tuning" of beam diameter at the position of FBS beam shaper by shifting shaper along z-axis.

Scribing of CIGS-solar cells

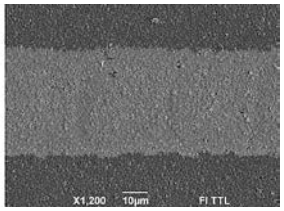


- Wasted area, reducing efficiency → need of smallest scribing lines
- Cut quality influence efficiency → need of small HAZ, no debris, smooth edges
- High scanning speed for high throughput → need of small pulse overlap

P1 – „Scribing"



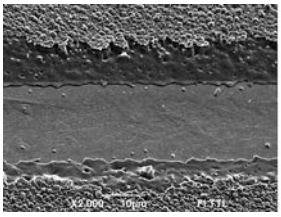
Gaussian Profile



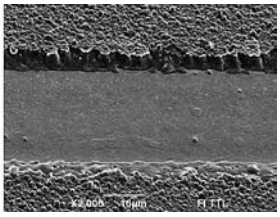
FBS-Top-Hat Profile
small overlap, smooth edges

Removal of a front contact in ZnO(1 µm)/CIGS/Mo/PI structure. Laser PL10100/SH, 10 ps, 370 mW, 100 kHz, 532 nm; scanning speed 4.3 m/s, single pass.

P3 – „Scribing"



Gaussian Profile



FBS-Top-Hat Profile
small HAZ, smooth edges

Tilted SEM pictures of the P3 scribe in ZnO(1 µm)/CIGS/ Mo/PI structure. Laser PL10100/SH, 10 ps, 370 mW, 100 kHz, 532 nm; scanning speed 60 mm/s, single pass.

Raciukaitis et. al, JLMN-Vol. 6, No. 1, 2011

Recommended Accessories

Zoom Beam Expander
See page 5.4

Two Axes Translation Polarizer Holder
840-0240
Find more at EksmaOptics.com

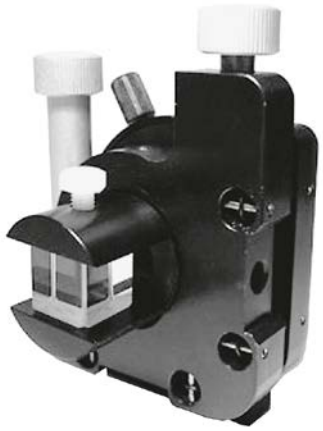
CONTINUOUSLY VARIABLE ATTENUATOR / BEAMSPLITTER – 990-0060

Features

- Divides laser beam into two beams of manually adjustable intensity ratio
- Convenient 90° angle between reflected and transmitted beams
- Negligible beam deviation
- Large dynamic range
- Broadband transmission
- Weight – 0.16 kg

Continuously Variable Attenuator/ Beamsplitter is designed to be used for laser pulses as short as 100 fs. It consists of 2 high-performance polarizing optics components placed in precision opto-mechanical holder 840-0197. Variable attenuator/beamsplitter incorporates a high-performance Polarizing Cube Beamsplitter which reflects s-polarized light at 90° while transmitting p-polarized light.

A rotating λ/2 waveplate is placed in the incident polarized laser beam. The intensity ratio of those two beams may be continuously varied without alteration of other beam parameters by rotating the waveplate.
The intensity of either exit beam, and their intensity ratio, can be controlled over a wide dynamic range. Pure p-polarization could be selected for maximum transmission, or pure s-polarization for maximum attenuation of the transmitted beam.



ACHROMATIC AIR-SPACED WAVEPLATE AND HIGH POWER BROADBAND CUBE POLARIZING BEAMSPLITTER

Specifications

Extinction ratio	Ts/Tp < 1:200
Clear aperture	11 mm

for Broadband Region

Central wavelength, nm	LDT, J/cm²	Catalogue number	
450-680	1 [1)]	990-0060-11VIS	
700-1000	2 [2)]	990-0060-11IR	

[1)] LDT measured at 532 nm, 10 Hz, 10 ns pulses.
[2)] LDT measured at 1064 nm, 10 Hz, 10 ns pulses.

MULTIPLE ORDER HALF WAVEPLATE AND HIGH POWER CUBE POLARIZING BEAMSPLITTER

Specifications

Extinction ratio	Ts/Tp < 1:500
Clear aperture	11 mm

Central wavelength, nm	LDT, J/cm² *	Catalogue number	
1064	15	990-0061-11	
1030	15	990-0062-11	
800	8	990-0063-11	
532	6	990-0064-11	
355	3	990-0065-11	

* LDT measured at designed wavelength, 10 Hz, 10 ns pulses.

VARIABLE ATTENUATORS FOR LINEARLY POLARIZED LASER BEAM – 990-0070

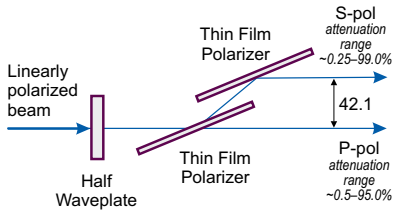
Features

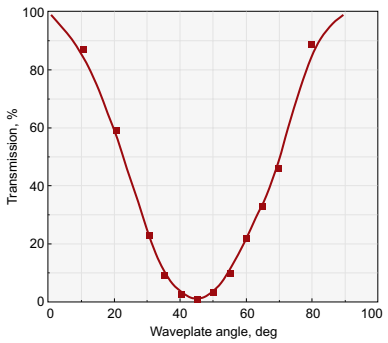
- Divides laser beam into two parallel beams of manually adjustable intensity ratio
- Large dynamic range
- Transmitted beam shift ~ 0.5 mm
- High optical damage threshold

Note: Movable base ***820-0090***, Rod Holder ***820-0050-02*** and standard rod should be ordered seperately.

This variable attenuator/beamsplitter consists of special design opto-mechanical Adapter and precision opto-mechanical holder 840-0197. Two Thin Film Brewster type polarizers, which reflect s-polarized light while transmitting p-polarized light, are housed into Adapter. Quartz Half Waveplates are housed in rotating holder 840-0197.

The intensity ratio of those two beams may be continuously varied without alteration of other beam parameters by rotating the waveplate. The intensity of either exit beam, or their intensity ratio, can be controlled over a wide dynamic range. P-polarization could be selected for maximum transmission, or high-purity s-polarization could be reflected when maximum attenuation of the transmitted beam takes place. The holder 840-0197 allows to adjust Angle Of Incidence of the Thin Film Brewster type polarizers by ±2° and to get the maximum polarization contrast.





For Nd:YAG Laser Applications

Aperture diameter	17 mm
Damage threshold	5 J/cm² pulsed at 1064 nm, typical
Polarization Contrast (after 1st polarizer)	>1:200
Polarization Contrast (after 2nd polarizer)	>1:500
Weight	0.35 kg

For Nd:YAG Laser Applications

Wavelength, nm	Catalogue number	
266	990-0070-266H *	
355	990-0070-355	
532	990-0070-532	
1064	990-0070-1064	

Multi order half waveplate is housed in rotating holder 840-0197 for Nd:YAG laser pulses (laser damage threshold: 5 J/cm² pulsed at 1064 nm, typical).

* With Zero Order Air-Spaced half waveplate.

For Femtosecond Applications

Aperture diameter	17 mm
Damage threshold	>10 mJ/cm², 50 fs pulse at 800 nm, typical
for high power laser applications	>100 mJ/cm², 50 fs pulse at 800 nm, typical
Time dispersion	t<4 fs for 100 fs Ti:Sapphire laser pulses
Polarization Contrast (after 1st polarizer)	>1:200
Polarization Contrast (after 2nd polarizer)	>1:500
Weight	0.35 kg

For Femtosecond Applications

Wavelength, nm	Catalogue number	
257	990-0070-257	
266	990-0070-266	
343	990-0070-343	
400	990-0070-400	
390-410	990-0070-400B	
515	990-0070-515	
505-525	990-0070-515B	
800	990-0070-800	
780-820	990-0070-800B	
1030	990-0070-1030	
1010-1050	990-0070-1030B	

Zero order optically contacted half waveplate is housed in rotating holder 840-0197 for femtosecond laser pulses (laser damage threshold: >10 mJ/cm², 50 fsec pulse, 800 nm typical).

For High Power Femtosecond Laser Applications

Wavelength, nm	Catalogue number	
257	990-0070-257H	
266	990-0070-266H	
343	990-0070-343H	
400	990-0070-400H	
390-410	990-0070-400HB	
515	990-0070-515H	
505-525	990-0070-515HB	
800	990-0070-800H	
780-820	990-0070-800HB	
1030	990-0070-1030H	
1010-1050	990-0070-1030HB	

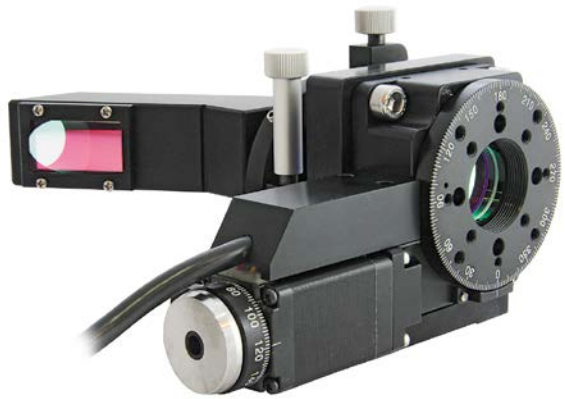
Zero Order Air-Spaced half waveplate is housed in rotating holder 840-0197 for high power femtosecond applications (laser damage threshold: >100 mJ/cm², 50 fsec pulse, 800 nm typical).

Related Products

Beam dumps 990-0800, 990-0820

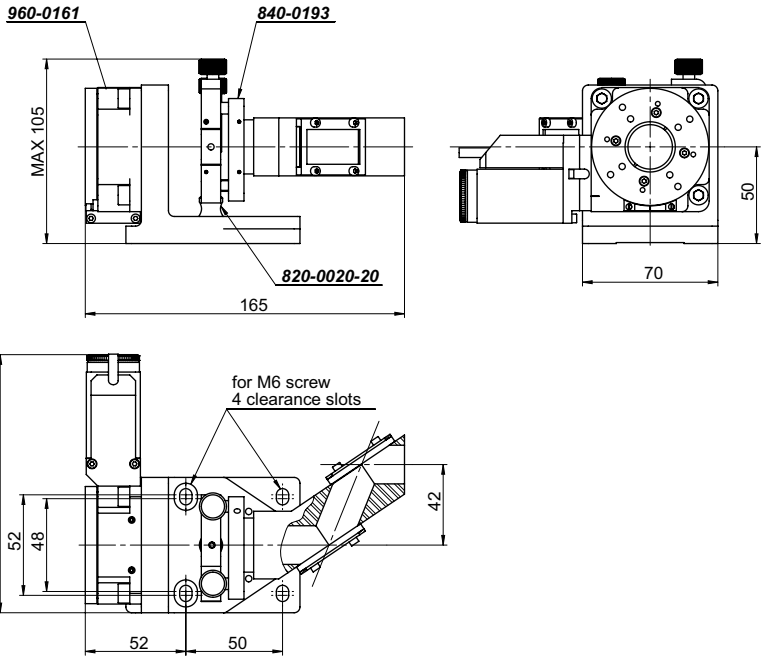
See page 5.19

MOTORIZED VARIABLE ATTENUATOR FOR LINEARLY POLARIZED LASER BEAM – 990-0070M



This motorized variable attenuator/beamsplitter consists of special design opto-mechanical Adapter and precision opto-mechanical holder 840-0193. Two Thin Film Brewster type polarizers, which reflect s-polarized light while transmitting p-polarized light, are housed into Adapter. Quartz Half Waveplates are housed in motorized rotation stage 960-0161.

The intensity ratio of those two beams may be continuously varied without alteration of other beam parameters by rotating the waveplate. The intensity of either exit beam, or their intensity ratio, can be controlled over a wide dynamic range. P-polarization could be selected for maximum transmission, or high-purity s-polarization could be reflected when maximum attenuation of the transmitted beam takes place. The holder 840-0193 allows to adjust Angle Of Incidence of the Thin Film Brewster type polarizers by ±2° and to get the maximum polarization contrast.



Ordering information

Please note: these motorized variable attenuators for linearly polarized laser beam are provided without controller and power supply. If you would like to order the complete solution (controller 980-1045 and power supply: PS12-1.5-4), please ad CP to code.

Example:

990-0070-266M – motorized attenuator without controller and power supply.

990-0070-266M+CP – motorized attenuator with controller and power supply.

For Nd:YAG Laser Applications

Wavelength, nm	Catalogue number	
266	990-0070-266HM *	
355	990-0070-355M	
532	990-0070-532M	
1064	990-0070-1064M	

Multi order half waveplate is housed in Motorized Rotation Stage 960-0161 and Polarizer with adapter in Kinematic Optical Mount 840-0193 for Nd:YAG laser application (laser damage threshold: 5 J/cm², 10 ns pulses, 10 Hz at 1064 nm, typical).

* With Zero Order Air-Spaced half waveplate.

For Femtosecond Applications

Wavelength, nm	Catalogue number	
257	990-0070-257M	
266	990-0070-266M	
343	990-0070-343M	
400	990-0070-400M	
390-410	990-0070-400BM	
515	990-0070-515M	
505-525	990-0070-515BM	
800	990-0070-800M	
780-820	990-0070-800BM	
1030	990-0070-1030M	
1010-1050	990-0070-1030BM	

Zero order optically contacted half waveplate is housed in Motorized Rotation Stage 960-0161 and Polarizer with adapter in Kinematic Optical Mount 840-0193 for femtosecond laser application (laser damage threshold: >10 mJ/cm², 50 fsec pulse, 800 nm typical).

For High Power Femtosecond Applications

Wavelength, nm	Catalogue number	
257	990-0070-257HM	
266	990-0070-266HM	
343	990-0070-343HM	
400	990-0070-400HM	
390-410	990-0070-400HBM	
515	990-0070-515HM	
505-525	990-0070-515HBM	
800	990-0070-800HM	
780-820	990-0070-800HBM	
1030	990-0070-1030HM	
1010-1050	990-0070-1030HBM	

Zero Order Air-Spaced half waveplate is housed in Motorized Rotation Stage 960-0161 and Polarizer with adapter in Kinematic Optical Mount 840-0193 for high power femtosecond laser application (laser damage threshold: >100 mJ/cm², 50 fsec pulse, 800 nm typical).

BROADBAND VARIABLE ATTENUATOR FOR FEMTOSECOND LASER PULSES – 990-0070HBBI70

Features

- Divides laser beam into two parallel beams of manually adjustable intensity ratio
- Large dynamic range
- Transmitted beam shift ~ 2.6 mm
- High optical damage threshold

990-0070-800HBBi70

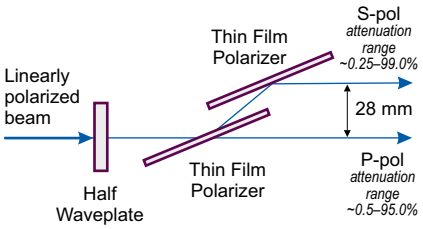
990-0070-800HBBi70M

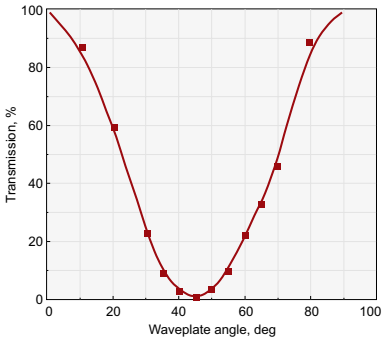
This variable attenuator/beamsplitter consists of a special design opto-mechanical adapter and a precision opto-mechanical holder 840-0197. Two thin film polarizers, operating at AOI=70° and reflecting s-polarized light while transmitting p-polarized light, are housed into the adapter. A quartz zero order air-spaced half waveplate is housed into the rotating holder 840-0197.

The intensity ratio of outgoing two parallel beams may be continuously varied without alteration of other beam parameters by rotating the waveplate. The intensity of the exit beam or outgoing beams intensity ratio can be controlled over a wide dynamic range.

P-polarized beam is transmitted straightly with a 2.6 mm shift and s-polarized beam (after 2 reflections) is parallel to the outgoing p-polarized beam, just separated by 28 mm.

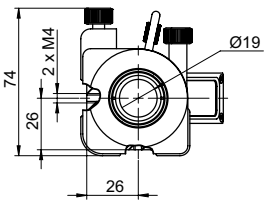
The 840-0197 holder allows to adjust angle of incidence of the thin film polarizers by ±2° and to achieve the maximum polarization contrast.

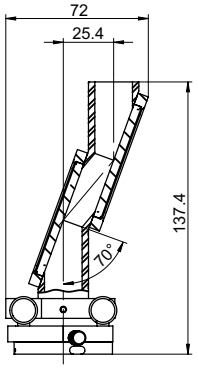




Specifications

Aperture diameter	12 mm
Operating bandwidth	100 nm
Damage treshold	50 mJ/cm² pulsed at 800 nm, 50 fsec, 50 Hz
Polarization contrast (after 1st polarizer)	>1:200
Polarization contrast (after 2nd polarizer)	>1:500





990-0070-800HBBi70

Ordering information

Please note: these motorized variable attenuators for linearly polarized laser beam are provided without controller and power supply. If you would like to order the complete solution (controller 980-1045 and power supply: PS12-1.5-4), please ad CP.

Example:

990-0070-800HBBi70 – motorized attenuator without controller and power supply.

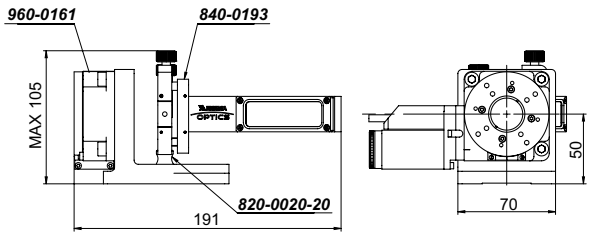
990-0070-800HBBi70+CP – motorized attenuator with controller and power supply.

Manual attenuators

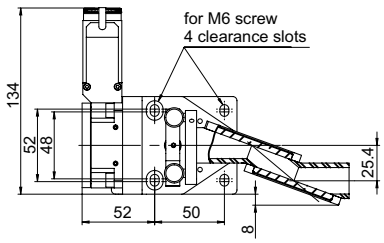
Wavelength, nm	Catalogue number	
750-850	990-0070-800HBBi70	
980-1080	990-0070-1030HBBi70	

Motorized attenuators

Wavelength, nm	Catalogue number	
750-850	990-0070-800HBBi70M	
980-1080	990-0070-1030HBBi70M	



990-0070-800HBBi70M



VARIABLE ATTENUATORS FOR LINEARLY POLARIZED LASER BEAM – 990-0071

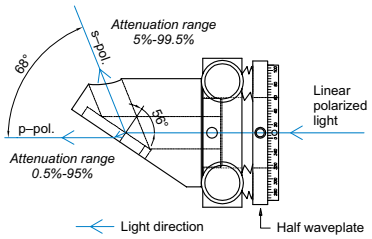
Features

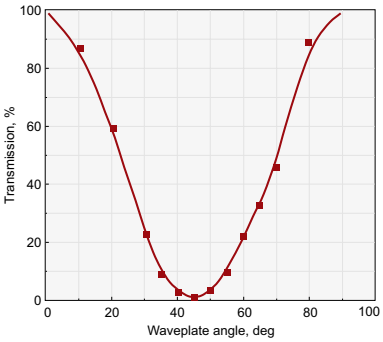
- Divides laser beam into separated by 68° angle two beams of manually adjustable intensity ratio
- Large dynamic range
- Transmitted beam shift ~0.5 mm
- High Optical damage threshold

Note: Solid Base Height Extender ***820-0210*** and Standard Rod ***820-0020-20*** should be ordered separately

This variable attenuator/beamsplitter consists of special design opto-mechanical adapter for polarizer at 56° 840-0117A or 840-0118A and precision opto-mechanical holder 840-0197. Thin Film Brewster type polarizer, which reflect s-polarized light at 56° while transmitting p-polarized light, is housed into adapter for polarizer at 56°. Quartz Half Waveplates are housed in rotating holder 840-0197.

The intensity ratio of those two beams may be continuously varied without alteration of other beam parameters by rotating the waveplate. The intensity of either exit beam, or their intensity ratio, can be controlled over a wide dynamic range. P-polarization could be selected for maximum transmission, or high-purity s-polarization could be reflected when maximum attenuation of the transmitted beam takes place. The holder 840-0197 allows to adjust Angle Of Incidence of the Thin Film Brewster type polarizer by ±2° and to get the maximum polarization contrast.





For Nd:YAG Laser Applications

Aperture diameter	10 mm
Damage threshold	5 J/cm² pulsed at 1064 nm, typical
Polarization Contrast	>1:200
Weight	0.25 kg

For Nd:YAG Laser Applications

Wavelength, nm	Catalogue number	
266	990-0071-266H *	
355	990-0071-355	
532	990-0071-532	
1064	990-0071-1064	

Multi order half waveplate is housed in rotating holder 840-0197 for Nd:YAG laser pulses (laser damage threshold: 5 J/cm² pulsed at 1064 nm, typical).

* With Zero Order Air-Spaced half waveplate.

For Femtosecond Applications

Aperture diameter	10 mm
Damage threshold	>10 mJ/cm², 50 fs pulse at 800 nm, typical
for high power laser applications	>100 mJ/cm², 50 fsec pulse, 800 nm typical
Time dispersion	t<4 fs for 100 fs Ti:Sapphire laser pulses
Polarization Contrast	>1:200
Weight	0.25 kg

For Femtosecond Applications

Wavelength, nm	Catalogue number	
257	990-0071-257	
266	990-0071-266	
343	990-0071-343	
400	990-0071-400	
390-410	990-0071-400B	
515	990-0071-515	
505-525	990-0071-515B	
800	990-0071-800	
780-820	990-0071-800B	
1030	990-0071-1030	
1010-1050	990-0071-1030B	

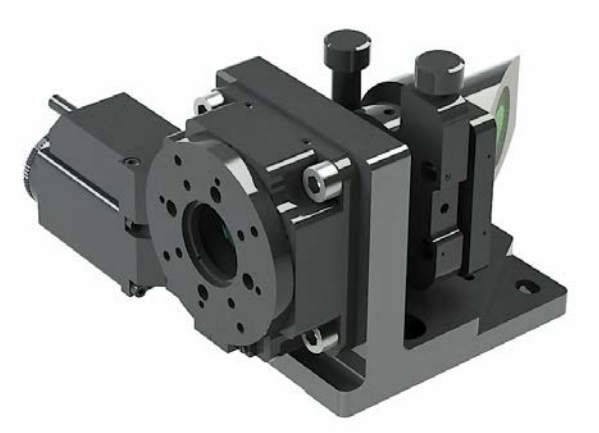
Zero order optically contacted half waveplate is housed in rotating holder 840-0197 for femtosecond laser pulses (laser damage threshold: >10 mJ/cm², 50 fs pulse at 800 nm, typical).

For High Power Femtosecond Laser Applications

Wavelength, nm	Catalogue number	
257	990-0071-257H	
266	990-0071-266H	
343	990-0071-343H	
400	990-0071-400H	
390-410	990-0071-400HB	
515	990-0071-515H	
505-525	990-0071-515HB	
800	990-0071-800H	
780-820	990-0071-800HB	
1030	990-0071-1030H	
1010-1050	990-0071-1030HB	

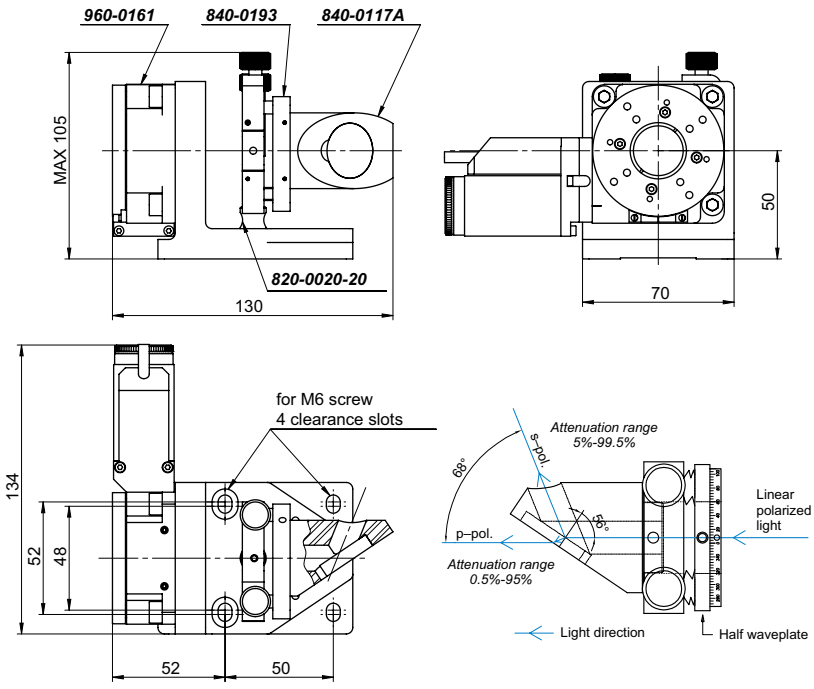
Zero Order Air-Spaced half waveplate is housed in rotating holder 840-0197 for high power femtosecond applications (laser damage threshold: >100 mJ/cm², 50 fsec pulse, 800 nm typical).

MOTORIZED VARIABLE ATTENUATOR FOR LINEARLY POLARIZED LASER BEAM – 990-0071M



This motorized variable attenuator/beamsplitter consists of special design opto-mechanical adapter for polarizer at 56° 840-0117A or 840-0118A and precision opto-mechanical holder 840-0193. Thin Film Brewster type polarizer, which reflect s-polarized light at 56° while transmitting p-polarized light, is housed into adapter for polarizer at 56°. Quartz Half Waveplates are housed in motorized rotation stage 960-0161.

The intensity ratio of those two beams may be continuously varied without alteration of other beam parameters by rotating the waveplate. The intensity of either exit beam, or their intensity ratio, can be controlled over a wide dynamic range. P-polarization could be selected for maximum transmission, or high-purity s-polarization could be reflected when maximum attenuation of the transmitted beam takes place. The holder 840-0193 allows to adjust Angle of Incidence of the Thin Film Brewster type polarizer by ±2° and to get the maximum polarization contrast.



Ordering information

Please note: these motorized variable attenuators for linearly polarized laser beam are provided without controller and power supply. If you would like to order the complete solution (controller 980-1045 and power supply: PS12-1.5-4), please ad CP to code

Example:
990-0071-266M – motorized attenuator without controller and power supply.

990-0071-266M+CP – motorized attenuator with controller and power supply.

For Nd:YAG Laser Applications

Wavelength, nm	Catalogue number	
266	990-0071-266HM *	
355	990-0071-355M	
532	990-0071-532M	
1064	990-0071-1064M	

Multi order half waveplate is housed in Motorized Rotation Stage 960-0161 and Polarizer with adapter in Kinematic Optical Mount 840-0193 for Nd:YAG laser application (laser damage threshold: 5 J/cm^2, 10 ns pulses, 10 Hz at 1064 nm, typical).

* With Zero Order Air-Spaced half waveplate.

For Femtosecond Applications

Wavelength, nm	Catalogue number	
266	990-0071-266M	
343	990-0071-343M	
400	990-0071-400M	
390 – 410	990-0071-400BM	
515	990-0071-515M	
505 – 525	990-0071-515BM	
800	990-0071-800M	
780 – 820	990-0071-800BM	
1030	990-0071-1030M	
1010 – 1050	990-0071-1030BM	

Zero order optically contacted half waveplate is housed in Motorized Rotation Stage 960-0161 and Polarizer with adapter in Kinematic Optical Mount 840-0193 for femtosecond laser application (laser damage threshold: >10 mJ/cm^2, 50 fsec pulse, 800 nm typical).

For High Power Femtosecond Laser Applications

Wavelength, nm	Catalogue number	
266	990-0071-266HM	
343	990-0071-343HM	
400	990-0071-400HM	
390 – 410	990-0071-400HBM	
515	990-0071-515HM	
505 – 525	990-0071-515HBM	
800	990-0071-800HM	
780 – 820	990-0071-800HBM	
1030	990-0071-1030HM	
1010 – 1050	990-0071-1030HBM	

Zero Order Air-Spaced half waveplate is housed in Motorized Rotation Stage 960-0161 and Polarizer with adapter in Kinematic Optical Mount 840-0193 for high power femtosecond laser application (laser damage threshold: >100 mJ/cm^2, 50 fsec pulse, 800 nm typical).

VARIABLE ATTENUATOR FOR FEMTOSECOND LASER PULSES – 990-0072

Features

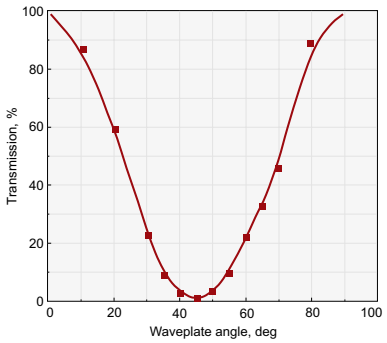
- Divides laser beam into two beams of manually adjustable intensity ratio separated by 68° angle
- Large dynamic range
- Trasmitted beam shift ~1 mm
- High optical damage threshold

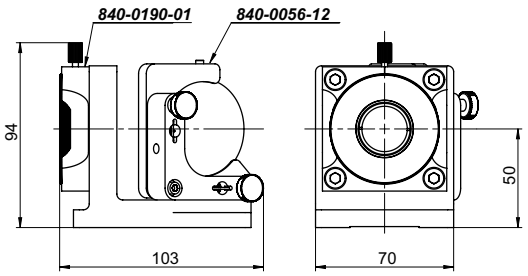
Check ***www.eksmaoptics.com*** for motorized version ***990-0072M***

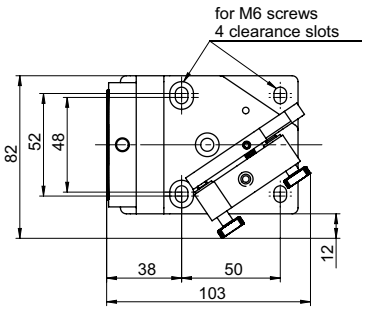
This variable attenuator/beamsplitter consists of Polarizer Holder 840-0190-01 and Kinematic Mirror/Beamsplitter Mount 840-0056-12. UVFS Thin Film Brewster type polarizer diameter 50.8 mm, which reflect s-polarized light while transmitting p-polarized light, is housed into Beamsplitter Mount 840-0056-12. A quartz Zero Order (optically contacted) Half Waveplate Ø25.4 mm (for femtosecond applications), quartz Zero Order Air-Spaced Half Waveplate (for high power femtosecond applications) or quartz Multi Order Half Waveplate Ø25.4 mm (for Nd:YAG laser applications) is housed in rotating polarizer holder 840-0180-A1 and placed in the incident linearly polarized laser beam.

The intensity ratio of those two separated and different polarized beams may be continuously varied without alteration of other beam parameters by rotating the waveplate. The intensity of either exit beam, or their intensity ratio, can be controlled over a wide dynamic range. P-polarization could be selected for maximum transmission, or high-purity s-polarization could be reflected when maximum attenuation of the transmitted beam takes place.

The holder 840-0056-12 allows to adjust Angle Of Incidence of the Thin Film Brewster type polarizers by ±4.5° and to get the maximum extinction contrast. The mounts are on rods, rod holders and Movable Base 820-0090. The optical axis height from the table top can be adjusted in the range 78-88 mm. Other height can be offered as custom changing the standard rods and rod holders into higher.







For Nd:YAG Laser Applications

Clear Aperture diameter	22 mm
Damage threshold	>5 J/cm², 10 ns pulse, 10 Hz at 1064 nm, typical
Polarization Contrast	>1:200
Transmitted beam shift	~ 1 mm
Weight	0.45 kg

A quartz Multi Order Half Waveplate Ø25.4 mm is housed in rotating holder 840-0180-A1.

For Nd:YAG Laser Applications

Wavelength, nm	Catalogue number	
266	990-0072-266H *	
355	990-0072-355	
532	990-0072-532	
1064	990-0072-1064	

* A quartz Zero Order Air-Spaced Half Waveplate clear aperture Ø22 mm is housed in rotating holder 840-0190-01.

For Femtosecond Applications

Clear Aperture diameter	22 mm
Damage threshold	>10 mJ/cm², 50 fs pulse at 800 nm, typical
for high power applications	>100 mJ/cm², 50 fs pulse at 800 nm, typical
Polarization Contrast	>1:200
Transmitted beam shift	~ 1 mm
Weight	0.45 kg

A quartz Zero Order (optically contacted) Half Waveplate (for femtosecond applications) or Zero Order Air-Spaced Half Waveplate (for high power applications) Ø25.4 mm are housed in rotating holder 840-0190-01.

For Femtosecond Applications

Wavelength, nm	Catalogue number	
266	990-0072-266	
343	990-0072-343	
400	990-0072-400	
515	990-0072-515	
800	990-0072-800	
780 – 820	990-0072-800B	
1030	990-0072-1030	
1010 – 1050	990-0072-1030B	

For High Power Femtosecond Laser Applications

Wavelength, nm	Catalogue number	
266	990-0072-266H	
343	990-0072-343H	
400	990-0072-400H	
515	990-0072-515H	
800	990-0072-800H	
780 – 820	990-0072-800HB	
1030	990-0072-1030H	
1010 – 1050	990-0072-1030HB	

VARIABLE ATTENUATOR FOR FEMTOSECOND AND Nd:YAG LASER PULSES – 990-0073

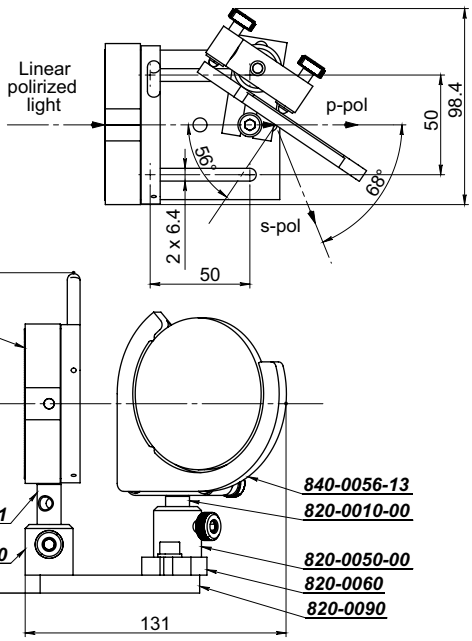
Features

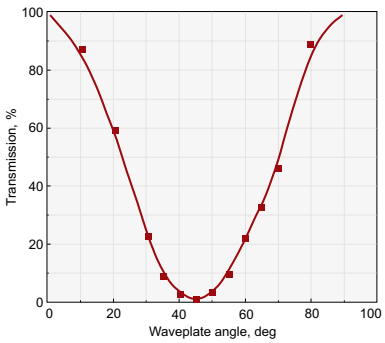
- Divides laser beam into two beams of manually adjustable intensity ratio separated by 68° angle
- Large dynamic range
- Trasmitted beam shift ~1.4 mm
- High optical damage threshold
- Motorized version available on request

This variable attenuator/beamsplitter consists of Polarizer Holder 840-0180-A2 and Kinematic Mirror/Beamsplitter Mount 840-0056-13. UVFS Thin Film Brewster type polarizer Ø76.2 mm, which reflect s-polarized light while transmitting p-polarized light, is housed into Beamsplitter Mount 840-0056-13. A quartz Zero Order (optically contacted) Half Waveplate Ø40 mm (for femtosecond applications), Zero Order Air-Spaced Half Waveplate (for high power femtosecond applications) or quartz Multi Order Half Waveplate Ø40 mm (for Nd:YAG laser applications) is housed in rotating polarizer holder 840-0180-A2 and placed in the incident linearly polarized laser beam.

The intensity ratio of those two separated and different polarized beams may be continuously varied without alteration of other beam parameters by rotating the waveplate. The intensity of either exit beam, or their intensity ratio, can be controlled over a wide dynamic range. P-polarization could be selected for maximum transmission, or high-purity s-polarization could be reflected when maximum attenuation of the transmitted beam takes place.

The holder 840-0056-13 allows to adjust Angle Of Incidence of the Thin Film Brewster type polarizers by ±4.5° and to get the maximum extinction contrast. The mounts are on rods, rod holders and Movable Base 820-0090. The optical axis height from the table top can be adjusted in the range 92-98 mm. Other height can be offered as custom changing the standard rods and rod holders into higher.





For Nd:YAG Laser Applications

Clear Aperture diameter	36 mm
Damage threshold	>5 J/cm², 10 ns pulse, 10 Hz at 1064 nm, typical
Polarization Contrast	>1:200
Transmitted beam shift	~ 1.4 mm
Weight	0.6 kg

Quartz Multi Order Half Waveplate Ø40 mm is housed in rotating polarizer holder 840-0180-A2.

For Nd:YAG Laser Applications

Wavelength, nm	Catalogue number	
266	990-0073-266H *	
355	990-0073-355	
532	990-0073-532	
1064	990-0073-1064	

* Zero Order Air-Spaced half waveplate is housed in rotating holder.

For Femtosecond Applications

Clear Aperture diameter	36 mm
Damage threshold	>10 mJ/cm², 50 fs pulse at 800 nm, typical
for high power applications	>100 mJ/cm², 50 fs pulse at 800 nm, typical
Polarization Contrast	>1:200
Transmitted beam shift	~ 1.4 mm
Weight	0.6 kg

A quartz Zero Order (optically contacted) Half Waveplate Ø40 mm (for femtosecond applications) or Zero Order Air-Spaced Half Waveplate (for high power applications) is housed in rotating polarizer holder 840-0180-A2.

For Femtosecond Applications

Wavelength, nm	Catalogue number	
266	990-0073-266	
343	990-0073-343	
400	990-0073-400	
515	990-0073-515	
800	990-0073-800	
780 – 820	990-0073-800B	
1030	990-0073-1030	
1010 – 1050	990-0073-1030B	

For High Power Femtosecond Laser Applications

Wavelength, nm	Catalogue number	
266	990-0073-266H	
343	990-0073-343H	
400	990-0073-400H	
515	990-0073-515H	
800	990-0073-800H	
780 – 820	990-0073-800HB	
1030	990-0073-1030H	
1010 – 1050	990-0073-1030HB	

COMPACT MOTORIZED LASER POWER ATTENUATOR – 990-0075

Features

- Compact design
- High optical damage threshold
- Full solution - includes controller, software, power supply and USB cable
- Standard models for the most popular laser wavelengths are offered ex-stock

990-0075 series laser power attenuator is a compact motorized device for laser power control of linearly polarized beam. Its operation principle consists of changing laser beam polarization by rotation of zero-order half-waveplate and then passing the beam through a fixed Brewster type thin film polarizer which transmits p-polarized and reflects s-polarized laser beam. The intensity ratio of s- and p- polarized beams can be continuously varied without alteration of other beam parameters by motorized rotation of the waveplate. The attenuation level is controlled by the software in 0.1 – 97% range.

The device combines unique mechanical design which ensures repeatability and high stability of performance. All optical components of the attenuator have high LIDT coatings and provide stable and reliable performance even using device with high power lasers in industrial applications.

A secondary laser beam with s-polarization can be rejected from the laser power attenuator unit to an external beam dump or utilized for the particular application. A standard compact external beam dump is optionally offered with this attenuator and is suitable for lasers with average power up to 6 W. This beam dump stops secondary s-polarized beam in the attenuator and allows to avoid any thermal effects or stress in the housing of the device.

Standard Kit includes:

- Motorized laser power attenuator
- Controller
- Software
- Power suppy (DC 12 V)
- USB cable (1.5 m)

Optical Specifications

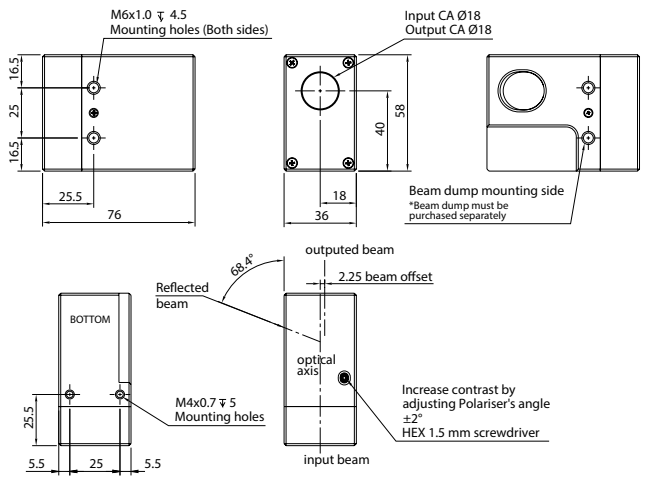
Clear input aperture	Ø18 mm
Clear output aperture	Ø18 mm
Power attenuation range	<0.1 % to >98 %
LIDT coating	>10 J/cm², 10 ns @ 1064 nm
Close to open time	< 0.2 sec
Resolution	175,542 µsteps in full rotation (0.002 deg, 7.2 arcsec, 0.035 mrad)
Accuracy (repeatability after 10,000 positions without homing)	±10 µsteps (±0.02 deg, less than ±0.035 %)
Motor	2 phase stepper motor, 200 steps with 256 µstepping

Mechanical Specifications

	Length	Width	Height
Attenuator	76 mm	36 mm	58 mm
Attenuator with beam dump	76 mm	52 mm	58 mm
Controller	125 mm	53 mm	31 mm

Operating Conditions

Operating temperature	10 to 40 °C
Storage temperature	-15 to 50 °C



Laser Power Attenuators

Wavelength, nm	LIDT	Catalogue number	
343	3 J/cm², 10 ns, 50 Hz @ 343 nm	990-0075-343M	
355	3 J/cm², 10 ns, 50 Hz @ 355 nm	990-0075-355M	
390 – 410	3 J/cm², 10 ns, 50 Hz @ 400 nm	990-0075-400M	
510 – 520	5 J/cm², 10 ns, 50 Hz @ 515 nm	990-0075-515M	
532	5 J/cm², 10 ns, 50 Hz @ 532 nm	990-0075-532M	
780 – 820	8 J/cm², 10 ns, 50 Hz @ 800 nm	990-0075-800M	
1020 – 1040	10 J/cm², 10 ns, 50 Hz @ 1030 nm	990-0075-1030M	
1064	10 J/cm², 10 ns, 50 Hz @ 1064 nm	990-0075-1064M	

Additional Accessories

Catalogue number	Description	
990-0075ABD	Attachable Beam Dump <6W with coated protective window	
990-0075SBD	Separated Beam Dump < 30 W	
990-0075C1	RS232 Cable, 1.8 m	
990-0075C5	RS232 Cable, 5 m	
990-0075C10	RS232 Cable, 10 m	
990-0075C15	RS232 Cable, 15 m	
990-0075RA	DIN35 Rail Adapter	

COMPACT VARIABLE LASER POWER ATTENUATOR – 990-0076

Features

- Attenuation range for reflected beam: 2% – 99.9%
- Attenuation range for transmitted beam: 0.1% – 98%
- Convenient 90° angle between reflected and transmitted beams
- No beam shift at exit

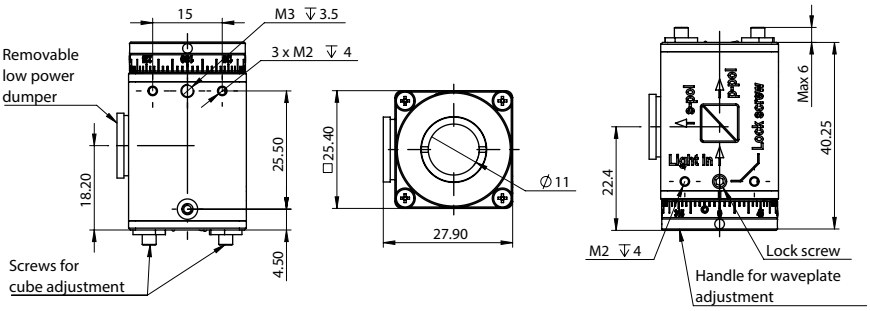
990-0076 Variable Attenuator incorporates a high-performance polarizing cube beamsplitter which reflects s-polarized light at 90° while transmitting p-polarized light. A rotatable λ/2 waveplate is placed in the incident polarized laser beam.

The intensity ratio of the two outgoing beams may be continuously varied without alteration of other beam parameters by rotating the half waveplate. The intensity of either exit beam, or their intensity ratio, can be controlled over a wide dynamic range. Pure p-polarization could be selected for maximum transmission, or pure s-polarization for maximum reflection.

Specifications

Clear aperture diameter	10 mm
Polarization contrast	>1:1000
Weight	0.1 kg

Wavelength, nm	LIDT	Catalogue number	
343	3 J/cm² @ 355 nm, 10 Hz, 10 ns	990-0076-343	
355	3 J/cm² @ 355 nm, 10 Hz, 10 ns	990-0076-355	
515	6 J/cm² @ 532 nm, 10 Hz, 10 ns	990-0076-515	
532	6 J/cm² @ 532 nm, 10 Hz, 10 ns	990-0076-532	
1030	15 J/cm² @ 1030 nm, 10 Hz, 10 ns	990-0076-1030	
1064	15 J/cm² @ 1064 nm, 10 Hz, 10 ns	990-0076-1064	



FILTERS HOLDER WITH 90° FLIP – 990-0400

Features

- Allows stacking of 5 filters of Ø25.4 mm (1"), or 3 filters of Ø50.8 (2")
- Fast flipping in and out of beam path
- Available to be used in 90° position
- Has one M4, two M6 and two holes Ø6.4mm for mounting on posts or table bases
- Large aperture allows to attenuate large diameter laser beam
- Black Anodized Aluminium and Brass screws

The holder of 1 inch filters 990-0415 allows the fixation of up to 5 filters into 1 inch optics ring holders. The thickness of optical filters (or any other optical elements) to be held is from 0.5 mm to 8.0 mm. Filters can be easily replaced in ring holders. This filter holder allows fast filter removal from beam path flipping it at 90° position. Any position of filters can be fixed with fixing screw. The firm 0° position can be fixed with the second brass screw (included).

The holder of 2 inch filters 990-0423 allows the fixation of up to 3 filters into 2 inch optics ring holders. The thickness of optical filters (or any other optical elements) to be held is from 0.5 mm to 14.0 mm.

The holder 990-0415ND is the same holder 990-0415 but with Neutral Density filters that operates as step energy attenuator and allows adjusting transmission from 100% (all 5 filters are at 90° position) till 0.015% (all 5 filters are at 0° position) at visible region. If you need other adjustment you can choose any other Neutral Density filter Ø25.4 mm.

Using the holder 990-0415 with various color glass or dielectric filters various transmitted band pass regions can be achieved. The Filters Holder with 90° Flip is made of black anodized aluminium and brass screws.

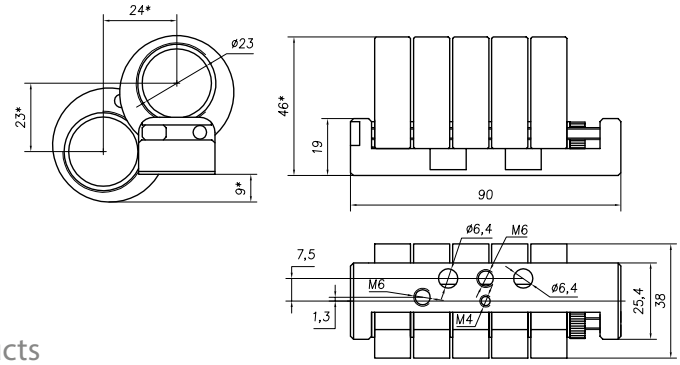
Acceptable filters number	Suitable filters diameter, mm	Clear aperture diameter, mm	Weight, kg	Catalogue number	
5	25.4	23	0.16	**990-0415**	
5	25.4	23	0.19	**990-0415ND**	
3	50.8	48	0.22	**990-0423**	

990-0415

990-0423

990-0415 at 0° position
(Note: Solid base height extender 820-0210 should be ordered seperately)

990-0423 at 0° position
(Note: Solid base height extender should be ordered seperately)



990-0415 at 0° or 90° position
(Note: Solid base height extender 820-0210 should be ordered seperately)

Related Products

Neutral Density Filters Ø25.4 mm

See page 1.14

AIR-COOLED BEAM DUMP – 990-0800

990-0800

Beam Dump 990-0800 is designed to block CW or pulsed laser beams. It can be used on beams of up to 50 W in the wavelength range from 0.1 to 30 µm.

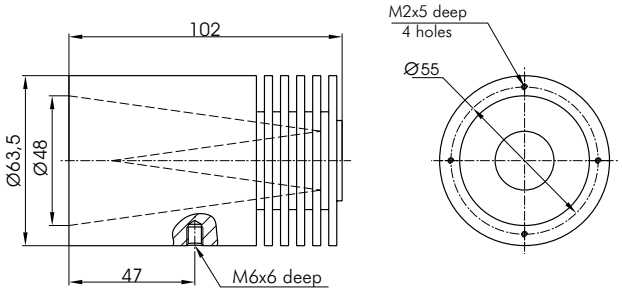
Due to the design of the beam dump, even if the non-reflective coating is damaged by high intensity pulses, there is no backward reflection.

990-0801 is a smaller beam dump designed to block a CW or a pulsed laser beam. It can be used on beams of up to 5 Watts in the wavelength range from 0.1 to 30 µm.

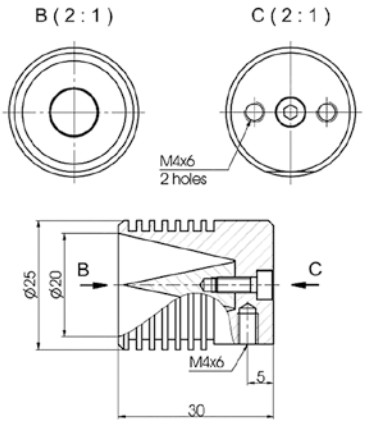
Specifications

Wavelength range	0.1 – 30 µm
Laser type	pulsed, CW

Aperture	Description	Catalogue number	
48 mm	for beams up to 50 W	990-0800	
20 mm	for beams up to 5 W	990-0801	



Drawing of ***990-0800***



Drawing of ***990-0801***

WATER-COOLED BEAM DUMP – 990-0820

990-0820

Beam Dump 990-0820 is designed to block CW or pulsed laser beams. It is mainly intended for beams 2 inch wide.

The dump is best suited for beams of up to 1 kW from 0.1 – 30 µm wavelength range.

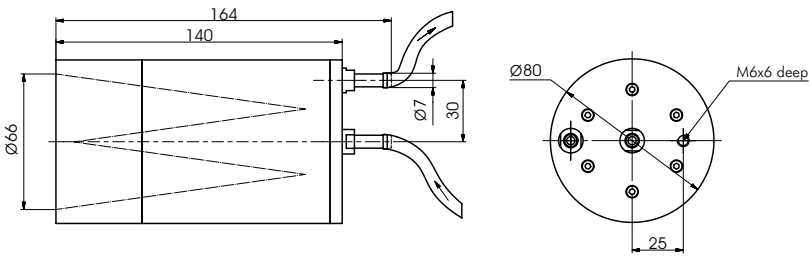
Even if the non-reflective coating is damaged by high intensity pulses, the beam is not reflected back into your optical scheme.

The dump mounts on M6 hole on its back.

Specifications

Wavelength range	0.1 – 30 µm
Max. handling power	1 kW
Max. energy	50 J (20 Hz)
Acceptance aperture	48 mm (1.89")
Laser type	pulsed, CW
Weight	1.2 kg

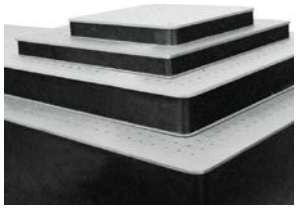
Catalogue number	
990-0820	



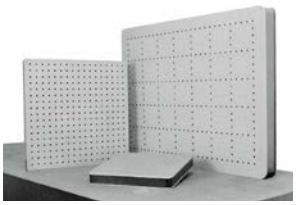
Opto-Mechanical Components

Find specifications, datasheets, drawings and order online at **www.eksmaoptics.com**

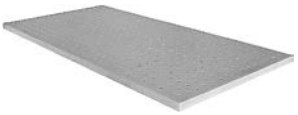
OPTICAL TABLES



Honeycomb Table Tops
720 – 740



Honeycomb Breadboards
704 – 712



Aluminium Breadboards
715

Solid steel Breadboard
716

Pneumatic Vibration Isolation System ***740***

Pneumatic Vibration Isolation Workstation ***740W***

Pneumatic Vibration Isolation System ***742***

Optical Table Supports
765 / ***766***

Active Vibration Isolation System ***770-5060***

Active Vibration Isolation Workstation ***778-5060***

Active Vibration Isolation System ***776-0200***

Laboratory Rack Device ***790***

Table Connectors
791

Laser Shelves
792

Protective Screens
793

Instrument Shelves
794

Laminar Tabletop Workstation
750

BRACKETS & RAILS

Narrow Aluminium Optical Rail
810-0001

Narrow Aluminium Rail Carriers
810-0002

Aluminium Optical Rails
810-0005

Aluminium Rail Carriers
810-0007

Steel Optical Rails
810-0010

Steel Rail Carriers
810-0020

Sliding Rail Carrier
810-0030

Multiple Mounting Plates
810-0035

Large Rods
810-0040; -0050

Vertical Positioner
810-0060

Large Rod Mounting Clamp
810-0061

Large Rod Small Mounting Clamp (aluminium) ***810-0062A***

Periscope on Silent Rods
810-0065

Periscope on Large Rods
810-0067

Large Table Base
810-0070

Angle Brackets
810-0080; -0090

Angle Brackets
810-0100

Angle Brackets
810-0110

Angle Brackets
810-0112

Angle Brackets
810-0115

Angle Brackets
810-0116

Angle Brackets
810-0120

Mini Angle Brackets
810-0130

Angle Brackets
810-0140

Angle Brackets
810-0145

Angle Brackets
810-0146

Angle Brackets
810-0150

Angle Brackets
810-0150-01

Angle Brackets
810-0160

BASE MOUNTS & ACCESSORIES

Silent Rods
795-0010

Thread Adapters
795-0016

Standard Rods
820-0010; -0020

Collar
820-0030

Rod Translators
820-0040

Translating Post Holder
820-0045

Rod Holders
820-0050

Rod Holder with Base Adapter
820-0051

Fixed Pedestals
820-0055

Movable Base
820-0060

Movable Base
820-0070

Movable Base
820-0080

Movable Base
820-0090

Movable Base
820-0100

Table Bases
820-0110

Base Plates with eccentric clamp
820-0120

Table Clamp
820-0125

Base Plate with Rotary Clamp
820-0130

Universal Base Plates
820-0135

Universal Base
Plates ***820-0136***

Low-profile Magnetic Base
820-0140

Compact Magnetic Bases
820-0150

Riser Blocks
820-0160; -0170

Rod Clamp
820-0180

Rod Clamp
820-0190

Rod Clamp
820-0200

Solid Base Height Extenders
820-0210; -0220

Rod Holders Base Adapter
820-0225

Table Clamps
820-0230

Table Clamps
820-0240

Connecting Cones
820-0250; -0254

Screws
820-0260

Hex key
820-0270

Screws
820-0280

Washer
820-0290

OPTICAL MOUNTS

Self-Centring Lens Mounts
830-0010; -0020

Self-Centering Lens/Optics Mounts
830-0025

Self-Centering Lens/Optics Mounts
830-0027-08

Adjustable Lens Mounts
830-0030

Universal Adjustable Lens/Optics Mounts ***830-0035***

Optical Component Mounts
830-0037

Variable Lens Holder
830-0040

Optics Clamp
830-0050

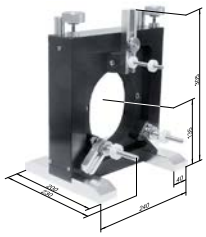
Plate Clamp
830-0055

Filter Holders
830-0060A; -0070A

Universal Plate Holder
830-0075

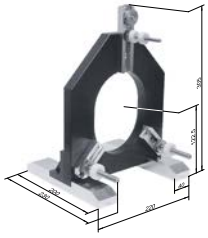
Rectangular Optics Holder
830-0100; -0110

OPTICAL POSITIONERS



Large Adjustable Kinematic Optical Mount ***840-0005***

Precise Adjustable Kinematic Mount for Large Optics ***840-0005-05***



Large Optical Mount ***840-0006***

Self-centring Large Aperture Optical Mount ***840-0007***

Kinematic Mirror and Beamsplitter Steel Mounts ***840-0010; -0020***

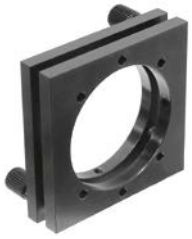
Kinematic Mirror and Beamsplitter Steel Mounts ***840-0030***

Kinematic Mirror, Beamsplitter Aluminium Mounts ***840-0032; -0033***

Stable Steel Mirror/Beamsplitter Mounts ***840-0036***

Precision and High Stability Aluminium Optics Mounts
840-0040; -0050

Universal Mirror Mount/Platform
840-0052



Large Aperture Optical Mount
840-0053

Miniature Kinematic Mirror / Beamsplitter Mount ***840-0054***

Kinematic Mirror / Beamsplitter Mounts ***840-0056***

Mounts with hard seats ***840-0057***

Compact Kinematic Mirror / Window Mount ***840-0058-01***

Mirror / Optics Mount ***840-0060***

Mirror Mounts with Locking Screws ***840-0080***

Compact Mirror Mount ***840-0090***

Miniature Tilt / Rotation Mount of Side Control ***840-0093***

Gimbal Mount ***840-0096***

Round Optics Adapter ***840-0100-A1***

Miniature Clamp ***840-0100-A2***

Mirror Adapter ***840-0100-A3***

Prism and Polarizing Cube Adapters ***840-0100-A4***

Platform Adapter ***840-0100-A5***

Small Optical Mount of Side Drive ***840-0102-T***

Mirror Mounts of Side Regulation ***840-0110-T***

Round Optics Adapters ***840-0110-A1***

Miniature Clamp ***840-0110-A2***

Mirror Adapter ***840-0110-A3***

Platform Adapter ***840-0110-A5***

Spring Clamps ***840-0111; -0112***

Adapter for Mirror and Beamsplitter at 45° ***840-0115***

Adapter for Mirror and Beamsplitter at 45° ***840-0116***

Adapters for Polarizer at 56°
840-0117

Adapters for Polarizer at 56°
840-0118

Prism / Optics Mount
840-1120-B

Universal Platform Mount
840-2120-B

Beamsplitter / Mirror Mounts
840-3120-B

Mirror Optical Mount
840-4120-B

Objective Mount
840-0120-T

Beamsplitters / Optics Mount
840-0130-T

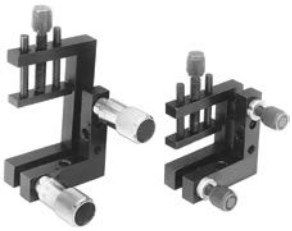
Universal Mirror Mount / Platform
840-0140-T

Large Aperture Optical Mount
840-0150-T

Flipping Mirror / Beamsplitter Mount
840-0155

Flipping Mirror / Beamsplitter Mount
840-0155-04

Miniature Flipping
Mirror / Beamsplitter Mount
840-0155-06; -09



Prism Holders
840-0160; -0170

Polarizer Holders
840-0180

Polarizer Holders
840-0185

High Precision Rotation Polarizer,
Waveplate Mount ***840-0186***

Polarizer Holder
840-0190

Beamsplitter Mount of Side Drive
840-0191

Kinematic Double Optical Mount of
Side Drive ***840-0192***

Kinematic Optical Mount of Side Drive ***840-0193***

Adjustable Polarizer Holder of Side Drive ***840-0195***

Optical Mount of Side Drive with Adjustable Polarizer Holder ***840-0197***

Kinematic Adjustable Polarizer Holder of Side Drive ***840-0199***

Five axes Kinematic Optical Mount ***840-0210***

Kinematic Vertical Drive Optical Mount/Vertical Drive Optical Mount ***840-0220; -0225***

Kinematic Vertical Drive Optical Mount ***840-0230***

Two Axes Translation Polarizer Holder ***840-0240***

BASE POSITIONERS

Multi-Axls Tilt Platform ***850-0010***

Kinematic Bases ***850-0020; -0022***

Magnetic Kinematic Base ***850-0030***

Single Axis Tilt Stage ***850-0040***

Adjustable Laser / Laser Head Holder ***850-0095***

Adjustable Height Platform ***850-0200***

Find specifications, datasheets, drawings and order online at **www.eksmaoptics.com**

TRANSLATION & ROTATION STAGES

Compact Translation Stage
860-0010

Translation Stage
860-0051

XYZ Translation System
860-0051XYZ

Vacuum Compatible Translation System ***860-0051XYZ***

Stable Steel Translation Stage
860-0052

Low Cost Linear Translation Stage
860-0053

Stainless Steel Single to Multi-Axes Stages ***860-0054***

Non-Magnetic Translation Stage
860-0056

Side Control Linear Stages
860-0058

Narrow (30 mm) Aluminium Translation Stages
860-0060-02; -05

Medium (50 mm) Aluminium Translation Stages
860-0060-06; -08; -10

Vacuum Compatible Aluminium Translation Stages
860-0060V-08; -10

Low Profile Aluminium Translation Stages ***860-0070-02; -04***

Low Profile Translation Stage with Quick Move Lever ***860-0070-06***

Vertical Translation Stage
860-0075

Basic Translation Stages
860-0085

Mini Rail System Ball Slide Positioners
860-0090

Ultra Low Profile Steel Translation Stages Single and two-Axes
860-0092

Side Control Linear Steel Stages
860-0092T

Vertical Drive Ultra Low Profile Steel Translation Stages ***860-0092D***

Low Profile two-Axes Aluminium Translation Stage ***860-0094***

Low Profile two-Axes Aluminium Translation Stage of Side Control ***860-0094-02***

Aluminium Ball Bearing Stage ***860-0096***

Aluminium Ball Bearing Vertical Stages ***860-0098***

Vertical Stage ***860-0099***

Micro Translation Stage ***860-0100***

XZ Micro Translation Stage of Side Regulation ***860-0102***

Linear Flexure Translation Stage ***860-0105***

Dovetail Linear Translation Stage ***860-0106***

Tilt / Rotation Stage ***860-0110***

Mini Rotation Stage ***860-0120***

Micro Rotation Stage ***860-0130***

Precision Rotary Stage ***860-0140***

2 inch Aperture Rotation Stage ***860-0150***

Rotation Stages ***860-0155***

Vacuum Compatible Rotation Stage ***860-0155V***

Rotation Stage of Big Platform ***860-0160***

Rotation Stage of Big Platform ***860-0165***

Mini Rotation Stage ***860-0170***

Small Goniometer ***860-0180***

Fiber Coupling Stage ***860-0210***

ADJUSTMENT SCREWS

Precise and Micrometer Screws
870-0010; -0020

Fine Closed Screw
870-0030

Micrometer Screws
870-0040

Thin Micrometers
870-0045

High-Resolution Micrometers
870-0050

Mini Micrometers
870-0055

Compact Fine Screws
870-0060

Adjustment Screws
870-0070; -0071

Ultra-Fine Adjustment Screws
870-0080

Fine hex Adjustment Screws
870-0090; -0095

MOTORIZED POSITIONERS

Motorized Mirror Mounts
940-0050

Motorized Mirror / Beamsplitter Mount ***940-0060***

Motorized Two Axes Translation Optical Mount ***940-0070***

Vacuum Compatible Motorized Vertical Drive Optical Mount with DC motor ***940-0080***

Motorized Flipper Mount
940-0090

Motorized Gimbal Mount
940-0096

Motorized Vertical Translation Stage
940-0200

Motorized Vertical Stage
940-0210

Motorized Z Stage
940-0212

Motorized Vertical Positioning Stage
940-0215

Motorized Precision Vertical Positioner ***940-0218***

Motorized Vertical Lift Stage
940-0220

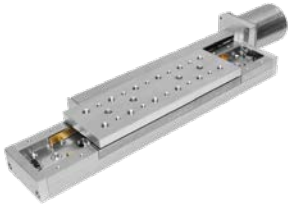
Narrow Motorized Translation Stage with Stepper Motor ***960-0050***

Narrow Motorized Translation Stage with Vacuum Compatible Stepper Motor ***960-0050V***

Narrow Motorized Translation Stages with DC Motors
961-0050; 962-0050

Narrow (width 30 mm) Motorized Translation Stages ***960-0060-01; -04***

Medium (width 50 mm) Motorized Translation Stages ***960-0060-06; -12***



Vacuum Compatible Motorized Stages ***960-0060V***

Motorized Translation Stage
960-0065

Motorized Translation Stage
960-0080

Motorized Translation Stage
960-0090

Motorized Translation Stage
960-0095

Motorized Translation Stage with SM System ***960-0095SM***

Motorized Translation Stage with DC motor ***961-0095***

Motorized XY Scanning Stage
960-0097

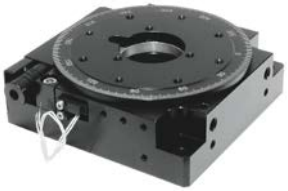
Motorized Delay Line
960-0100

Long-Travel Motorized Linear Stages
960-0110

Long-Travel Motorized Linear Stages
960-0115

Large Motorized Rotation Stages
960-0130

Motorized Rotation Stages
960-0140



Motorized Rotation Stages
960-0150

Motorized Rotation Stages
with SM System ***960-0140SM***

Motorized Rotation Stages
with SM System ***960-0150SM***

Motorized Rotation Stages
960-0160

Motorized Rotation Stages
960-0170

Vacuum Compatible Motorized
Rotation Stage ***960-0170V***

Motorized Goniometers
960-0180

Universal Motorized Rotation Stage
960-0190

Motorized Vertical Translation Stage
960-0199

Large Motorized Rotation Stage
960-0250

Narrow Motorized Translation Stage
with DC Motor ***961-0060***

Narrow Motorized Translation Stage
with Vacuum Compatible DC Motor
961-0060V

Motorized Screws
970-0040

Motorized Actuator
970-0050

Compact Motorized Actuator
970-0060

Motorized Actuator
970-0065

Ultra-High Resolution Compact
Motorized Actuator (DC Motor)
970-0067

Ultra-High Resolution Compact
Motorized Actuator with Vacuum
Compatible DC motor ***970-0067V***

Motorized Fiber Coupling Stage
970-0070

Motorized Translation Stage
970-0080

Motorized Translation Stage
970-0085

Motorized Rotation and Tilt Stage
970-0090

Stepper & DC Motor Controller
980-0045-USB

Power Supplies

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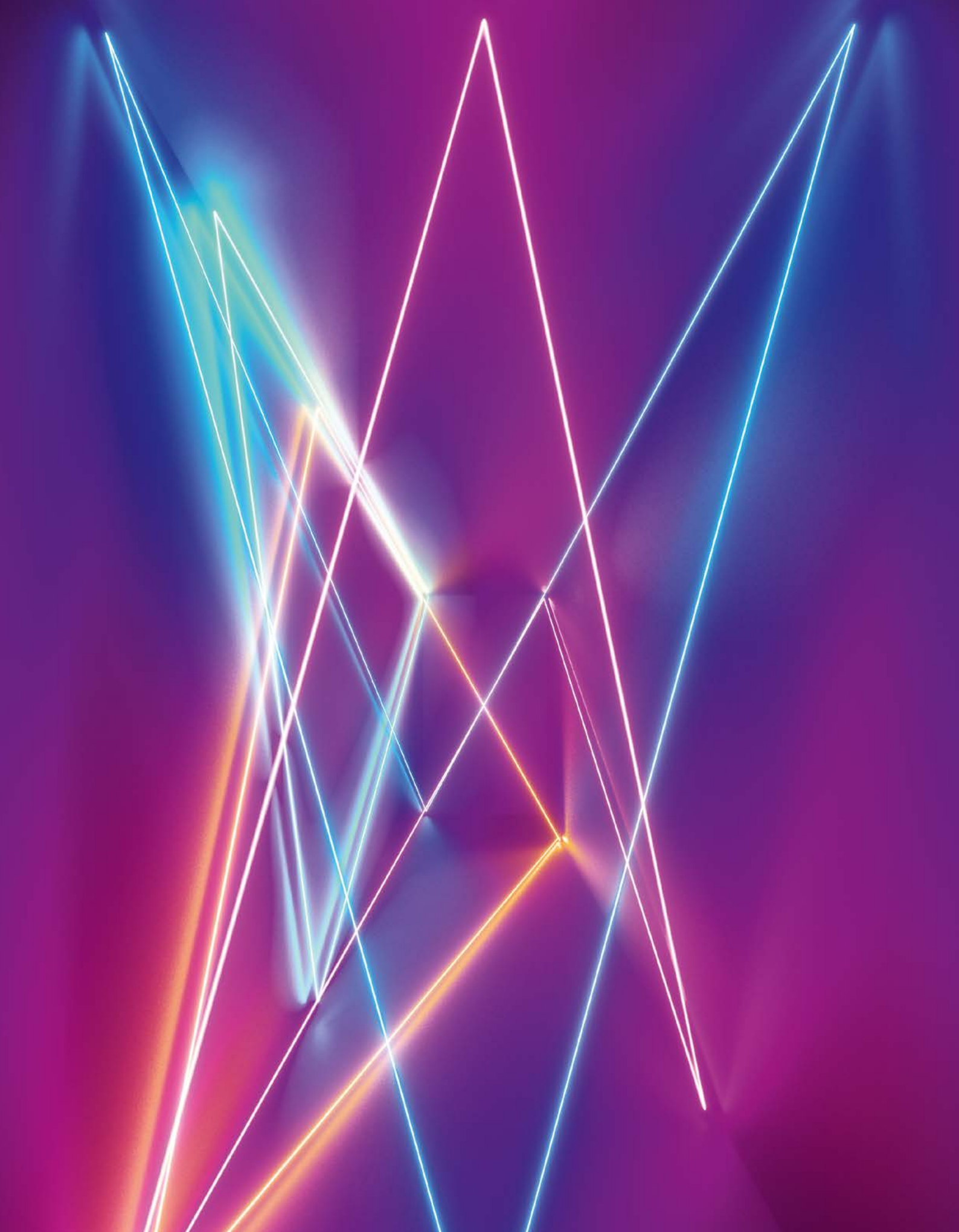


Appendixes

Table of Contents

USEFUL FORMULAS & CONSTANTS

Physical Constants

Planck's constant $h = 6.6260755\times10^{-34}$ J·s $= 4.5\times10^{-15}$ eV·s
$= 6.626\times10^{-27}$ erg·s

Dirac's constant $\hbar = h/2\pi = 1.054\times10^{-34}$ J·s $= 1.054\times10^{-27}$ erg·s

Boltzmann's constant $k_B = 1.380\times10^{-16}$ erg/K
$= 8.62\times10^{-5}$ eV/K $= 1.380\times10^{-23}$ J/K

kT = 25.9 meV at room temperature
= 0.36 meV at liquid-helium temperature (4.2 K)
= 6.7 meV at liquid-nitrogen temperature (4.2 K)

Velocity of light in vacuum $c = 2.99792458\times10^{8}$ m/s

Electron charge $e = 1.602\times10^{-19}$ coulombs

Avogadro number $N_a = 6.0221367\times10^{23}$ particles/mol

Permeability of vacuum $\mu_0 = 4\times10^{-7}$ T²·m³/J
$= 12.566370614\times10^{-7}$ T²·m³/J

Permittivity of vacuum $\varepsilon_0 = 1/(\mu_0\cdot c^2) = 8.854187817\times10^{-12}$ C²/J·m

Electron rest mass $m_e = 9.1093897\times10^{-31}$ kg

Proton rest mass $m_p = 1.6726231\times10^{-27}$ kg

Neutron rest mass $m_n = 1.6749286\times10^{-27}$ kg

Etalon Formulas

Two parameters completely specify an etalon: the free spectral range (*FSR*) and the finesse ($\mathfrak{F}$). The *FSR* is the spacing (usually given in frequency) between transmission peaks. The finesse is the ratio of the free spectral range to the full width at half maximum (*FWHM*) of the transmission peak and is directly related to the reflectivity of the surface *R*.

$$FSR = \frac{c}{2nl} \qquad \mathfrak{F} = \frac{FSR}{FWHM} = \frac{\pi\sqrt{R}}{1-R}$$

c is the speed of light, *n* is the index of refraction of the etalon, and *L* is the thickness of the etalon.

At high finesse values (where *R* is very close to 100% or 1),

$$R \approx 1-\frac{\pi}{\mathfrak{F}}$$

Finesse	Reflectivity
2	24%
4	47%
6	60%
8	68%
10	73%
15	81%
20	85%

Wave Vector, Frequency, Wavelength & Wavenumbers

$$k = \frac{2\pi}{\lambda} = \frac{2\pi n}{\lambda_0} = \frac{2\pi n\nu}{c} = \frac{n\omega}{c} \qquad \lambda = \frac{c}{n\nu} = \frac{\lambda_0}{n} = \frac{2\pi}{k} = \frac{2\pi c}{n\omega}$$

$$\nu = \frac{c}{\lambda_0} = \frac{c}{n\lambda} = \frac{kc}{2\pi n} = \frac{\omega}{2\pi} \qquad \Delta\lambda = \frac{c\,\Delta\nu}{\nu^2} = \frac{\lambda^2\Delta\nu}{c}$$

An easy number to remember is a 1-pm linewidth is approximately 125 MHz at 1550 nm.

$$\text{Wavenumber (cm}^{-1}) = \frac{10^7}{\lambda\ (\text{nm})}$$

$$\text{Electron Volts (eV)} = \frac{1242}{\lambda\ (\text{nm})}$$

k = wave vector

ν = frequency

$\omega = 2\pi\nu$ = angular frequency

λ = wavelength

λ_0 = wavelength in vacuum

n = refractive index

Wavelength (in vacuum), nm	Frequency, THz	Electron Volts, eV	Wavenumber, cm^{-1}
1561.42	192.00	0.80	6404.43
1550	193.41	0.80	6451.61
1320	227.12	0.94	7575.76
1064	281.76	1.17	9398.50
980	305.91	1.27	10204.08
780	384.35	1.59	12820.51
632.8	473.76	1.96	15802.78
350	856.55	3.55	28571.43

International System of Units (SI) Prefixes

Factor	Name	Symbol
10^{21}	zetta	Z
10^{18}	exa	E
10^{15}	peta	P
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{2}	hecto	h
10^{-2}	centi	c
10^{-3}	mili	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p
10^{-15}	femto	f
10^{-18}	atto	a
10^{-21}	zepto	z
10^{-24}	yocto	y

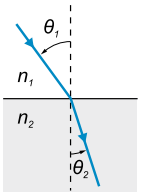
Common Material Properties

Material	Refractive Index, *n*	*ΔFSR**, MHz	Thermal Expansion Coefficient *α*, ppm/°C	Thermo-Optic Coefficient *β* or *∂n/∂T*, ppm/°C
Air	1.000	0.0	0.0	1.0
Fused Silica	1.444	13.1	0.55	6.57
Silicon	3.477	198.1	3.24	160
LASFN9	1.813	9.4	7.4	1.3

* Change in FSR due to dispersive effects as measured from 1510 to 1570 nm for a 50-GHz etalon

Snell's Law

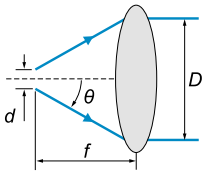
$$n_1 \sin\theta_1 = n_2 \sin\theta_2$$



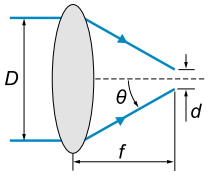
Numerical Aperture

$$f/\# = \frac{f}{D} \approx \frac{1}{2NA} \qquad NA = n\sin\theta$$

Collimating



Focusing



Reflection Air / Material

$$R = \left(\frac{n-1}{n+1}\right)^2 \text{ at AOI=0°}$$

Where n – refractive index,
AOI – Angle of Incidence.

Phase Matching Types of Nonlinear Crystals

Negative crystals ($n_o > n_e$)

Type 1 $k_{o1}+k_{o2}=k_{e3}(\theta)$
or "ooe interaction"

Type 2 $k_{e1}(\theta)+k_{o2}=k_{e3}(\theta)$
or "eoe interaction"

Type 2 $k_{o1}+k_{e2}(\theta)=k_e3(\theta)$
or "oee interaction"

Positive crystals ($n_e > n_o$)

Type 1 $k_{e1}(\theta)+k_{e2}(\theta)=k_{o3}$
or "eeo interaction"

Type 2 $k_{o1}+k_{e2}(\theta)=k_{o3}$
or "oeo interaction"

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Whereas k-wave propagation vector ($k=2\pi n/\lambda$); θ – phase matching angle in the crystal; o – ordinary polarization, e – extraordinary polarization;
1, 2, 3 indices – corresponds to wave vectors with longest (1), mid (2) and shortest (3) wavelengths.

Brewster's Angle

The angle where only *s*-polarized light is reflected

$$\theta_{Brewster} = \arctan\left(\frac{n_{transmitted\ medium}}{n_{incident\ medium}}\right)$$

Gausian Beam

A Gaussian beam spreads as follows,

$$\omega^2(x) = \omega_0^2\left[1+\left(\frac{\lambda x}{\pi\omega_0^2}\right)^2\right]$$

where $\omega(x)$ is the $1/e^2$ radius, λ is the wavelength, and x is the distance from the beam waist ω_0 where x=0.

A Rule of Thumb for Choosing a Lens

$$f = \frac{dD\pi}{4\lambda}$$

where f is the lens focal length, d is the beam diameter at the focus, D is the $1/e^2$ diameter of the collimated beam.

Nonlinear Crystal Thickness Limited by Group Velocity Mismatch (GVM)

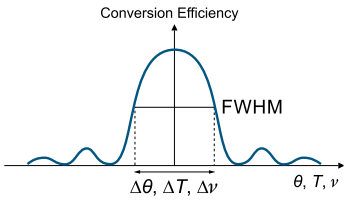
$$L = \frac{t}{GVM} \qquad GVM = \frac{1}{u_1} - \frac{1}{u_2}$$

$$u = \frac{c}{n(\lambda)}\left[1+\frac{\lambda}{n(\lambda)}\frac{\partial n(\lambda)}{\partial\lambda}\right]$$

Whereas t – pulse duration,
c – speed of the light, n – refractive index, λ – wavelength.

Nonlinear Crystal acceptances

Nonlinear Crystal acceptances – Angular $\Delta\theta$, Temperature ΔT, Spectral $\Delta\nu$ – corresponding bandwidths at Full Width of Half Maximum (FWHM) of conversion efficiency.



Total Internal Reflection Angle

$$\theta_{TIR} > \arcsin\left(\frac{n_{transmitted\ medium}}{n_{incident\ medium}}\right)$$

where $n_{transmitted\ medium} < n_{incident\ medium}$ is required for total internal reflection.

Scaling Law for Laser Radiation Damage

$$E = E_1\sqrt{\frac{t}{t_1}}$$

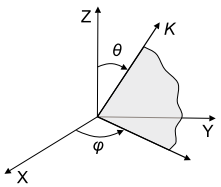
where E [J/cm²] is the damage threshold, t is the pulse duration, E_1 and t_1 are the reference damage threshold and pulse duration.

Non Critical Phase Matching

NCPM – when crystal phase matching angle equals 90° ($\theta = 90°$). NCPM is achieved at special temperatures and/or wavelengths.

Uniaxial Crystals Refractivity

Polar coordinate system for description of refractive properties of uniaxial crystal.



Whereas K – light propagation vector at phase matching conditions, Z – optical axis of crystal, θ – phase matching angle (or cut angle), φ – azimuthal angle.

Birefrigency angle or Walk-off

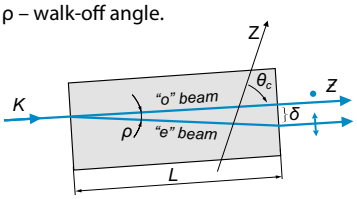
$$\rho(\theta) = \pm\arctan\left[\left(\frac{n_o}{n_e}\right)^2\tan(\theta)\right] \mp \theta$$

Upper signs refer to negative crystal ($n_o > n_e$) and the lower signs refer to positive one ($n_e > n_o$).

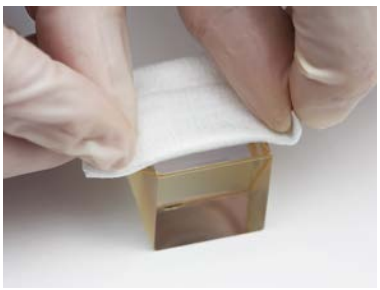
Beam displacement because of walk–off:

$\Delta = L\tan(\rho)$

Whereas L – crystal length,
ρ – walk-off angle.



OPTICAL COMPONENTS CLEANING INSTRUCTIONS

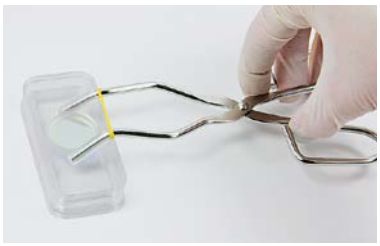


Inspect and make sure that you need to clean your optical component. If it's not necessary, avoid extra cleaning. The polished face of the crystals is the key element that ensures preservation and longer usability of the component. If you need to clean the optical component, please follow these instructions:

- Always wear powder-free latex gloves or finger cots and handle component by the edges. Do not touch the surface of optical component with your fingertips. Avoid handling optics with metal instruments. Use delicate tweezers with soft tips for a small size components.
- Any larger dust and dirt particles can be removed by using very soft brush or compressed air. **Attention:** if you use compressed air, keep the distance (at least 10 cm). In the less distance you can damage the polished face with temperature stress.
- If polished face looks fine do not clean with something else. If it's still dirty please use solvents. **Never clean "dry":** Cleaning dry optics, no matter what the wiper, is virtually guaranteed to cause problems. Use only extra pure water free class solvents, such as ethyl acetate ($C_4H_8O_2$), butyl acetate ($C_6H_{10}O_2$), or similar. Always use lint-free lens tissues for optics cleaning.
- **For the optical component cleaning** apply a small drop of the cleaning solution on the top surface. Leave enough time for it to dissolve and float away any contaminating materials. But before the cleaner dries, gently wipe the surface with the highest quality lens cleaning tissue.
- **For crystal and small** (up to 5 mm^2 area) **optical component cleaning** use lint-free lens tissue or cotton swab. Do not use cotton swabs for a larger component as it leaves stripes. Moisten a tissue with solvent and carefully cross the surface of crystal. Make sure that the wiper size is the same or a bit larger than the polished face of component. The tissue is only for onetime use! Repeat this action till the component looks fine.

If the cleaning does not help to remove contamination the optical component must be repolished.

TWEEZERS / FORCEPS FOR OPTICAL COMPONENTS 260-1050



These stainless steel tweezers/forceps are convenient instrument for handling of optical components with diameter from 10 to 50.8 mm. Tweezers/forceps have silicon tips that reduce the risk of damage of optics.

Catalogue number	
260-1050	

CRYSTALS HANDLING SAFETY GUIDE

- **Do not open** container until contents are at the room temperature to prevent moisture condensation. Open package carefully in dust free and dry *(relative humidity less than 60%)* atmosphere.

- Please **use gloves** to handle crystals. Hold the crystal at the non-polished faces only. Holding the crystal near the breath will destroy the polishing.

- **Dust** from the polished surface can be **removed by soft paint brush**. Experienced users can try to clean faces with particles-free cotton wool tipped swabs soaked in water free ethyl-acetate.

- The crystals are **temperature sensitive**. Drastic chilling or warming (at the rate > 5°degC/min) will cause shattering by thermal stress.

- The crystals should be **stored in desiccator** or in a container with minimum gas volume.

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