EKSMA OPTICS

LASER COMPONENTS

Your Premier Source for High Power and High Peak Intensity Laser Optics

Optical Components

Nd:YAG *LaserLine* Optics & Crystals

FemtoLine Optics & Crystals

Nonlinear & Laser Crystals

Pockels Cells & Drivers

Pulse Picking Systems

Optical Systems

Opto-Mechanics

Browse & Buy at
www.eksmaoptics.com

2018 / 2019

Laser Components

2018 / 2019

Revision EUDM-180421

EKSMA OPTICS

TECHNICAL FLEXIBILITY SERVING YOUR PHOTONICS NEEDS

COMPANY

EKSMA OPTICS is a manufacturer and global supplier of precision laser components used in lasers, laser systems and optical instruments.

Our laser components are used across different laser and photonics applications in scientific, industry, medical, aesthetic, military and aerospace markets. The coverage of applications of laser optical components by wavelength spectrum starts from UV (193 nm) through VIS up to IR (20 μm) and at THz ranges.

QUALITY

All components provided by the Company are subject to high quality testing and certifications 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 ISO 9001:2008 certified. Certification issued by Bureau Veritas.

ISO 9001 BUREAU VERITAS Certification

ISO 9001:2008 CERTIFIED

MANUFACTURING

EKSMA OPTICS invested heavily in to advanced manufacturing equipment and extension of manufacturing capabilities.

THE COMPANY OWNS:

- Cutting, grinding and polishing facility for flat glass and fused silica optics.
- Polishing facility of nonlinear and electro-optical crystals LBO, BBO, KDP, DKDP, KTP, $AgGaSe_2$, $ZnGeP_2$ and other crystals on request.
- Grinding and polishing facility of spherical and aspherical lenses, including axicons. Lenses are made of N-BK7, S-LAH64 and UVFS in our lens production facility.
- IBS coatings facility for advanced, exceptional precision thin film coatings used for laser optics and crystals.
- Assembling facility of electro-optical modulators – Pockels cells based on BBO, DKDP and KTP crystals.

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PRODUCT RANGE

Optical Components

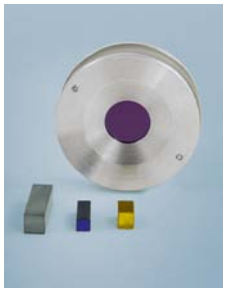
- Coatings
- Mirrors
- Lenses & Lens Kits
- Windows
- Filters
- Prisms
- Polarizing Optics
- UV & IR Optics

Pockels Cells, Drivers & Pulse Picking

- BBO Pockels Cells
- KD*P Pockels Cells
- KTP Pockels Cells
- Mounting Stages
- Drivers & HV Power Supplies
- Pulse Picking Systems
- Q-Switching Kits

Nonlinear & Laser Crystals

- Nonlinear Crystals
- Laser Crystals
- Crystals for Stimulated Raman Scattering
- Passive Q-Switches
- Crystal Ovens & Holders
- Laser Safety Goggles and Visualizators



Opto-mechanical Components

- Optical Tables
- Brackets & Rails
- Base Mounts & Accessories
- Optical Mounts
- Optical Positioners
- Translation & Rotation Stages
- Motorized Positioners

Nd:YAG LaserLine Components

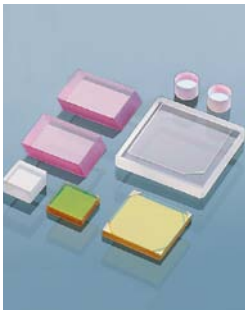
- Mirrors
- Windows
- AR Coated Lens Kits
- Polarizing Optics
- Nd:YAG rods and slabs
- Harmonics Crystals

Optical Systems

- Beam Expanders
- F-Theta Lenses
- Variable Attenuators for Linearly Polarized Laser Pulses
- Gauss-to-Top Hat Beam Shaping Lens
- Iris Diaphragms

Femtoline Components

- Mirrors
- Thin Lenses
- AR Coated Lens Kits
- Polarizing Optics
- Yb:KYW, Yb:KGW Laser Crystals
- Harmonics Crystals for Yb doped and Ti:Sapphire Lasers



Online product catalogue

www.eksmaoptics.com

FEATURED PRODUCTS

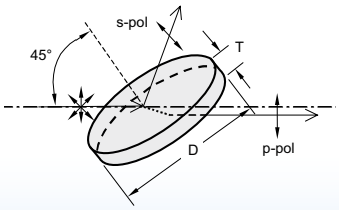
Anti-Reflection Coated Lens Kits

- 40 or 15 lenses
- Various focal lengths
- Uncoated, BBAR or AR coated

See page: 1.46

Thin Film Polarizers with High Extinction Ratio
45° Angle of Incidence

- Designed for use in high energy lasers
- LDT >10 J/cm^2, 10 ns, 1064 nm
- T_p/T_s: >1000:1



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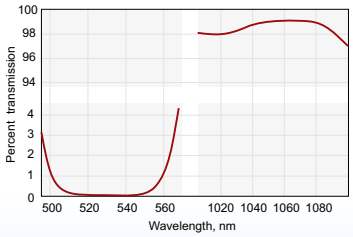
Broadband Variable Attenuators
for Femtosecond Lasers

- Divides beam into two parallel beams
- Wavelength ranges: 750-850 nm or 980-1080 nm
- LDT >50 mJ/cm^2, 50 fsec, 50 Hz, 800 nm
- Manual or motorized

See page: 6.15

Laser Harmonic Separators
with High Transmission

- Designed for Nd:YAG lasers
- HR > 99.5% and HT > 99%
- LDT > 10 J/cm^2, 8 nsec, 1064 nm



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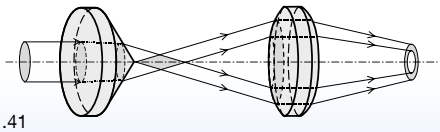
Precision Plano-Convex Axicons

- Made of BK7 or UVFS
- Range of cone apex angles: 140° to 179°
- Can be supplied with AR or BBAR coatings



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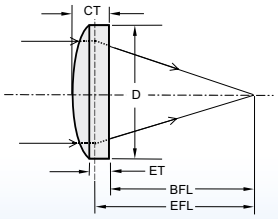
CNC Polished Precision Aspherical Lenses

- Made from N-BK7, N-LAH64 or UVFS
- Can be supplied with AR coatings



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Pulse Picking Systems

- Complete pulse picking solution
- Synchronization with your laser operating at up to 100 MHz repetition rate
- Pulse picking at up to few MHz rate

See page: 3.16

Heatpoint Oven for Nonlinear Crystals

- Compact design
- For crystals up to 6×6×30 mm
- Preset temperature: 30 – 80 °C
- Special 1” positioning mount available

See page: 2.28

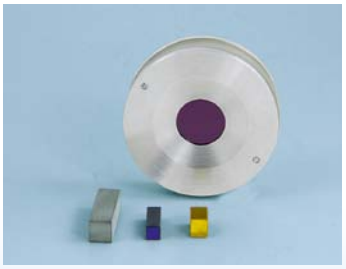
Femtokits for Third Harmonic Generation
of Ti:Sapphire Laser

- 150 - 250 fsec
- 120 - 150 fsec
- 70 - 120 fsec
- 30 - 70 fsec
- 15 - 30 fsec

See page: 5.34

Infrared Nonlinear Crystals

- $ZnGeP_2$ Crystals
- $AgGaSe_2$ Crystals
- $AgGaS_2$ Crystals
- GaSe Crystals
- For Frequency Conversion in 0.8-18 µm range



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ORDERING INFORMATION

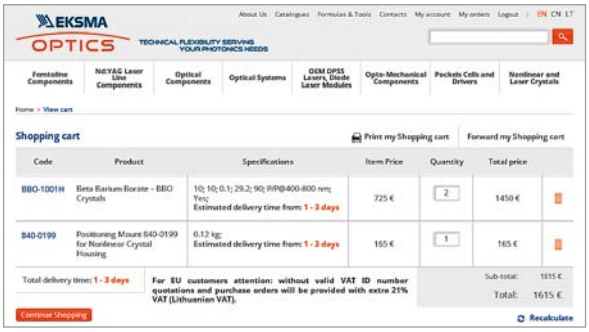
PRICES

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 “Official Quotation”. Our sales team will contact you soon and provide the estimated delivery time for the shopping cart.



SHIPPING

EKSMA OPTICS work with all express freight forwarders. Most common are DHL, TNT, FedEx, UPS. Other freight forwarders are available on request.

If not specified by a customer, the default forwarder is DHL. The customer can evaluate shipping charges by DHL using e-shop www.eksmaoptics.com. Final shipping costs are subject to quote depending on individual orders. EKSMA OPTICS reserves the right to change the prices without prior written notice depending on freight forwarders pricing. Shipping charges are prepaid and added as a separate item to your invoice.

EKSMA OPTICS offers free shipping* for online orders. Orders placed through our e-shop will be delivered to customer using DHL or UPS. Import duty if applicable must be paid by customer. Offer applies to orders placed online that weight below 2 kg only and are over 300 EUR or 500 USD.

** free shipping offer for our distributors is applied only if the order is over 500 EUR.*

***free shipping is applied for orders that are sent only via website and is not applied for orders sent directly to info@eksmaoptics.com.*

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

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Mokslininku str. 11, LT-08412 Vilnius, Lithuania
Company Code: 300624547; VAT No.: LT100002802516
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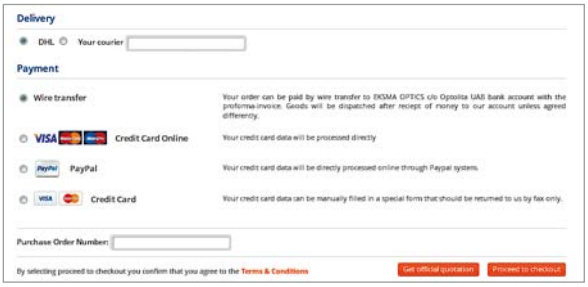
PAYMENT OPTIONS

Standard payment option at e-shop is by credit card using Paypal or Paysera services. Wire transfer or bank check is also available option. However, please contact EKSMA OPTICS for authorization for this type of payment.



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	OPTOLITA 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.

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from 193 nm up to 20 μm and for THz range

EKSMA OPTICS

Precision Laser Optics

Optical Components

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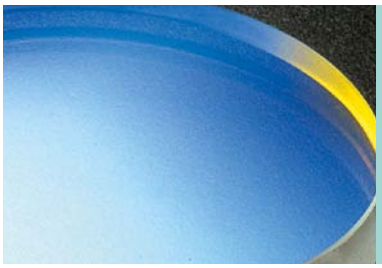
OPTICAL COMPONENTS CLEANING INSTRUCTIONS

See page A.4



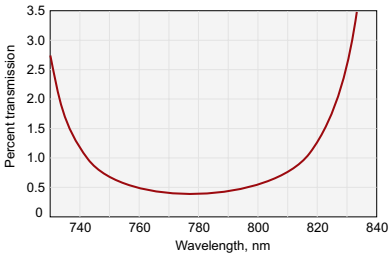
Coatings

HIGH REFLECTIVITY COATINGS

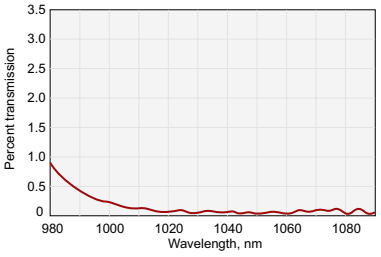
These multilayer coatings are stacks intended to achieve the highest possible reflectivity at specific laser line wavelengths at normal or 45 degrees incidence. Laser line high reflectivity coatings are intended for external beam manipulation applications where even slight losses may be intolerable.

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

Laser Line Coatings



***1031**. HR>99.5% @ 780 nm, AOI = 45°.*

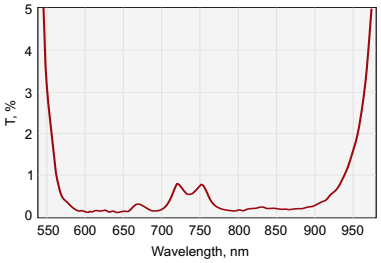


***1037**. HR>99.8% @ 1064 nm, AOI = 0°.*

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

Contact us for other wavelengths and AOI's values.

Broadband Coatings



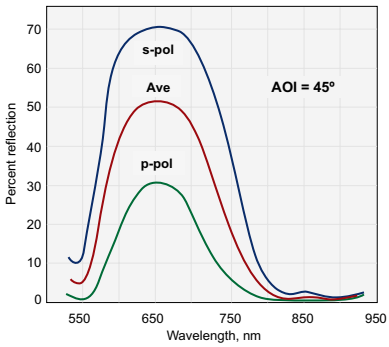
***1130**. HR>99% @ 600–900nm, AOI= 0°.*

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

Contact us for other wavelengths and AOI's values.

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.

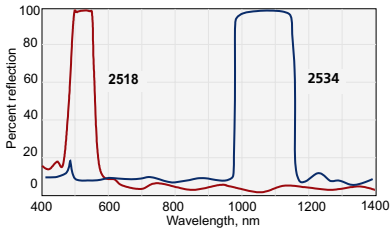


Coating number AOI = 0°	Coating number AOI = 45°	Wavelength, nm	Reflectivity, %	Recommended substrate	Damage threshold, J/cm² in 10 ns
2012-i0	2012-i45	248	25±3	UV FS	1
2015-i0	2015-i45		50±3		
2017-i0	2017-i45		75±3		
2022-i0	2022-i45	266	25±3	UV FS	1
2025-i0	2025-i45		50±3		
2027-i0	2027-i45		75±3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

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.



Coating number AOI = 0°	Coating number AOI = 45°	Wavelength, nm	AOI = 0° R, %	AOI = 0° T, %	AOI = 45° R, %	AOI = 45° T, %	Recommended substrate	Damage threshold, J/cm² in 10 ns
2506-i0	2506-i45	200-220 / 390-450	>90.0	>85	>90.0	>80	UV FS	1
2510-i0	2510-i45	355 / 532+1064	>99.0	>93	>99.0	>90	UV FS	1
2514-i0	2514-i45	380-420 / 720-820	>99.0	>90	>99.0	>90	UV FS, BK7	1
2518-i0	2518-i45	532 / 1064	>99.5	>95	>99.5	>95	UV FS, BK7	1
2522-i0	2522-i45	600 / 1200	>99.5	>95	>99.5	>95	UV FS, BK7	2
2526-i0	2526-i45	800 / 400	>99.5	>90	>99.5	>90	UV FS, BK7	2
2530-i0	2530-i45	1064 / 400-700	>99.5	>85	>99.5	>80	UV FS, BK7	2
2534-i0	2534-i45	1064 / 532	>99.5	>93	>99.5	>90	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

Coating suffix	Wavelength, nm	Reflection per surface (AOI=0°)	Laser Damage Threshold, J/cm²	Price, EUR Ø25.4 / Ø50.8
AR266	266	R<0.4%	1	45 / 56
AR343	333-353	R<0.5%	3	29 / 50
AR355	355	R<0.25%	3	29 / 50
AR400	380-420	R<0.5%	3	29 / 50
AR515	500-530	R<0.3%	5	29 / 50
AR532	532	R<0.2%	5	29 / 50
AR800	760-840	R<0.4%	8	35 / 56
AR1030	1000-1060	R<0.3%	10	29 / 50
AR1064	1064	R<0.2%	10	29 / 50

IBS Laser Line Anti-Reflection Coatings

Coating suffix	Wavelength, nm	Reflection per surface (AOI=0°)	Laser Damage Threshold, J/cm²	Price, EUR Ø25.4 / Ø50.8
AR343HT	333-353	R<0.2%	4	135 / 250
AR355HT	355	R<0.2%	4	135 / 250
AR400HT	380-420	R<0.2%	4	105 / 180
AR515HT	500-530	R<0.1%	7	105 / 180
AR532HT	532	R<0.1%	7	105 / 180
AR800HT	760-840	R<0.1%	10	105 / 180
AR1030HT	1000-1060	R<0.1%	15	105 / 180
AR1064HT	1064	R<0.1%	15	105 / 180

Other Laser Line Anti-Reflection Coating Options

Coating number		Wavelength,	Reflectivity, %		Damage threshold,
AOI = 0º	AOI = 45º	nm	AOI = 0º	AOI = 45º	J/cm² in 10 ns
3005-i0	3005-i45	193	< 1.0	<2.0	1
3007-i0	3007-i45	248	< 0.8	<1.5	1.5
3009-i0	3009-i45	266	< 0.4	<1.0	1.5
3011-i0	3011-i45	308	<0.3	<0.6	1.5
3014-i0	3014-i45	343	<0.25	<0.5	2
3015-i0	3015-i45	351-355	< 0.25	<0.5	2
3017-i0	3017-i45	400	< 0.25	<0.5	2
3021-i0	3021-i45	488-514	< 0.3	<0.5	2
3023-i0	3023-i45	515	< 0.2	<0.5	4
3025-i0	3025-i45	532	< 0.2	<0.5	4
3027-i0	3027-i45	633-650	< 0.25	<0.5	4
3031-i0	3031-i45	780	< 0.2	<0.5	5
3033-i0	3033-i45	800	< 0.2	<0.5	5
3035-i0	3035-i45	850	< 0.2	<0.5	5
3036-i0	3036-i45	1030	< 0.2	<0.5	5
3037-i0	3037-i45	1064	< 0.2	<0.5	5
3041-i0	3041-i45	1320	<0.3	<0.5	5
3045-i0	3045-i45	1547	<0.5	<1.0	4

Contact us for other wavelengths and AOI's values.

DUAL BAND ANTI-REFLECTION COATINGS

Standard Dual Band Anti-Reflection Coatings

Coating suffix	Wavelength, nm	Reflection per surface (AOI=0°)	Laser Damage Threshold, J/cm²	Price, EUR Ø25.4 / Ø50.8
ARD1030	515+1030	R<0.5%	4	35 / 56
ARD1064	532+1064	R<0.5%	4	35 / 56

IBS Dual Band Anti-Reflection Coatings

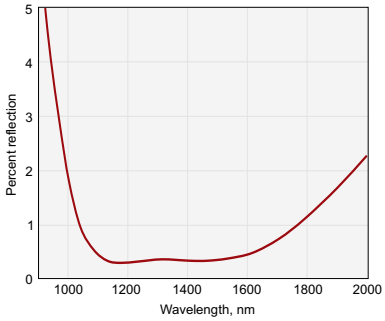
Coating suffix	Wavelength, nm	Reflection per surface (AOI=0°)	Laser Damage Threshold, J/cm²	Price, EUR Ø25.4 / Ø50.8
ARD800HT	400+800	R<0.2%	4	125 / 205
ARD1030HT	515+1030	R<0.1%	6	115 / 195
ARD1064HT	532+1064	R<0.1%	6	115 / 195

Other Dual Band Anti-Reflection Coating Options

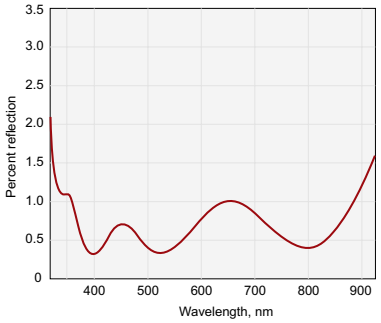
Coating number		Wavelength,	Reflectivity, %		Damage threshold,
AOI = 0°	AOI = 45°	nm	AOI = 0°	AOI = 45°	J/cm² in 10 ns
3106-i0	3106-i45	266 + 532	<0.5	<1.0	1.5
3110-i0	3110-i45	355 + 532	<0.5	<1.0	2
3114-i0	3114-i45	355 + 1064	<0.5	<1.0	2
3118-i0	3118-i45	400 + 800	<0.5	<1.0	3
3121-i0	3121-i45	515 + 1030	<0.5	<1.0	4
3122-i0	3122-i45	532 + 1064	<0.5	<1.0	4
3126-i0	3126-i45	670 + 1064	<0.5	<1.0	4
3127-i0	3127-i45	808 + 1064	<0.5	<1.0	4
3130-i0	3130-i45	1064 +1320	<0.5	<1.0	4
3134-i0	3134-i45	1064 +1570	<0.5	<1.0	3

Contact us for other wavelengths and AOI's values.

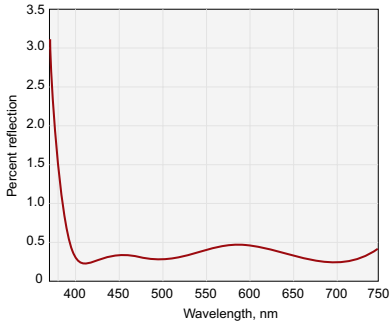
BROADBAND ANTI-REFLECTION COATINGS



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°.*

Standard Broadband Anti-Reflection Coatings

Coating suffix	Wavelength, nm	Reflection per surface (AOI=0°)	Laser Damage Threshold, J/cm²	Price, EUR Ø25.4 / Ø50.8
ARB300	210-400	R<2%	1	70 / 85
ARB550	400-700	R<0.9%	2	56 / 67
ARB625	350-900	R<1.5%	2	60 / 78
ARB825	650-1100	R<0.7%	3	61 / 72
ARB800	700-900	R<0.5%	3	50 / 68
ARB1375	1050-1700	R<0.7%	2	76 / 89

IBS Broadband Anti-Reflection Coatings

Coating suffix	Wavelength, nm	Reflection per surface (AOI=0°)	Laser Damage Threshold, J/cm²	Price, EUR Ø25.4 / Ø50.8
ARB550HT	450-650	R<0.2%	3	135 / 215
ARB600HT	500-700	R<0.2%	4	115 / 195
ARB800HT	700-900	R<0.1%	5	115 / 195
ARB1000HT	900-1100	R<0.1%	5	115 / 195

Other Broadband Anti-Reflection Coating Options

Coating number AOI = 0°	Coating number AOI = 45°	Wavelength, nm	Reflectivity, % AOI = 0°	Reflectivity, % AOI = 45°	Damage threshold, J/cm² in 10 ns
3205-i0	3205-i45	210-400	<2.0	<3.0	1.5
3207-i0	3207-i45	250-350	<1.2	<2.5	1.5
3209-i0	3209-i45	300-400	<1.0	<2.0	1.5
3211-i0	3211-i45	350-500	<0.8	<1.6	2.0
3213-i0	3213-i45	350-900	<1.5	<3.0	2.0
3215-i0	3215-i45	400-550	<0.4	<0.8	2.5
3217-i0	3217-i45	400-700	<0.9	<1.8	3.0
3219-i0	3219-i45	420-680	<0.5	<1.0	3.0
3221-i0	3221-i45	450-750	<0.5	<1.0	3.0
3223-i0	3223-i45	500-800	<0.6	<1.2	3.0
3224-i0	3224-i45	500-1000	<1.5	<3.0	3.0
3225-i0	3225-i45	600-900	<0.7	<1.2	3.0
3227-i0	3227-i45	700-900	<0.5	<1.0	3.0
3229-i0	3229-i45	800-1200	<0.7	<1.4	2.5
3231-i0	3231-i45	1000-1400	<0.7	<1.4	2.0
3232-i0	3232-i45	1050-1700	<1.0	<1.5	2.0
3233-i0	3233-i45	1300-1700	<0.7	<1.4	2.0
3235-i0	3235-i45	1500-2000	<0.7	<1.4	1.5

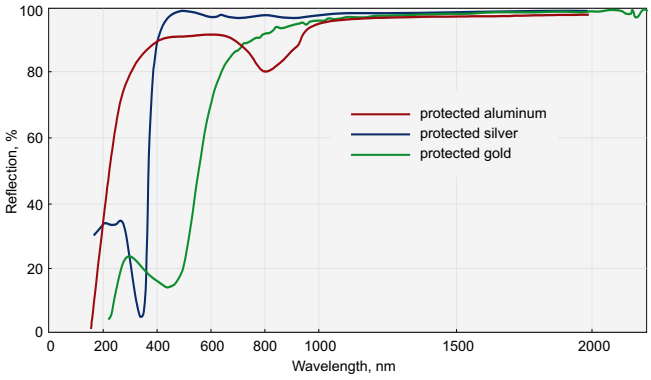
Contact us for other wavelengths and AOI's values.

METALLIC COATINGS

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

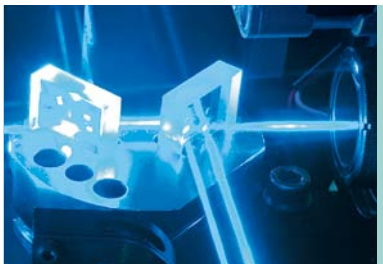
Protected metallic coatings provide a moderate level of reflection over a very broad spectral range and are widely used as mirrors. These coatings are protected by a thin layer of dielectric material in order to make them durable. Enhanced metallic coatings provide greater reflection across the operating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



Coating number	Wavelength, nm	Average reflection, %	Type	Laser Induced Damage Threshold at 1064 nm, 50 Hz, 11 nsec, J/cm²	Price, EUR Ø25 / Ø50
0005	250–350	>88	UV enhanced aluminium	0.25	34 / 52
0010	450–650	>91	VIS enhanced aluminium	0.25	25 / 40
0015	300–IR	>86	Protected aluminium	0.25	17 / 28
0025	400–IR	>96	Protected silver	1.8	56 / 76
0030	900–IR	>98	Protected gold	1.0	82 / 107

Please contact us for other wavelengths and AOI's.



Windows & Filters

CURVED WINDOWS

- **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**

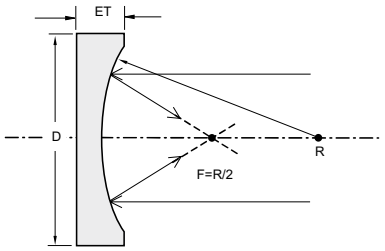
We offer two substrate materials spanning a range of thermal expansion coefficients. For applications in which thermal shock is absent and thermal stability is not critical, BK7 glass is a suitable and inexpensive material. For applications requiring high thermal stability or involving severe thermal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



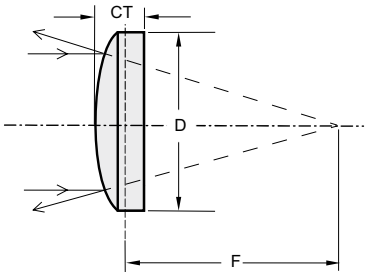
Catalogue number BK7	Catalogue number UV FS	Diameter D, mm	Edge thickness ET, mm	ROC, mm	Price, EUR BK7 / UV FS
010-0101E	010-1101E	12.7	3.0	-25	32 / 57
010-0103E	010-1103E	12.7	3.0	-50	32 / 57
010-0104E	010-1104E	12.7	3.0	-75	32 / 57
010-0105E	010-1105E	12.7	3.0	-100	32 / 57
010-0107E	010-1107E	12.7	3.0	-150	32 / 57
010-0108E	010-1108E	12.7	3.0	-200	32 / 57
010-0110E	010-1110E	12.7	3.0	-250	32 / 57
010-0111E	010-1111E	12.7	3.0	-300	32 / 57
010-0109E	010-1109E	12.7	3.0	-400	32 / 57
010-0115E	010-1115E	12.7	3.0	-500	32 / 57
010-0120E	010-1120E	12.7	3.0	-1000	32 / 57
010-0123E	010-1123E	12.7	3.0	-1500	32 / 57
010-0125E	010-1125E	12.7	3.0	-2000	32 / 57
010-0130E	010-1130E	12.7	3.0	-3000	32 / 57
010-0140E	010-1140E	12.7	3.0	-4000	32 / 57
010-0150E	010-1150E	12.7	3.0	-5000	32 / 57
010-0101T6	010-1101T6	12.7	6.0	-25	33 / 58
010-0103T6	010-1103T6	12.7	6.0	-50	33 / 58
010-0104T6	010-1104T6	12.7	6.0	-75	33 / 58
010-0105T6	010-1105T6	12.7	6.0	-100	33 / 58
010-0107T6	010-1107T6	12.7	6.0	-150	33 / 58
010-0108T6	010-1108T6	12.7	6.0	-200	33 / 58
010-0110T6	010-1110T6	12.7	6.0	-250	33 / 58
010-0111T6	010-1111T6	12.7	6.0	-300	33 / 58
010-0109T6	010-1109T6	12.7	6.0	-400	33 / 58
010-0115T6	010-1115T6	12.7	6.0	-500	33 / 58
010-0120T6	010-1120T6	12.7	6.0	-1000	33 / 58
010-0123T6	010-1123T6	12.7	6.0	-1500	33 / 58
010-0125T6	010-1125T6	12.7	6.0	-2000	33 / 58
010-0130T6	010-1130T6	12.7	6.0	-3000	33 / 58
010-0140T6	010-1140T6	12.7	6.0	-4000	33 / 58
010-0150T6	010-1150T6	12.7	6.0	-5000	33 / 58
010-0201E	010-1201E	25.4	6.0	-50	55 / 75
010-0207E	010-1207E	25.4	6.0	-75	55 / 75
010-0202E	010-1202E	25.4	6.0	-100	55 / 75
010-0208E	010-1208E	25.4	6.0	-125	55 / 75
010-0203E	010-1203E	25.4	6.0	-150	55 / 75
010-0204E	010-1204E	25.4	6.0	-200	55 / 75
010-0205E	010-1205E	25.4	6.0	-250	55 / 75
010-0206E	010-1206E	25.4	6.0	-300	55 / 75
010-0211E	010-1211E	25.4	6.0	-350	55 / 75
010-0209E	010-1209E	25.4	6.0	-400	55 / 75
010-0210E	010-1210E	25.4	6.0	-500	55 / 75
010-0212E	010-1212E	25.4	6.0	-600	55 / 75
010-0214E	010-1214E	25.4	6.0	-700	55 / 75
010-0215E	010-1215E	25.4	6.0	-750	55 / 75
010-0216E	010-1216E	25.4	6.0	-800	55 / 75
010-0217E	010-1217E	25.4	6.0	-900	55 / 75
010-0220E	010-1220E	25.4	6.0	-1000	55 / 75
010-0222E	010-1222E	25.4	6.0	-1500	55 / 75
010-0225E	010-1225E	25.4	6.0	-2000	55 / 75
010-0226E	010-1226E	25.4	6.0	-2500	55 / 75
010-0227E	010-1227E	25.4	6.0	-3000	55 / 75

Catalogue number BK7	Catalogue number UV FS	Diameter D, mm	Edge thickness ET, mm	ROC, mm	Price, EUR BK7 / UV FS
010-0229E	010-1229E	25.4	6.0	-4000	55 / 75
010-0230E	010-1230E	25.4	6.0	-5000	55 / 75
010-0235E	010-1235E	25.4	6.0	-6000	55 / 75
010-0240E	010-1240E	25.4	6.0	-8000	65 / 80
010-0250E	010-1250E	25.4	6.0	-10000	65 / 80
010-0501E	010-1501E	50.8	10.0	-100	110 / 210
010-0508E	010-1508E	50.8	10.0	-150	110 / 210
010-0502E	010-1502E	50.8	10.0	-200	110 / 210
010-0503E	010-1503E	50.8	10.0	-250	110 / 210
010-0506E	010-1506E	50.8	10.0	-300	110 / 210
010-0504E	010-1504E	50.8	10.0	-400	110 / 210
010-0505E	010-1505E	50.8	10.0	-500	110 / 210
010-0507E	010-1507E	50.8	10.0	-600	110 / 210
010-0510E	010-1510E	50.8	10.0	-750	110 / 210
010-0511E	010-1511E	50.8	10.0	-800	110 / 210
010-0515E	010-1515E	50.8	10.0	-1000	110 / 210
010-0518E	010-1518E	50.8	10.0	-1500	110 / 210
010-0520E	010-1520E	50.8	10.0	-2000	110 / 210
010-0521E	010-1521E	50.8	10.0	-2500	110 / 210
010-0522E	010-1522E	50.8	10.0	-3000	110 / 210
010-0524E	010-1524E	50.8	10.0	-4000	110 / 210
010-0525E	010-1525E	50.8	10.0	-5000	110 / 210

Catalogue number BK7	Catalogue number UV FS	Diameter D, mm	Edge thickness ET, mm	ROC, mm	Price, EUR BK7 / UV FS
010-0530E	010-1530E	50.8	10.0	-6000	110 / 210
010-0540E	010-1540E	50.8	10.0	-8000	110 / 210
010-0550E	010-1550E	50.8	10.0	-10000	110 / 210
010-0705E	010-1705E	76.2	12.7	-200	195 / 285
010-0708E	010-1708E	76.2	12.7	-300	195 / 285
010-0710E	010-1710E	76.2	12.7	-400	195 / 285
010-0712E	010-1712E	76.2	12.7	-500	195 / 285
010-0714E	010-1714E	76.2	12.7	-600	195 / 285
010-0720E	010-1720E	76.2	12.7	-800	195 / 285
010-0725E	010-1725E	76.2	12.7	-1000	195 / 285
010-0730E	010-1730E	76.2	12.7	-1500	195 / 285
010-0735E	010-1735E	76.2	12.7	-2000	195 / 285
010-0745E	010-1745E	76.2	12.7	-3000	195 / 285
010-0808E	010-1808E	101.6	15.0	-300	440 / 540
010-0810E	010-1810E	101.6	15.0	-400	440 / 540
010-0812E	010-1812E	101.6	15.0	-500	440 / 540
010-0814E	010-1814E	101.6	15.0	-600	440 / 540
010-0820E	010-1820E	101.6	15.0	-800	440 / 540
010-0825E	010-1825E	101.6	15.0	-1000	440 / 540
010-0830E	010-1830E	101.6	15.0	-1500	440 / 540
010-0835E	010-1835E	101.6	15.0	-2000	440 / 540
010-0845E	010-1845E	101.6	15.0	-3000	440 / 540

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.

Catalogue number BK7	Catalogue number UV FS	Diameter D, mm	Center thickness CT, mm	ROC, mm	Price, EUR BK7 / UV FS
011-0103E	011-1103E	12.7	6.0	+50	34 / 60
011-0105E	011-1105E	12.7	6.0	+100	34 / 60
011-0107E	011-1107E	12.7	6.0	+150	34 / 60
011-0108E	011-1108E	12.7	6.0	+200	34 / 60
011-0111E	011-1111E	12.7	6.0	+300	34 / 60
011-0113E	011-1113E	12.7	6.0	+400	34 / 60
011-0115E	011-1115E	12.7	6.0	+500	34 / 60
011-0201E	011-1201E	25.4	6.0	+50	65 / 85
011-0207E	011-1207E	25.4	6.0	+75	65 / 85
011-0202E	011-1202E	25.4	6.0	+100	65 / 85
011-0203E	011-1203E	25.4	6.0	+150	65 / 85
011-0204E	011-1204E	25.4	6.0	+200	65 / 85
011-0205E	011-1205E	25.4	6.0	+300	65 / 85
011-0206E	011-1206E	25.4	6.0	+400	65 / 85
011-0209E	011-1209E	25.4	6.0	+500	65 / 85
011-0210E	011-1210E	25.4	6.0	+600	65 / 85
011-0212E	011-1212E	25.4	6.0	+800	65 / 85
011-0215E	011-1215E	25.4	6.0	+1000	65 / 85
011-0216E	011-1216E	25.4	6.0	+1500	65 / 85
011-0220E	011-1220E	25.4	6.0	+2000	65 / 85
011-0222E	011-1222E	25.4	6.0	+3000	65 / 85
011-0225E	011-1225E	25.4	6.0	+4000	65 / 85
011-0227E	011-1227E	25.4	6.0	+5000	65 / 85
011-0502E	011-1502E	50.8	10.0	+100	120 / 220
011-0503E	011-1503E	50.8	10.0	+150	120 / 220
011-0504E	011-1504E	50.8	10.0	+200	120 / 220
011-0505E	011-1505E	50.8	10.0	+300	120 / 220
011-0506E	011-1506E	50.8	10.0	+400	120 / 220
011-0509E	011-1509E	50.8	10.0	+500	120 / 220
011-0510E	011-1510E	50.8	10.0	+600	120 / 220
011-0512E	011-1512E	50.8	10.0	+800	120 / 220
011-0515E	011-1515E	50.8	10.0	+1000	120 / 220
011-0518E	011-1518E	50.8	10.0	+1500	120 / 220
011-0520E	011-1520E	50.8	10.0	+2000	120 / 220
011-0522E	011-1522E	50.8	10.0	+3000	120 / 220
011-0525E	011-1525E	50.8	10.0	+4000	120 / 220

HOUSING ACCESSORIES

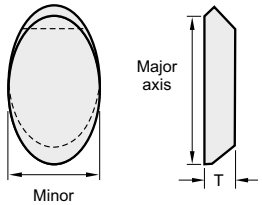
Kinematic Mirror Mount 840-0020

See page 7.33

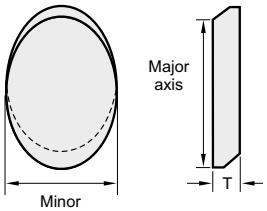
ELLIPTICAL WINDOWS

- **Bend light at precise angles with minimum wave distortion**

Type A



Type B



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.

Standard High Reflectivity Coatings
see page 1.3 for more information

SPECIFICATIONS

Material	BK7, UV FS
Surface Quality S_1, S_2	20-10 scratch & dig (MIL-PRF-13830B)
Surface Flatness S_1, S_2	λ/4 @ 633 nm
Axis Tolerance	+0.00 -0.12 mm
Thickness Tolerance	±0.25 mm
Parallelism	<3 min

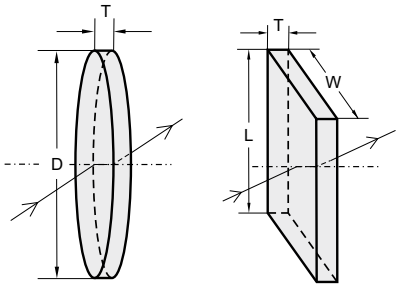
Presented substrates are **uncoated**. For appropriate coating, please refer to the ***Coatings section***.

Material	Catalogue number	Minor axis, mm	Major axis, mm	Thickness T, mm	Price, EUR
BK7	020-0183	18.0	25.0	3.0	43
	020-0254	25.0	35.0	4.0	49
	020-0304	30.0	42.5	4.0	56
UV FS	020-1183	18.0	25.0	3.0	71
	020-1254	25.0	35.0	4.0	75
	020-1304	30.0	42.5	4.0	99

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

- **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.

Only homogeneous and inclusion free materials are used.

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

Please contact us if you can not find the exact size or shape of a window you need. A wide variety of other shapes and sizes can be supplied upon request.

Round Windows

HOUSING ACCESSORIES

Kinematic Mirror Mount 840-0020

See page 7.33

Catalogue number BK7	Catalogue number UV FS	Diameter D, mm Metric	Diameter D, mm English	Thickness T, mm	Price, EUR BK7 / UV FS
210-0102	210-1102	12.5	12.7	2.0	9 / 18
210-0103	210-1103	12.5	12.7	3.0	10 / 19
210-0202	210-1202	25.0	25.4	2.0	15 / 25
210-0203	210-1203	25.0	25.4	3.0	16 / 26
210-0402	210-1402	40.0	38.1	2.0	23 / 40
210-0403	210-1403	40.0	38.1	3.0	24 / 41
210-0502	210-1502	50.0	50.8	2.0	28 / 48
210-0503	210-1503	50.0	50.8	3.0	29 / 49
210-0703	210-1703	75.0	76.2	6.3	90 / 150

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

See page 7.32

Catalogue number BK7	Catalogue number UV FS	Rectangular dimensions Width W, mm	Rectangular dimensions Length L, mm	Thickness T, mm	Price, EUR BK7 / UV FS
215-0122	215-1122	15.0	20.0	2.0	11 / 20
215-0222	215-1222	25.4	25.4	2.0	15 / 25
215-0232	215-1232	20.0	30.0	2.0	16 / 26
215-0252	215-1252	25.4	50.8	2.0	20 / 32
215-0552	215-1552	50.8	50.8	2.0	28 / 48
215-0556	215-1556	50.8	50.8	6.3	33 / 53

PRECISION THIN ROUND WINDOWS

HOUSING ACCESSORIES

Optical Component Mount 830-0037

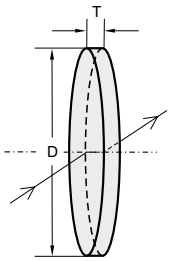
See page 7.29

Plate Clamp 830-0055

See page 7.30

Universal Plate Holder 830-0075

See page 7.31



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

Catalogue number UV FS	Diameter D, mm Metric	Diameter D, mm English	Thickness T, mm	Flatness	Parallelism	Price, EUR
226-1111	12.5	12.7	1.0	λ/10	30 arcsec	60
226-1121	12.5	12.7	2.0	λ/10	30 arcsec	53
226-1191	20.0	20.0	1.0	λ/10	30 arcsec	75
226-1201	20.0	20.0	2.0	λ/10	30 arcsec	72
226-1211	25.0	25.4	1.0	λ/10	30 arcsec	80
226-1221	25.0	25.4	2.0	λ/10	30 arcsec	75
226-1531	50.0	50.8	3.0	λ/10	30 arcsec	165
226-1116	12.5	12.7	1.0	λ/4	1 arcmin	42
226-1126	12.5	12.7	2.0	λ/4	1 arcmin	38
226-1216	25.0	25.4	1.0	λ/4	1 arcmin	61
226-1226	25.0	25.4	2.0	λ/4	1 arcmin	55
226-1516	50.0	50.8	1.0	λ/4	1 arcmin	139
226-1526	50.0	50.8	2.0	λ/4	1 arcmin	131
226-1536	50.0	50.8	3.0	λ/4	1 arcmin	125

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

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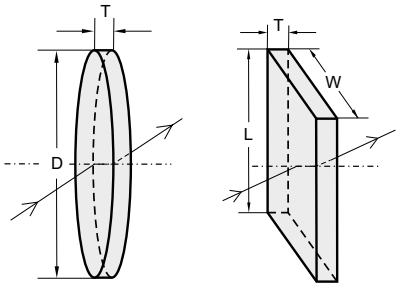
PRECISION WINDOWS

- **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

Catalogue number BK7	Catalogue number UV FS	Diameter D, mm Metric	Diameter D, mm English	Thickness T, mm	Flatness	Parallelism	Price, EUR BK7 / UV FS
220-0101	220-1101	12.5	12.7	3.0	λ/10	30 arcsec	28 / 43
220-0161	220-1161	12.5	12.7	6.0	λ/10	30 arcsec	25 / 40
220-0191	220-1191	20.0	20.0	3.0	λ/10	30 arcsec	35 / 45
220-0211	220-1211	20.0	20.0	5.0	λ/10	30 arcsec	31 / 43
220-0231	220-1231	25.0	25.4	3.0	λ/10	30 arcsec	44 / 57
220-0201	220-1201	25.0	25.4	6.0	λ/10	30 arcsec	39 / 49
220-0462	220-1462	40.0	38.1	6.0	λ/10	30 arcsec	56 / 80
220-0402	220-1402	40.0	38.1	8.0	λ/10	30 arcsec	51 / 90
220-0562	220-1562	50.0	50.8	6.0	λ/10	30 arcsec	78 / 125
220-0582	220-1582	50.0	50.8	8.0	λ/10	30 arcsec	71 / 120
220-0502	220-1502	50.0	50.8	10.0	λ/10	30 arcsec	65 / 145
220-0722	220-1722	75.0	76.2	12.7	λ/10	30 arcsec	135 / 225
220-0752	220-1752	75.0	76.2	15.0	λ/10	30 arcsec	140 / 235
220-0103	220-1103	12.5	12.7	3.0	λ/10	3 arcsec	44 / 62
220-0163	220-1163	12.5	12.7	6.0	λ/10	3 arcsec	41 / 56
220-0193	220-1193	12.5	12.7	10.0	λ/10	3 arcsec	37 / 50
220-0203	220-1203	25.0	25.4	6.0	λ/10	3 arcsec	69 / 94
220-0293	220-1293	25.0	25.4	10.0	λ/10	3 arcsec	62 / 84
220-0403	220-1403	40.0	38.1	10.0	λ/10	3 arcsec	89 / 139
220-0503	220-1503	50.0	50.8	12.0	λ/10	3 arcsec	119 / 185
220-0106	220-1106	12.5	12.7	3.0	λ/4	1 arcmin	19 / 34
220-0166	220-1166	12.5	12.7	6.0	λ/4	1 arcmin	17 / 31
220-0236	220-1236	25.0	25.4	3.0	λ/4	1 arcmin	23 / 40
220-0206	220-1206	25.0	25.4	6.0	λ/4	1 arcmin	22 / 35
220-0466	220-1466	40.0	38.1	6.0	λ/4	1 arcmin	38 / 75
220-0406	220-1406	40.0	38.1	8.0	λ/4	1 arcmin	37 / 85
220-0566	220-1566	50.0	50.8	6.0	λ/4	1 arcmin	55 / 120
220-0586	220-1586	50.0	50.8	8.0	λ/4	1 arcmin	52 / 115
220-0786	220-1786	75.0	76.2	8.0	λ/4	1 arcmin	120 / 210
220-0726	220-1726	75.0	76.2	12.7	λ/4	1 arcmin	125 / 215

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

See page 7.33

Rectangular Windows

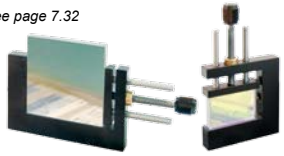
Surface flatness: λ/10 @633nm. Parallelism: <30 arcsec

Catalogue number BK7	Catalogue number UV FS	Rectangular dimensions Width W, mm	Rectangular dimensions Length L, mm	Thickness T, mm	Price, EUR BK7 / UV FS
225-0123	225-1123	15.0	20.0	3.0	45 / 78
225-0126	225-1126	15.0	20.0	6.0	40 / 70
225-0226	225-1226	25.4	25.4	6.0	43 / 76
225-0236	225-1236	20.0	30.0	6.0	46 / 110
225-0250	225-1250	25.4	50.8	10.0	59 / 135
225-0550	225-1550	50.8	50.8	10.0	83 / 189

RELATED PRODUCTS

We offer AR Coated Precision Windows for Nd:YAG laser applications
See page 4.11

Rectangular Optics Holders 830-0100, 830-0110
See page 7.32



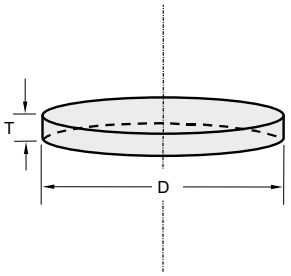
For applications where fine adjusment is required, use Prism Holders 840-0160, 840-0170
See page 7.47

OPTICAL FLATS

- **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).



Catalogue number UV FS	Diameter D, mm Metric	Diameter D, mm English	Thickness T, mm	Price, EUR
230-1208	25.0	25.4	8.0	112
230-1410	40.0	38.1	10.0	149

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

SPECIFICATIONS

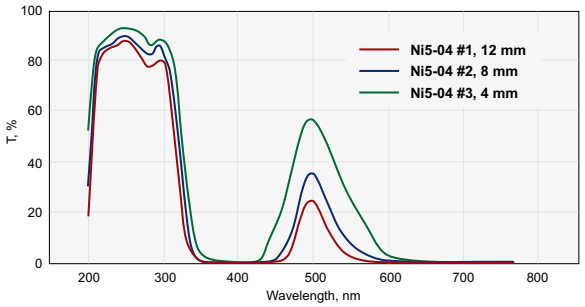
Material		UV FS
Diameter tolerance		+0.00 -0.12 mm
Thickness tolerance		±0.2 mm
Surface flatness:	1st surface	λ/20 @ 633 nm
	2nd surface	2 λ @ 633 nm

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).



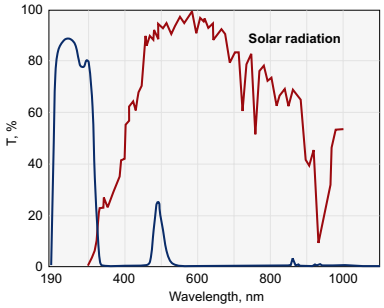
Typical spectral transmittance curves of different thickness $NiSO_4*6H_2O$ elements

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.

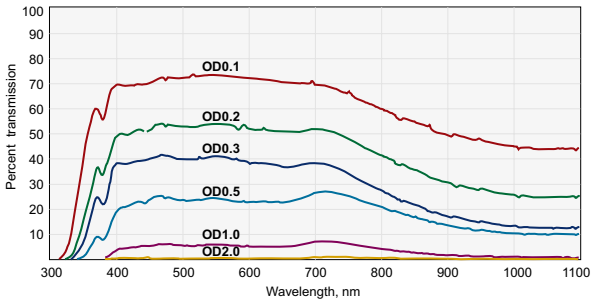


NEUTRAL DENSITY ABSORPTION TYPE FILTERS AT 450-650 nm

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.

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



External transmission curves (include reflections from uncoated surfaces)

RELATED PRODUCTS

Variable Wheel Attenuator 990-0604

Visit www.eksmaoptics.com

Filter Holder 830-0060A, 830-0070A

See page 7.31

Optical Density	Internal Transmittance, % @ 633 nm	Code				Price, EUR
		Ø25.4 mm	25.4x25.4 mm	Ø50.8 mm	50.8x50.8 mm	Ø25.4 / 25.4x25.4 / / Ø50.8 / 50.8x50.8
0.05	89	240-2500	240-2600	240-5000	240-5600	21 / 22 / 56 / 55
0.1	80	240-2501	240-2601	240-5001	240-5601	21 / 22 / 56 / 55
0.2	63	240-2502	240-2602	240-5002	240-5602	21 / 22 / 56 / 55
0.3	50	240-2503	240-2603	240-5003	240-5603	21 / 22 / 56 / 55
0.4	40	240-2504	240-2604	240-5004	240-5604	21 / 22 / 56 / 55
0.5	32	240-2505	240-2605	240-5005	240-5605	21 / 22 / 56 / 55
0.6	25	240-2506	240-2606	240-5006	240-5606	21 / 22 / 56 / 55
0.7	20	240-2507	240-2607	240-5007	240-5607	21 / 22 / 56 / 55
0.8	15	240-2508	240-2608	240-5008	240-5608	21 / 22 / 56 / 55
0.9	12.5	240-2509	240-2609	240-5009	240-5609	21 / 22 / 56 / 55
1.0	10	240-2510	240-2610	240-5010	240-5610	21 / 22 / 56 / 55
1.5	3	240-2515	240-2615	240-5015	240-5615	21 / 22 / 56 / 55
2.0	1	240-2520	240-2620	240-5020	240-5620	22 / 23 / 57 / 56
3.0	0.1	240-2530	240-2630	240-5030	240-5630	23 / 24 / 58 / 57
4.0	0.01	240-2540	240-2640	240-5040	240-5640	24 / 25 / 59 / 58

NEUTRAL DENSITY REFLECTIVE TYPE FILTERS AT 400-2000 nm

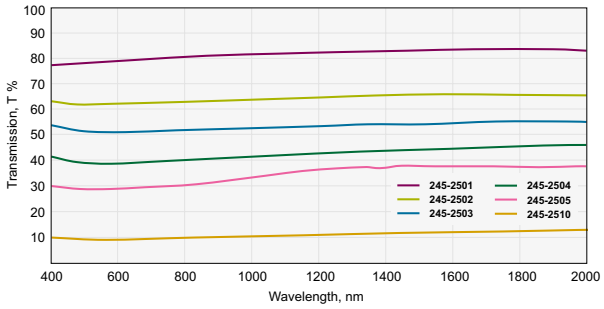
Neutral density reflective type filters of 1'' (25.4 mm) size with optical density that varies from 0.1 to 2.5 are available.

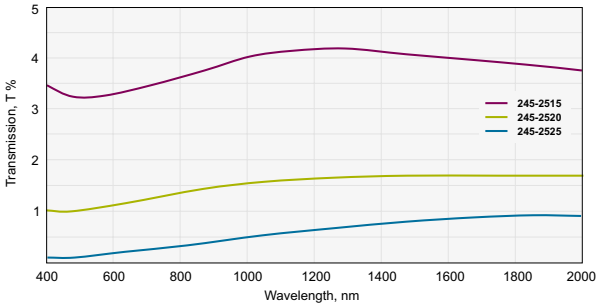
Neutral density filters of Corning 7059 glass provide spectrally uniform attenuation from 400 nm to 2000 nm.

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/cm^2 (10 ns pulse)
Design Wavelength	400-2000 nm
Optical Density Tolerance	±10% Nominal





Catalogue Number	Optical Density	Transmission T, % @ 550 nm	Price, EUR
245-2501	0.1	79	29
245-2502	0.2	63	29
245-2503	0.3	50	29
245-2504	0.4	40	29
245-2505	0.5	32	29
245-2510	1.0	10	29
245-2515	1.5	3	29
245-2520	2.0	1	29
245-2525	2.5	0.3	29

RELATED PRODUCTS

Plate Clamp 830-0055
See page 7.30

Universal Plate Holder 830-0075
See page 7.31

Variable Wheel Attenuator 990-0604-02
Visit www.eksmaoptics.com

Filters Holder with 90° Flip 990-0400
See page 6.20

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

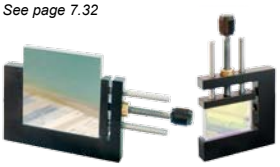
Material	Schott colour glass
Surface quality	60-40 scratch & dig (MIL-PRF-13830B)
Surface flatness	1λ per inch @ 633 nm
Parallelism	3 arcmin
Diameter tolerance	+0.0, -0.2 mm
Thickness	3.0 ± 0.2 mm
Clear aperture	90% of the diameter

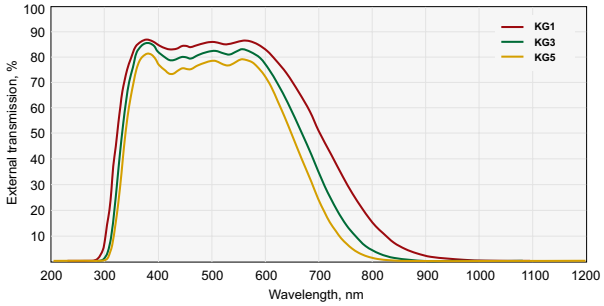
Custom sizes and shapes are available upon request.

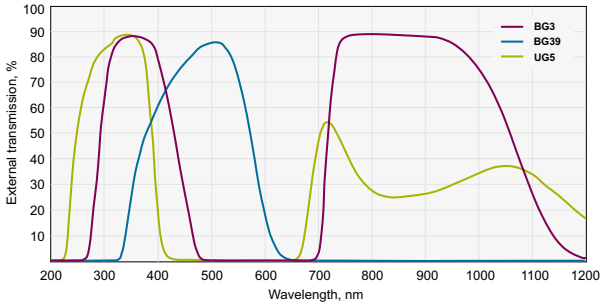
RELATED PRODUCTS

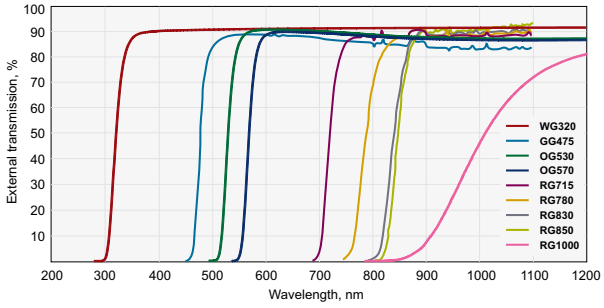
Filter Holders
830-0070A
See page 7.31

Rectangular Optics Holders
830-0100, 830-0110
See page 7.32









External transmission curves (include reflections from uncoated surfaces)

Material	Code				Price, EUR
	Ø25.4 mm	25.4×25.4 mm	Ø50.8 mm	50.8×50.8 mm	Ø25.4 / 25.4×25.4 / Ø50.8 / 50.8×50.8
BG3	241-2003	241-3003	241-5003	241-6003	27 / 26 / 51 / 53
UG5	241-2005	241-3005	241-5005	241-6005	45 / 44 / 89 / 88
BG39	241-2039	241-3039	241-5039	241-6039	32 / 31 / 63 / 62
KG1	242-2001	242-3001	242-5001	242-6001	24 / 23 / 47 / 46
KG3	242-2003	242-3003	242-5003	242-6003	27 / 26 / 51 / 50
KG5	242-2005	242-3005	242-5005	242-6005	28 / 27 / 52 / 51
WG320	243-2320	243-3320	243-5320	243-6320	24 / 23 / 47 / 46
GG475	243-2475	243-3475	243-5475	243-6475	24 / 23 / 47 / 46
OG530	243-2530	243-3530	243-5530	243-6530	24 / 23 / 47 / 46
OG570	243-2570	243-3570	243-5570	243-6570	24 / 23 / 47 / 46
RG715	243-2715	243-3715	243-5715	243-6715	24 / 23 / 47 / 46
RG780	243-2780	243-3780	243-5780	243-6780	28 / 27 / 52 / 51
RG830	243-2830	243-3830	243-5830	243-6830	28 / 27 / 52 / 51
RG850	243-2850	243-3850	243-5850	243-6850	28 / 27 / 52 / 51
RG1000	243-2990	243-3990	243-5990	243-6990	24 / 23 / 47 / 46

LASER SAFETY EYEWEAR

251-1064 Goggles

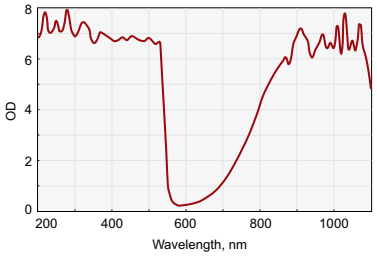
250-0800 Spectacles

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

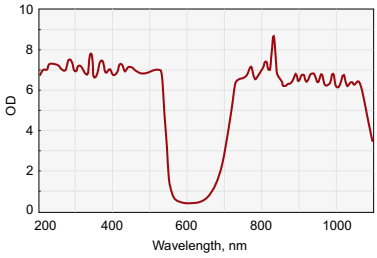
EKSMA OPTICS offers two different kinds of laser safety eyewear in two different styles: spectacles and goggles. The eyewear are amber colour and suitable for safe operation with Nd:YAG, Ti:Sapphire, Yb:KGW/KYW fundamental, second, third, fourth harmonics.

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.



Nd:YAG and Harmonics, VLT 24%



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

250-1064, 251-1064

Wavelength, nm	Optical Density
190–534	6.5+
910–1070	6+
870–1070	5+

250-0800, 251-0800

Wavelength, nm	Optical Density
190–534	6+
720–1064	5+
740–1064	6+

Code	Description	Price, EUR
250-0800	Spectacles for Nd:YAG + Ti:Sapphire applications	170
251-0800	Goggles for Nd:YAG + Ti:Sapphire applications	170
250-1064	Spectacles for Nd:YAG applications	150
251-1064	Goggles for Nd:YAG applications	150

VISUALIZATORS

Visualizator with a Holder

990-0840

- **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**

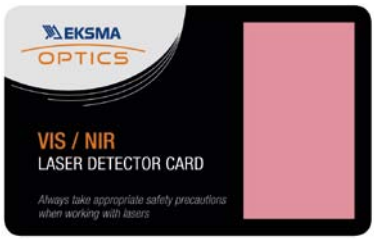
Laser Beam Visualizer **990-0840** is used for visualization of CW or pulsed laser radiation with wavelength 880-1070 nm. When CW or pulsed laser radiation of wavelength 880-1070 nm falls onto the working surface, the latter glows in the second harmonic of the beam. Use this item to adjust and check 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.

Catalogue number	Spectral range, nm	Emitted light colour	Threshold sensitivity, W/cm²	Price, EUR
990-0840	880-1070	Green	0.02	80
990-0841	190-1090 + 1470-1600	Red	0.01	99
990-0842	190-1090 + + 1470-1600/880-1070	Red / Green	0.01 / 0.02	155

VIS / NIR Laser Detection Card



VIS/NIR Laser detection card provides instant, fade free operation for simple alignment, location and safety purpose visualization of laser light. Works for the ranges 400-640 nm and 800-1700 nm. Emits in red wavelength spectrum.

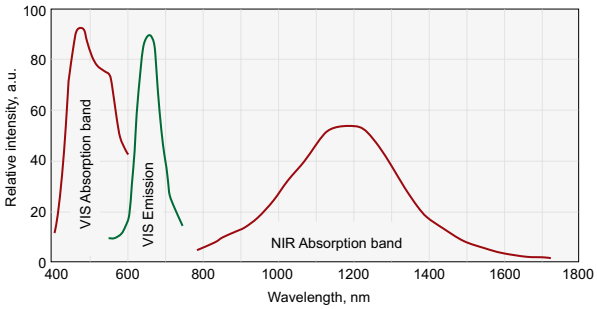
The card is made from a durable plastic and has a photosensitive region adhered to the front surface that allows for the easy location of a visible or near-infrared (NIR) light beam and its focal point. Proper function of this card requires charging it with visible light before use. Additionally, because emissions from the card are not persistent, the user must move the card around for optimal brightness of the beam spot.

- **Card Dimensions (W × H): 54 × 86 mm**
- **Active region dimensions: 26 × 46 mm**
- **Emission: red centred at 655 nm (broadband emission @ 600-730 nm)**
- **Emission Band: ~580-750 nm**
- **Absorption Band: 400-640 nm and 800-1700 nm**
- **Requires Charging by Visible Light**

Perfect for weak beam visualization

SPECIFICATIONS

Minimum Stimulation for Visible Emission	
Continuous	<1 nW/cm² @ 450 nm (measured under darkened conditions) <25 μW/cm² @ 950 nm (measured under darkened conditions)
Pulsed	Nd:YAG 2 kW/cm² @ 1064 nm (7 ns pulse @ 10 Hz, low ambient light)
Maximum Stimulation	
	Nd:YAG 60 MW/cm² @ 1064 nm (7 ns pulse - single pulse)
Persistence	
IR stimulation	< 0.5 secs
Visible stimulation	0.5 – 3 secs



Catalogue number	Spectral range, nm	Emitted light colour	Price, EUR
990-0845	400-640 and 800-1700	Red	52

Mirrors

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.** Laser damage threshold: 6 J/cm², 8 nsec pulse, 1064 nm typical.

Wavelength, nm	**Application**	**R,** % (s+p)/2	**Catalogue number** (AOI=45°) Ø12.7 × 3 mm	Ø12.7 × 6 mm	Ø25.4 × 6 mm	Ø50.8 × 8 mm	**Price,** EUR Ø12.7 / Ø25.4 / Ø50.8
351-361	Nd:YAG 3H	99.5	**031-0350**	**031-0350T6**	**032-0350**	**035-0350**	59 / 90 / 128
380-420	Ti: Sa 2H	99.5	**031-0400**	**031-0400T6**	**032-0400**	**035-0400**	57 / 89 / 133
442	HeCd	99.5	**031-0442**	**031-0442T6**	**032-0442**	**035-0442**	57 / 83 / 133
488-515	Ar+	99.5	**031-0490**	**031-0490T6**	**032-0490**	**035-0490**	57 / 83 / 133
500-530	Yb:KGW/KYW 2H	99.5	**031-0515**	**031-0515T6**	**032-0515**	**035-0515**	56 / 74 / 110
527-532	Nd:YAG 2H	99.5	**031-0530**	**031-0530T6**	**032-0530**	**035-0530**	56 / 74 / 110
589	Dye	99.5	**031-0590**	**031-0590T6**	**032-0590**	**035-0590**	56 / 82 / 122
633-670	HeNe+Diode	99.5	**031-0630**	**031-0630T6**	**032-0630**	**035-0630**	56 / 75 / 122
694	Ruby	99.5	**031-0694**	**031-0694T6**	**032-0694**	**035-0694**	56 / 75 / 122
760-840	Ti:Sa 1H	99.5	**031-0800**	**031-0800T6**	**032-0800**	**035-0800**	61 / 85 / 133
780	Diode	99.5	**031-0780**	**031-0780T6**	**032-0780**	**035-0780**	57 / 83 / 122
852	Diode	99.5	**031-0850**	**031-0850T6**	**032-0850**	**035-0850**	57 / 83 / 133
980	Diode	99.5	**031-0980**	**031-0980T6**	**032-0980**	**035-0980**	57 / 83 / 122
1000-1060	Yb:KGW/KYW 1H	99.5	**031-1030**	**031-1030T6**	**032-1030**	**035-1030**	57 / 75 / 110
1047-1064	Nd:YAG 1H	99.5	**031-1060**	**031-1060T6**	**032-1060**	**035-1060**	57 / 75 / 110
1300-1320	YAG	99.5	**031-1300**	**031-1300T6**	**032-1300**	**035-1300**	61 / 85 / 137
1520-1570	Diode	99.5	**031-1550**	**031-1550T6**	**032-1550**	**035-1550**	61 / 90 / 139

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 Ø76.2x12.7 mm. Laser damage threshold: 6 J/cm², 8 nsec pulse, 1064 nm typical.

Wavelength, nm	**Application**	**R,** % (s+p)/2	**Catalogue number** (AOI=45°)	**Price,** EUR
380-420	Ti: Sa 2H	99.5	**037-0400**	199
500-530	Yb:KGW/KYW 2H	99.5	**037-0515**	185
527-532	Nd:YAG 2H	99.5	**037-0530**	185
760-840	Ti: Sa 1H	99.5	**037-0800**	199
1000-1060	Yb:KGW/KYW 3H	99.5	**037-1030**	185
1047-1064	Nd:YAG 1H	99.5	**037-1060**	185

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

Wavelength, nm	**Application**	**R,** % (s+p)/2	**Catalogue number** (AOI=45°) Ø12.7 × 3 mm	Ø12.7 × 6 mm	Ø25.4 × 6 mm	Ø50.8 × 8 mm	**Price,** EUR Ø12.7 / Ø25.4 / Ø50.8
244-248	KrF	99.0	**041-0240**	**041-0240T6**	**042-0240**	**045-0240**	71 / 99 / 216
262-266	Nd:YAG	99.0	**041-0260**	**041-0260T6**	**042-0260**	**045-0260**	71 / 99 / 207
257-275	Ti:Sa 3H	99.0	**041-0266**	**041-0266T6**	**042-0266**	**045-0266**	71 / 99 / 207
308	XeCl	99.2	**041-0300**	**041-0300T6**	**042-0300**	**045-0300**	69 / 97 / 207
325	HeCd	99.5	**041-0325**	**041-0325T6**	**042-0325**	**045-0325**	67 / 95 / 181
333-353	Yb:KGW/KYW 3H	99.5	**041-0343**	**041-0343T6**	**042-0343**	**045-0343**	77 / 107 / 187
347	Ruby	99.5	**041-0347**	**041-0347T6**	**042-0347**	**045-0347**	67 / 95 / 181
351-361	Nd:YAG 3H	99.5	**041-0350**	**041-0350T6**	**042-0350**	**045-0350**	67 / 95 / 187
		99.9	–	**041-0350T6HHR**	**042-0350HHR**	**045-0350T12HHR***	110 / 130 / 460
380-420	Ti:Sa 2H	99.5	**041-0400**	**041-0400T6**	**042-0400**	**045-0400**	67 / 95 / 181
500-530	Yb:KGW/KYW 2H	99.5	**041-0515**	**041-0515T6**	**042-0515**	**045-0515**	62 / 90 / 169
527-532	Nd:YAG 2H	99.5	**041-0530**	**041-0530T6**	**042-0530**	**045-0530**	62 / 90 / 169
		99.9	–	**041-0530T6HHR**	**042-0530HHR**	**045-0530T12HHR***	75 / 105 / 410
760-840	Ti:Sa 1H	99.5	**041-0800**	**041-0800T6**	**042-0800**	**045-0800**	75 / 97 / 181
		99.9	–	**041-0800T6HHR**	**042-0800HHR**	**045-0800T12HHR***	108 / 130 / 440
1000-1060	Yb:KGW/KYW 1H	99.5	**041-1030**	**041-1030T6**	**042-1030**	**045-1030**	62 / 90 / 169
		99.9	–	**041-1030T6HHR**	**042-1030HHR**	**045-1030T12HHR***	75 / 105 / 410
1047-1064	Nd:YAG 1H	99.5	**041-1060**	**041-1060T6**	**042-1060**	**045-1060**	62 / 90 / 169
		99.9	–	**041-1060T6HHR**	**042-1060HHR**	**045-1060T12HHR***	75 / 105 / 410

** Thickness of Ø50.8 HHR mirrors is 12.0 mm.*

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

Wavelength, nm	**Application**	**R,** % (s+p)/2	**Catalogue number** (AOI=45°)	**Price,** EUR
257-275	Ti:Sa 3H	99.0	**047-0266**	290
333-353	Yb:KGW/KYW 3H	99.5	**047-0343**	281
351-361	Nd:YAG 3H	99.5	**047-0350**	281
380-420	Ti:Sa 2H	99.5	**047-0400**	272
500-530	Yb:KGW/KYW 2H	99.5	**047-0515**	258
527-532	Nd:YAG 2H	99.5	**047-0530**	258
760-840	Ti:Sa 1H	99.5	**047-0800**	272
1000-1060	Yb:KGW/KYW 1H	99.5	**047-1030**	258
1047-1064	Nd:YAG 1H	99.5	**047-1060**	258

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.

Dual Band Mirrors

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

Wavelength, nm	**Application**	**R,** % (s+p)/2	**Catalogue number** (AOI=45°) Ø12.7 × 3 mm	Ø12.7 × 6 mm	Ø25.4 × 6 mm	Ø50.8 × 8 mm	Ø76.2 × 12.7 mm	Price, EUR Ø12.7 / Ø25.4 / / Ø50.8 / Ø76.2
390-410+780-820	Ti:Sa 2H+1H	99.5	**051-4080**	**051-4080T6**	**052-4080**	**055-4080**	**057-4080**	85 / 103 / 151 / 227
500-530+1000-1060	Yb:KGW/KYW 2H+1H	99.5	**051-5103**	**051-5103T6**	**052-5103**	**055-5103**	**057-5103**	85 / 103 / 151 / 227
532+1064	Nd:YAG 2H+1H	99.5	**051-5306**	**051-5306T6**	**052-5306**	**055-5306**	**057-5306**	85 / 103 / 151 / 227
633+1064	HeNe:Nd:YAG 1H	99.5	**051-6306**	**051-6306T6**	**052-6306**	**055-6306**	**057-6306**	85 / 103 / 151 / 227

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.** Laser damage threshold: 2 J/cm², 8 nsec pulse, 1064 nm typical.

Wavelength, nm	**Application**	**R,** % (s+p)/2	**Catalogue number** (AOI=45°) Ø12.7 × 3 mm	Ø12.7 × 6 mm	Ø25.4 × 6 mm	Ø50.8 × 8 mm	Ø76.2 × 12.7 mm	Price, EUR Ø12.7 / Ø25.4 / / Ø50.8 / Ø76.2
266+355	Nd:YAG 4H+3H	99.0	**061-2635**	**061-2635T6**	**062-2635**	**065-2635**	**067-2635**	125 / 149 / 230 / 365
266+532	Nd:YAG 4H+2H	99.0	**061-2653**	**061-2653T6**	**062-2653**	**065-2653**	**067-2653**	125 / 149 / 230 / 365
355+532	Nd:YAG 3H+2H	99.5	**061-3553**	**061-3553T6**	**062-3553**	**065-3553**	**067-3553**	115 / 139 / 215 / 323
355+1064	Nd:YAG 3H+1H	99.0	**061-3506**	**061-3506T6**	**062-3506**	**065-3506**	**067-3506**	115 / 139 / 215 / 323
390-410+780-820	Ti:Sa 2H+1H	99.5	**061-4080**	**061-4080T6**	**062-4080**	**065-4080**	**067-4080**	110 / 128 / 214 / 321
500-530+1000-1060	Yb:KGW/KYW 2H+1H	99.5	**061-5103**	**061-5103T6**	**062-5103**	**065-5103**	**067-5103**	110 / 128 / 214 / 321
532+1064	Nd:YAG 2H+1H	99.5	**061-5306**	**061-5306T6**	**062-5306**	**065-5306**	**067-5306**	109 / 134 / 209 / 318
		99.9	–	–	**062-5306HHR**	–	–	– / 180 / – / –
633+1064	HeNe:Nd:YAG 1H	99.5	**061-6306**	**061-6306T6**	**062-6306**	**065-6306**	**067-6306**	109 / 134 / 209 / 318

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.** Laser damage threshold: 1 J/cm², 8 nsec pulse, 1064 nm typical.

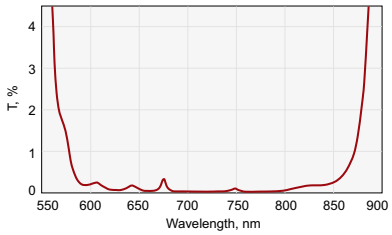
Wavelength, nm	Application	R, % (s+p)/2	Catalogue number (AOI=45°) Ø12.7 × 3 mm	Ø12.7 × 6 mm	Ø25.4 × 6 mm	Ø50.8 × 8 mm	Price, EUR Ø12.7 / Ø25.4 / Ø50.8
360–440	Ti:Sa 2H	99	**071-3644**	**071-3644T6**	**072-3644**	**075-3644**	89 / 107 / 151
420–540	Dye	99	**071-4254**	**071-4254T6**	**072-4254**	**075-4254**	85 / 103 / 145
520–650	Dye	99	**071-5265**	**071-5265T6**	**072-5265**	**075-5265**	85 / 103 / 145
600–850	Diode	99	**071-6085**	**071-6085T6**	**072-6085**	**075-6085**	85 / 103 / 145
730–950	Ti:Sa	99	**071-7395**	**071-7395T6**	**072-7395**	**075-7395**	86 / 104 / 147
800–1100	Diode,YAG	99	**071-8011**	**071-8011T6**	**072-8011**	**075-8011**	86 / 104 / 147

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**. Laser damage threshold: 1 J/cm², 8 nsec pulse, 1064 nm typical.

Wavelength, nm	Application	R, % (s+p)/2	Catalogue number (AOI=45°) Ø12.7 × 3 mm	Ø12.7 × 6 mm	Ø25.4 × 6 mm	Ø50.8 × 8 mm	Price, EUR Ø12.7 / Ø25.4 / Ø50.8
220-250	Spectroscopy	99	**081-2225**	**081-2225T6**	**082-2225**	**085-2225**	145 / 165 / 264
260-380	Spectroscopy	99	**081-2638**	**081-2638T6**	**082-2638**	**085-2638**	135 / 155 / 249
360-440	Ti:Sa 2H	99	**081-3644**	**081-3644T6**	**082-3644**	**085-3644**	115 / 139 / 215
420-540	Dye	99	**081-4254**	**081-4254T6**	**082-4254**	**085-4254**	110 / 128 / 214
520-650	Dye	99	**081-5265**	**081-5265T6**	**082-5265**	**085-5265**	110 / 128 / 214
600-850	Diode	99	**081-6085**	**081-6085T6**	**082-6085**	**085-6085**	110 / 128 / 214
730-950	Ti:Sa	99	**081-7395**	**081-7395T6**	**082-7395**	**085-7395**	130 / 148 / 234
800-1100	Diode, YAG	99	**081-8011**	**081-8011T6**	**082-8011**	**085-8011**	120 / 138 / 224

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

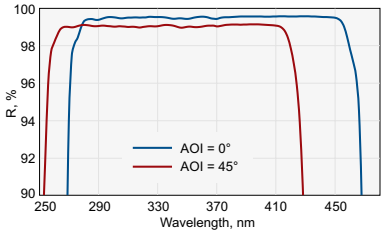
Broadband Low GDD Ultrafast Laser Mirrors
See page 5.5

Kinematic Mirror/ Beamsplitter Mounts 840-0056
See page 7.38

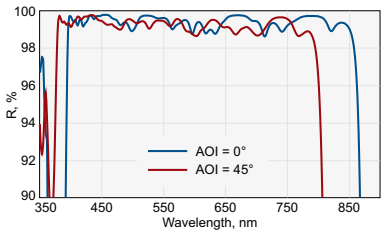
UV FS Broadband and Laser Line Mirrors for AOI from 0 to 45°

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

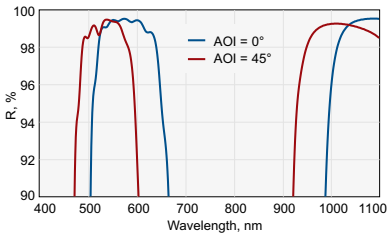
EKSMA OPTICS introduces broadband and laser line dielectric mirrors with high reflectance (greater than 99% over specified range minimum) that operate at all angles of incidence from 0° to 45°. Broadband and laser line mirrors are available for 280-400 nm, 349-355 nm, 400-750 nm, 524-532 nm, 532+1064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



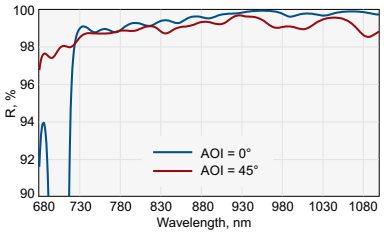
081-2840-i0-45.
HR>99% @ 280-400 nm, AOI from 0 to 45°



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°



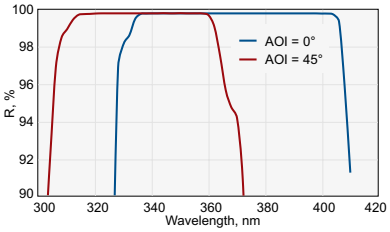
081-7511-i0-45.
HR>99% @ 750-1100 nm, AOI from 0 to 45°

Substrate: **UV grade Fused Silica**

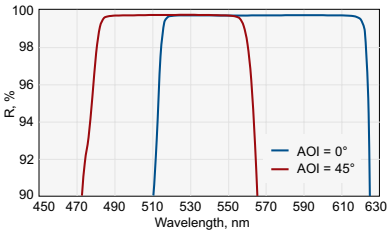
Wavelength, nm	**AOI,** deg	**R,** % (s+p)/2	Catalogue number Ø12.7 × 6 mm	Ø25.4 × 6 mm	Ø50.8 × 6 mm	**LDT,** J/cm² 10 ns, 10 Hz	**Price,** EUR Ø12.7 / Ø25.4 / Ø50.8
257	0-45	99.0	**041-0257-i0-45**	**042-0257-i0-45**	–	0.5	130 / 165 / –
280-400	0-45	99.0	**086-2840-i0-45**	**082-2840-i0-45**	–	0.5	77 / 98 / –
343-355	0-45	99.5	**041-0350-i0-45**	**042-0350-i0-45**	–	1	99 / 121 / –
400-750	0-45	99.0	**086-4075-i0-45**	**082-4075-i0-45**	**085-4075-i0-45**	1	42 / 65 / 124
524-532	0-45	99.9	**041-0530HHR-i0-45**	**042-0530HHR-i0-45**	–	10	90 / 120 / –
532+1064	0-45	99.7	**061-5306HHR-i0-45**	**062-5306HHR-i0-45**	–	3	95 / 125 / –
750-1100	0-45	99.0	**086-7511-i0-45**	**082-7511-i0-45**	**085-7511-i0-45**	1	42 / 65 / 124
760-840 Low GDD	0-45	99.9	**041-1060HHR-i0-45**	**042-1060HHR-i0-45**	–	3	110 / 140 / –
1047-1064	0-45	99.7	**041-1060HHR-i0-45**	**042-1060HHR-i0-45**	–	20	90 / 120 / –

Substrate: **BK7**

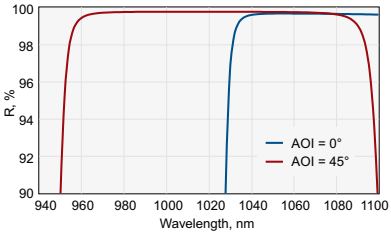
Wavelength, nm	**AOI,** deg	**R,** % (s+p)/2	Catalogue number Ø12.7 × 6 mm	Ø25.4 × 6 mm	Ø50.8 × 6 mm	**LDT,** J/cm² 10 ns, 10 Hz	**Price,** EUR Ø12.7 / Ø25.4 / Ø50.8
400-750	0-45	99.0	**076-4076-i0-45**	**072-4075-i0-45**	**075-4075-i0-45**	1	38 / 59 / 112
750-1100	0-45	99.0	**076-7511-i0-45**	**072-7511-i0-45**	**075-7511-i0-45**	1	38 / 59 / 112



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°

RELATED PRODUCTS

Mounted version available!
See page 7.40

HOUSING ACCESSORIES

Kinematic Mirror Mount 840-0010
See page 7.33

Adapter for Mirror at 45º 840-0115
See page 7.41

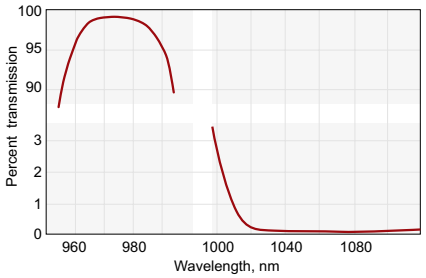
DICHROIC MIRRORS

- **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



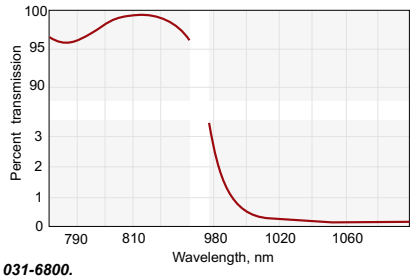
042-6200HT.
HR > 99.5% @ 1028-1080 nm, HT > 98% @ 965-982 nm, AOI = 0°

COATING

Technology	Ion Beam Sputtering (IBS)
Laser Damage Threshold	>10 J/cm², 8 nsec pulse, 1064 nm typical
Back side antireflection coated	R < 0.1% at AOI = 0° R < 0.25% at AOI = 45°

Reflected wavelength, nm, R > 99.5%	Transmitted wavelength, nm	Transmission, %	AOI	Substrate material	Size		Price, EUR
					Ø12.7x3 mm	Ø25.4x6 mm	Ø12.7 / Ø25.4
1064	808	>99	0	UV FS	**041-6800HT**	**042-6800HT**	175 / 220
1064	808	>99	45	UV FS	**041-6805HT**	**042-6805HT**	190 / 235
1028-1080	965-982	>98	0	UV FS	**041-6200HT**	**042-6200HT**	220 / 260
1028-1080	965-982	>98	45	UV FS	**041-6205HT**	**042-6205HT**	250 / 290
1028-1080	965-982	>98	22.5	UV FS	**041-6202HT**	**042-6202HT**	220 / 260

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	Code		Price, EUR
					Ø12.7x3 mm	Ø25.4x6 mm	Ø12.7 / Ø25.4
633	1064	>90	45	BK7	**041-6105**	**042-6105**	90 / 115
1064	633	>90	45	BK7	**041-6605**	**042-6605**	95 / 120
1064	808	>95	0	BK7	**031-6800**	**032-6800**	95 / 120
1064	808	>95	45	BK7	**031-6805**	**032-6805**	95 / 120
1064	808	>95	0	UV FS	**041-6800**	**042-6800**	120 / 150
1064	808	>95	45	UV FS	**041-6805**	**042-6805**	120 / 150

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, %	Wave-length, 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

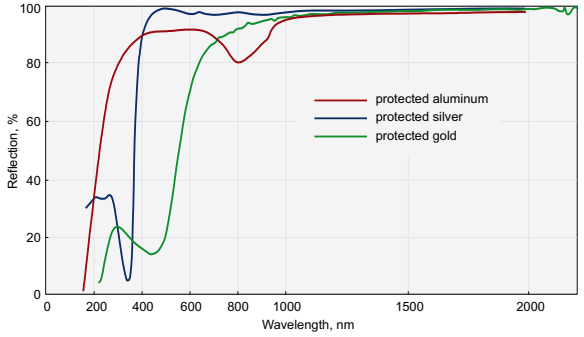
** Laser Induced Damage Threshold results are measured according to ISO 21254-2: 1000-on-1 test procedure.*

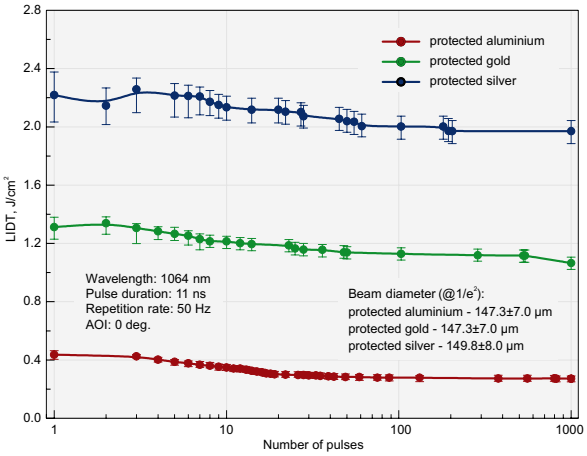
SPECIFICATIONS for Flat Substrates

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

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



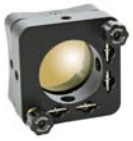


Comparison of Protected Ag, Al and Au Mirrors @ 1064 nm, 50 Hz, 11 nsec

RELATED PRODUCTS

Mounted version available!

See page 7.40

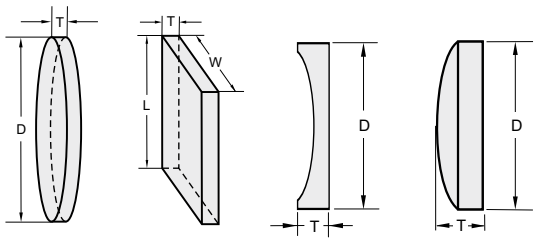


Protected Aluminium Mirrors

- **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

Catalogue number	Width W, mm	Length L, mm	Thickness T, mm	Substrate material	Price, EUR
091-0315	15.0	20.0	6.0	BK7	22
092-0315	20.0	30.0	6.0	BK7	29
093-0315	25.4	25.4	6.0	BK7	27
094-0315	25.4	50.8	10.0	BK7	60
095-0315	50.8	50.8	10.0	BK7	90
091-3315	15.0	20.0	6.0	UV FS	36
092-3315	20.0	30.0	6.0	UV FS	47
093-3315	25.4	25.4	6.0	UV FS	45
094-3315	25.4	50.8	10.0	UV FS	95
095-3315	50.8	50.8	10.0	UV FS	135

Flat Round Mirrors. Substrate type: plano-plano

Catalogue number	Diameter D, mm	Thickness T, mm	Substrate material	Price, EUR
091-0015	12.7	3.0	BK7	20
091-0015T6	12.7	6.0	BK7	20
092-0015	25.4	6.0	BK7	25
095-0015	50.8	8.0	BK7	80
097-0015	76.2	12.7	BK7	160
098-0015	101.6	15.0	BK7	260
091-3015	12.7	3.0	UV FS	30
091-3015T6	12.7	6.0	UV FS	30
092-3015	25.4	6.0	UV FS	35
095-3015	50.8	8.0	UV FS	120
097-3015	76.2	12.7	UV FS	195
098-3015	101.6	15.0	UV FS	340

Spherical Mirrors

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

Catalogue number	Substrate type	Radius, mm	Substrate material	Price, EUR
091-0115R-50	Plano-concave	-50	BK7	35
091-0115R-75	Plano-concave	-75	BK7	35
091-0115R-100	Plano-concave	-100	BK7	35
091-0115R-150	Plano-concave	-150	BK7	35
091-0115R-200	Plano-concave	-200	BK7	35
091-0115R-250	Plano-concave	-250	BK7	35
091-0115R-300	Plano-concave	-300	BK7	35
091-0115R-400	Plano-concave	-400	BK7	35
091-0115R-500	Plano-concave	-500	BK7	35
091-0115R-1000	Plano-concave	-1000	BK7	35
091-0115R-1500	Plano-concave	-1500	BK7	35
091-0115R-2000	Plano-concave	-2000	BK7	35
091-3115R-50	Plano-concave	-50	UV FS	45
091-3115R-75	Plano-concave	-75	UV FS	45
091-3115R-100	Plano-concave	-100	UV FS	45
091-3115R-150	Plano-concave	-150	UV FS	45
091-3115R-200	Plano-concave	-200	UV FS	45
091-3115R-250	Plano-concave	-250	UV FS	45
091-3115R-300	Plano-concave	-300	UV FS	45
091-3115R-400	Plano-concave	-400	UV FS	45

Catalogue number	Substrate type	Radius, mm	Substrate material	Price, EUR
091-3115R-500	Plano-concave	-500	UV FS	45
091-3115R-1000	Plano-concave	-1000	UV FS	45
091-3115R-1500	Plano-concave	-1500	UV FS	45
091-3115R-2000	Plano-concave	-2000	UV FS	45
091-0215R+50	Plano-convex	+50	BK7	37
091-0215R+75	Plano-convex	+75	BK7	37
091-0215R+100	Plano-convex	+100	BK7	37
091-0215R+150	Plano-convex	+150	BK7	37
091-0215R+200	Plano-convex	+200	BK7	37
091-0215R+300	Plano-convex	+300	BK7	37
091-0215R+400	Plano-convex	+400	BK7	37
091-0215R+500	Plano-convex	+500	BK7	37
091-3215R+50	Plano-convex	+50	UV FS	48
091-3215R+75	Plano-convex	+75	UV FS	48
091-3215R+100	Plano-convex	+100	UV FS	48
091-3215R+150	Plano-convex	+150	UV FS	48
091-3215R+200	Plano-convex	+200	UV FS	48
091-3215R+300	Plano-convex	+300	UV FS	48
091-3215R+400	Plano-convex	+400	UV FS	48
091-3215R+500	Plano-convex	+500	UV FS	48

Spherical Mirrors

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

Catalogue number	Substrate type	Radius, mm	Substrate material	Price, EUR
092-0115R-50	Plano-concave	-50	BK7	55
092-0115R-75	Plano-concave	-75	BK7	55
092-0115R-100	Plano-concave	-100	BK7	55
092-0115R-150	Plano-concave	-150	BK7	55
092-0115R-200	Plano-concave	-200	BK7	55
092-0115R-250	Plano-concave	-250	BK7	55
092-0115R-300	Plano-concave	-300	BK7	55
092-0115R-400	Plano-concave	-400	BK7	55
092-0115R-500	Plano-concave	-500	BK7	55
092-0115R-600	Plano-concave	-600	BK7	55
092-0115R-750	Plano-concave	-750	BK7	55
092-0115R-800	Plano-concave	-800	BK7	55
092-0115R-1000	Plano-concave	-1000	BK7	55
092-0115R-1500	Plano-concave	-1500	BK7	55
092-0115R-2000	Plano-concave	-2000	BK7	55
092-0115R-2500	Plano-concave	-2500	BK7	55
092-0115R-3000	Plano-concave	-3000	BK7	55
092-0115R-4000	Plano-concave	-4000	BK7	55
092-0115R-5000	Plano-concave	-5000	BK7	55
092-0115R-6000	Plano-concave	-6000	BK7	55
092-0115R-8000	Plano-concave	-8000	BK7	55

Catalogue number	Substrate type	Radius, mm	Substrate material	Price, EUR
092-3115R-50	Plano-concave	-50	UV FS	70
092-3115R-75	Plano-concave	-75	UV FS	70
092-3115R-100	Plano-concave	-100	UV FS	70
092-3115R-150	Plano-concave	-150	UV FS	70
092-3115R-200	Plano-concave	-200	UV FS	70
092-3115R-250	Plano-concave	-250	UV FS	70
092-0115R-300	Plano-concave	-300	UV FS	70
092-0115R-400	Plano-concave	-400	UV FS	70
092-3115R-500	Plano-concave	-500	UV FS	70
092-3115R-600	Plano-concave	-600	UV FS	70
092-3115R-750	Plano-concave	-750	UV FS	70
092-3115R-800	Plano-concave	-800	UV FS	70
092-3115R-1000	Plano-concave	-1000	UV FS	70
092-3115R-1500	Plano-concave	-1500	UV FS	55
092-3115R-2000	Plano-concave	-2000	UV FS	70
092-3115R-2500	Plano-concave	-2500	UV FS	70
092-0115R-3000	Plano-concave	-3000	UV FS	70
092-3115R-4000	Plano-concave	-4000	UV FS	70
092-3115R-5000	Plano-concave	-5000	UV FS	70
092-0115R-6000	Plano-concave	-6000	UV FS	70
092-0115R-8000	Plano-concave	-8000	UV FS	70

Catalogue number	Substrate type	Radius, mm	Substrate material	Price, EUR
092-0215R+50	Plano-convex	+50	BK7	59
092-0215R+75	Plano-convex	+75	BK7	59
092-0215R+100	Plano-convex	+100	BK7	59
092-0215R+150	Plano-convex	+150	BK7	59
092-0215R+200	Plano-convex	+200	BK7	59
092-0215R+300	Plano-convex	+300	BK7	59
092-0215R+400	Plano-convex	+400	BK7	59
092-0215R+500	Plano-convex	+500	BK7	59
092-0215R+600	Plano-convex	+600	BK7	59
092-0215R+800	Plano-convex	+800	BK7	59
092-0215R+1000	Plano-convex	+1000	BK7	59
092-0215R+1500	Plano-convex	+1500	BK7	59
092-0215R+2000	Plano-convex	+2000	BK7	59
092-0215R+4000	Plano-convex	+4000	BK7	59
092-0215R+5000	Plano-convex	+5000	BK7	59

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

Spherical Mirrors

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

Catalogue number	Substrate type	Radius, mm	Substrate material	Price, EUR
095-0115R-100	Plano-concave	-100	BK7	118
095-0115R-150	Plano-concave	-150	BK7	118
095-0115R-200	Plano-concave	-200	BK7	118
095-0115R-250	Plano-concave	-250	BK7	118
095-0115R-300	Plano-concave	-300	BK7	118
095-0115R-400	Plano-concave	-400	BK7	118
095-0115R-500	Plano-concave	-500	BK7	118
095-0115R-600	Plano-concave	-600	BK7	118
095-0115R-800	Plano-concave	-800	BK7	118
095-0115R-1000	Plano-concave	-1000	BK7	118
095-0115R-1500	Plano-concave	-1500	BK7	118
095-0115R-2000	Plano-concave	-2000	BK7	118
095-0115R-2500	Plano-concave	-2500	BK7	118
095-0115R-3000	Plano-concave	-3000	BK7	118
095-0115R-4000	Plano-concave	-4000	BK7	118
095-0115R-5000	Plano-concave	-5000	BK7	118
095-0115R-6000	Plano-concave	-6000	BK7	118
095-0115R-8000	Plano-concave	-8000	BK7	118
095-0115R-10000	Plano-concave	-10000	BK7	118
095-3115R-100	Plano-concave	-100	UV FS	143
095-3115R-150	Plano-concave	-150	UV FS	143
095-3115R-200	Plano-concave	-200	UV FS	143
095-0115R-250	Plano-concave	-250	UV FS	143
095-3115R-300	Plano-concave	-300	UV FS	143
095-3115R-400	Plano-concave	-400	UV FS	143
095-3115R-500	Plano-concave	-500	UV FS	143
095-3115R-600	Plano-concave	-600	UV FS	143
095-3115R-800	Plano-concave	-800	UV FS	143
095-3115R-1000	Plano-concave	-1000	UV FS	143
095-3115R-1500	Plano-concave	-1500	UV FS	143
095-3115R-2000	Plano-concave	-2000	UV FS	143
095-3115R-2500	Plano-concave	-2500	UV FS	143
095-3115R-3000	Plano-concave	-3000	UV FS	143
095-3115R-4000	Plano-concave	-4000	UV FS	143
095-3115R-5000	Plano-concave	-5000	UV FS	143
095-0115R-6000	Plano-concave	-6000	UV FS	143
095-0115R-8000	Plano-concave	-8000	UV FS	143
095-3115R-10000	Plano-concave	-10000	UV FS	143

Catalogue number	Substrate type	Radius, mm	Substrate material	Price, EUR
095-0215R+100	Plano-convex	+100	BK7	127
095-0215R+150	Plano-convex	+150	BK7	127
095-0215R+200	Plano-convex	+200	BK7	127
095-0215R+300	Plano-convex	+300	BK7	127
095-0215R+400	Plano-convex	+400	BK7	127
095-0215R+500	Plano-convex	+500	BK7	127
095-0215R+600	Plano-convex	+600	BK7	127
095-0215R+800	Plano-convex	+800	BK7	127
095-0215R+1000	Plano-convex	+1000	BK7	127
095-0215R+1500	Plano-convex	+1500	BK7	127
095-0215R+2000	Plano-convex	+2000	BK7	127
095-3215R+100	Plano-convex	+100	UV FS	153
095-3215R+150	Plano-convex	+150	UV FS	153
095-3215R+200	Plano-convex	+200	UV FS	153
095-3215R+300	Plano-convex	+300	UV FS	153
095-3215R-400	Plano-convex	+400	UV FS	153
095-3215R+500	Plano-convex	+500	UV FS	153
095-3215R+600	Plano-convex	+600	UV FS	153
095-3215R+800	Plano-convex	+800	UV FS	153
095-3215R+1000	Plano-convex	+1000	UV FS	153
095-3215R+1500	Plano-convex	+1500	UV FS	153
095-3215R+2000	Plano-convex	+2000	UV FS	153

RELATED PRODUCTS

Curved Windows. *See page 1.8*

Kinematic Mirror Mount 840-0010
See page 7.33

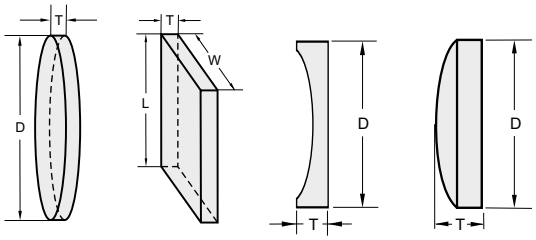
Adapter for Mirror at 45° 840-0115
See page 7.41

Protected Silver Mirrors

- **LIDT – 0.25 J/cm² at 800 nm, 50 Hz, 94 fsec pulses***
- **LIDT – 1.8 J/cm² 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

Catalogue number	Width W, mm	Length L, mm	Thickness T, mm	Substrate material	Price, EUR
091-0325	15.0	20.0	6.0	BK7	36
092-0325	20.0	30.0	6.0	BK7	48
093-0325	25.4	25.4	6.0	BK7	46
094-0325	25.4	50.8	10.0	BK7	70
095-0325	50.8	50.8	10.0	BK7	100
091-3325	15.0	20.0	6.0	UV FS	50
092-3325	20.0	30.0	6.0	UV FS	66
093-3325	25.4	25.4	6.0	UV FS	64
094-3325	25.4	50.8	10.0	UV FS	105
095-3325	50.8	50.8	10.0	UV FS	145

Flat Round Mirrors. Substrate type: plano-plano

Catalogue number	Diameter D, mm	Thickness T, mm	Substrate material	Price, EUR
091-0025	12.7	3.0	BK7	26
091-0025T6	12.7	6.0	BK7	26
092-0025	25.4	6.0	BK7	39
095-0025	50.8	8.0	BK7	90
097-0025	76.2	12.7	BK7	180
098-0025	101.6	15.0	BK7	330
091-3025	12.7	3.0	UV FS	36
091-3025T6	12.7	6.0	UV FS	36
092-3025	25.4	6.0	UV FS	44
095-3025	50.8	8.0	UV FS	96
097-3025	76.2	12.7	UV FS	215
098-3025	101.6	15.0	UV FS	410

Spherical Mirrors

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

Catalogue number	Substrate type	Radius, mm	Substrate material	Price, EUR
091-0125R-50	Plano-concave	-50	BK7	42
091-0125R-75	Plano-concave	-75	BK7	42
091-0125R-100	Plano-concave	-100	BK7	42
091-0125R-150	Plano-concave	-150	BK7	42
091-0125R-200	Plano-concave	-200	BK7	42
091-0125R-250	Plano-concave	-250	BK7	42
091-0125R-300	Plano-concave	-300	BK7	42
091-0125R-400	Plano-concave	-400	BK7	42
091-0125R-500	Plano-concave	-500	BK7	42
091-0125R-1000	Plano-concave	-1000	BK7	42
091-0125R-1500	Plano-concave	-1500	BK7	42
092-0125R-2000	Plano-concave	-2000	BK7	42
091-3125R-50	Plano-concave	-50	UV FS	52
091-3125R-75	Plano-concave	-75	UV FS	52
091-3125R-100	Plano-concave	-100	UV FS	52
091-3125R-150	Plano-concave	-150	UV FS	52
091-3125R-200	Plano-concave	-200	UV FS	52
091-3125R-250	Plano-concave	-250	UV FS	52
091-3125R-300	Plano-concave	-300	UV FS	52
091-3125R-400	Plano-concave	-400	UV FS	52
091-3125R-500	Plano-concave	-500	UV FS	52
091-3125R-1000	Plano-concave	-1000	UV FS	52
091-3125R-1500	Plano-concave	-1500	UV FS	52
092-3125R-2000	Plano-concave	-2000	UV FS	52

Catalogue number	Substrate type	Radius, mm	Substrate material	Price, EUR
091-0225R+50	Plano-convex	+50	BK7	44
091-0225R+100	Plano-convex	+100	BK7	44
091-0225R+150	Plano-convex	+150	BK7	44
091-0225R+200	Plano-convex	+200	BK7	44
091-0225R+300	Plano-convex	+300	BK7	44
091-0225R+400	Plano-convex	+400	BK7	44
091-0225R+500	Plano-convex	+500	BK7	44
091-3225R+50	Plano-convex	+50	UV FS	55
091-3225R+100	Plano-convex	+100	UV FS	55
091-3225R+150	Plano-convex	+150	UV FS	55
091-3225R+200	Plano-convex	+200	UV FS	55
091-3225R+300	Plano-convex	+300	UV FS	55
091-3225R+400	Plano-convex	+400	UV FS	55
091-3225R+500	Plano-convex	+500	UV FS	55

Spherical Mirrors

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

Catalogue number	Substrate type	Radius, mm	Substrate material	Price, EUR
092-0125R-50	Plano-concave	-50	BK7	65
092-0125R-75	Plano-concave	-75	BK7	65
092-0125R-100	Plano-concave	-100	BK7	65
092-0125R-150	Plano-concave	-150	BK7	65
092-0125R-200	Plano-concave	-200	BK7	65
092-0125R-250	Plano-concave	-250	BK7	65
092-0125R-300	Plano-concave	-300	BK7	65
092-0125R-400	Plano-concave	-400	BK7	65
092-0125R-500	Plano-concave	-500	BK7	65
092-0125R-600	Plano-concave	-600	BK7	65
092-0125R-700	Plano-concave	-700	BK7	65
092-0125R-750	Plano-concave	-750	BK7	65
092-0125R-800	Plano-concave	-800	BK7	65
092-0125R-1000	Plano-concave	-1000	BK7	65
092-0125R-1500	Plano-concave	-1500	BK7	65
092-0125R-2000	Plano-concave	-2000	BK7	65
092-0125R-2500	Plano-concave	-2500	BK7	65
092-0125R-3000	Plano-concave	-3000	BK7	65
092-0125R-4000	Plano-concave	-4000	BK7	65
092-0125R-5000	Plano-concave	-5000	BK7	65
092-0125R-6000	Plano-concave	-6000	BK7	65
092-0125R-8000	Plano-concave	-8000	BK7	65
092-3125R-50	Plano-concave	-50	UVFS	80
092-3125R-75	Plano-concave	-75	UVFS	80
092-3125R-100	Plano-concave	-100	UVFS	80
092-3125R-150	Plano-concave	-150	UVFS	80
092-3125R-200	Plano-concave	-200	UVFS	80
092-3125R-250	Plano-concave	-250	UVFS	80
092-3125R-300	Plano-concave	-300	UVFS	80
092-3125R-400	Plano-concave	-400	UVFS	80
092-3125R-500	Plano-concave	-500	UVFS	80
092-3125R-600	Plano-concave	-600	UVFS	80
092-3125R-700	Plano-concave	-700	UVFS	80
092-3125R-750	Plano-concave	-750	UVFS	80
092-3125R-800	Plano-concave	-800	UVFS	80
092-3125R-1000	Plano-concave	-1000	UVFS	80

Catalogue number	Substrate type	Radius, mm	Substrate material	Price, EUR
092-3125R-1500	Plano-concave	-1500	UVFS	80
092-3125R-2000	Plano-concave	-2000	UVFS	80
092-3125R-2500	Plano-concave	-2500	UVFS	80
092-3125R-3000	Plano-concave	-3000	UVFS	80
092-3125R-4000	Plano-concave	-4000	UVFS	80
092-3125R-5000	Plano-concave	-5000	UVFS	80
092-3125R-6000	Plano-concave	-6000	UVFS	80
092-3125R-8000	Plano-concave	-8000	UVFS	80
092-0225R+50	Plano-convex	+50	BK7	69
092-0225R+100	Plano-convex	+100	BK7	69
092-0225R+150	Plano-convex	+150	BK7	69
092-0225R+200	Plano-convex	+200	BK7	69
092-0225R+300	Plano-convex	+300	BK7	69
092-0225R+400	Plano-convex	+400	BK7	69
092-0225R+500	Plano-convex	+500	BK7	69
092-0225R+600	Plano-convex	+600	BK7	69
092-0225R+800	Plano-convex	+800	BK7	69
092-0225R+1000	Plano-convex	+1000	BK7	69
092-0225R+1500	Plano-convex	+1500	BK7	69
092-0225R+2000	Plano-convex	+2000	BK7	69
092-0225R+4000	Plano-convex	+4000	BK7	69
092-0225R+5000	Plano-convex	+5000	BK7	69
092-3225R+50	Plano-convex	+50	UV FS	85
092-3225R+100	Plano-convex	+100	UV FS	85
092-3225R+150	Plano-convex	+150	UV FS	85
092-3225R+200	Plano-convex	+200	UV FS	85
092-3225R+300	Plano-convex	+300	UV FS	85
092-3225R+400	Plano-convex	+400	UV FS	85
092-3225R+500	Plano-convex	+500	UV FS	85
092-3225R+600	Plano-convex	+600	UV FS	85
092-3225R+800	Plano-convex	+800	UV FS	85
092-3225R+1000	Plano-convex	+1000	UV FS	85
092-3225R+1500	Plano-convex	+1500	UV FS	85
092-3225R+2000	Plano-convex	+2000	UV FS	85
092-3225R+4000	Plano-convex	+4000	UV FS	85
092-3225R+5000	Plano-convex	+5000	UV FS	85

Spherical Mirrors

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

Catalogue number	Substrate type	Radius, mm	Substrate material	Price, EUR
095-0125R-100	Plano-concave	-100	BK7	164
095-0125R-150	Plano-concave	-150	BK7	164
095-0125R-200	Plano-concave	-200	BK7	164
095-0125R-250	Plano-concave	-250	BK7	164
095-0125R-300	Plano-concave	-300	BK7	164
095-0125R-400	Plano-concave	-400	BK7	164
095-0125R-500	Plano-concave	-500	BK7	164
095-0125R-600	Plano-concave	-600	BK7	164
095-0125R-800	Plano-concave	-800	BK7	164
095-0125R-1000	Plano-concave	-1000	BK7	164
095-0125R-1500	Plano-concave	-1500	BK7	164
095-0125R-2000	Plano-concave	-2000	BK7	164
095-0125R-2500	Plano-concave	-2500	BK7	164
095-0125R-3000	Plano-concave	-3000	BK7	164
095-0125R-4000	Plano-concave	-4000	BK7	164
095-0125R-5000	Plano-concave	-5000	BK7	164
095-0125R-6000	Plano-concave	-6000	BK7	164
095-0125R-8000	Plano-concave	-8000	BK7	164
095-0125R-10000	Plano-concave	-10000	BK7	164

Catalogue number	Substrate type	Radius, mm	Substrate material	Price, EUR
095-3125R-100	Plano-concave	-100	UV FS	189
095-3125R-150	Plano-concave	-150	UV FS	189
095-3125R-200	Plano-concave	-200	UV FS	189
095-3125R-250	Plano-concave	-250	UV FS	189
095-3125R-300	Plano-concave	-300	UV FS	189
095-3125R-400	Plano-concave	-400	UV FS	189
095-3125R-500	Plano-concave	-500	UV FS	189
095-3125R-600	Plano-concave	-600	UV FS	189
095-3125R-800	Plano-concave	-800	UV FS	189
095-3125R-1000	Plano-concave	-1000	UV FS	189
095-3125R-1500	Plano-concave	-1500	UV FS	189
095-3125R-2000	Plano-concave	-2000	UV FS	189
095-3125R-2500	Plano-concave	-2500	UV FS	189
095-3125R-2500	Plano-concave	-2500	UV FS	189
095-3125R-3000	Plano-concave	-3000	UV FS	189
095-3125R-4000	Plano-concave	-4000	UV FS	189
095-3125R-5000	Plano-concave	-5000	UV FS	189
095-3125R-6000	Plano-concave	-6000	UV FS	189
095-3125R-8000	Plano-concave	-8000	UV FS	189

Catalogue number	Substrate type	Radius, mm	Substrate material	Price, EUR
095-3125R-10000	Plano-concave	-10000	UV FS	189
095-0225R+100	Plano-convex	+100	BK7	174
095-0225R+150	Plano-convex	+150	BK7	174
095-0225R+200	Plano-convex	+200	BK7	174
095-0225R+300	Plano-convex	+300	BK7	174
095-0225R+400	Plano-convex	+400	BK7	174
095-0225R+500	Plano-convex	+500	BK7	174
095-0225R+600	Plano-convex	+600	BK7	174
095-0225R+800	Plano-convex	+800	BK7	174
095-0225R+1000	Plano-convex	+1000	BK7	174
095-0225R+1500	Plano-convex	+1500	BK7	174
095-0225R+2000	Plano-convex	+2000	BK7	174

Catalogue number	Substrate type	Radius, mm	Substrate material	Price, EUR
095-3225R+100	Plano-convex	+100	UV FS	199
095-3225R+150	Plano-convex	+150	UV FS	199
095-3225R+200	Plano-convex	+200	UV FS	199
095-3225R+300	Plano-convex	+300	UV FS	199
095-3225R+400	Plano-convex	+400	UV FS	199
095-3225R+500	Plano-convex	+500	UV FS	199
095-0225R+600	Plano-convex	+600	UV FS	199
095-0225R+800	Plano-convex	+800	UV FS	199
095-0225R+1000	Plano-convex	+1000	UV FS	199
095-0225R+1500	Plano-convex	+1500	UV FS	199
095-0225R+2000	Plano-convex	+2000	UV FS	199

Spherical Mirrors

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

Catalogue number	Substrate type	Radius, mm	Substrate material	Price, EUR
097-0125R-200	Plano-concave	-200	BK7	250
097-0125R-300	Plano-concave	-300	BK7	250
097-0125R-400	Plano-concave	-400	BK7	250
097-0125R-500	Plano-concave	-500	BK7	250
097-0125R-600	Plano-concave	-600	BK7	250
097-0125R-800	Plano-concave	-800	BK7	250
097-0125R-1000	Plano-concave	-1000	BK7	250
097-0125R-2000	Plano-concave	-2000	BK7	250
097-0125R-3000	Plano-concave	-3000	BK7	250
097-3125R-200	Plano-concave	-200	UV FS	340
097-3125R-300	Plano-concave	-300	UV FS	340
097-3125R-400	Plano-concave	-400	UV FS	340
097-3125R-500	Plano-concave	-500	UV FS	340
097-3125R-600	Plano-concave	-600	UV FS	340
097-3125R-800	Plano-concave	-800	UV FS	340
097-3125R-1000	Plano-concave	-1000	UV FS	340
097-3125R-2000	Plano-concave	-2000	UV FS	340
097-3125R-3000	Plano-concave	-3000	UV FS	340

Spherical Mirrors

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

Catalogue number	Substrate type	Radius, mm	Substrate material	Price, EUR
098-0125R-300	Plano-concave	-300	BK7	590
098-0125R-400	Plano-concave	-400	BK7	590
098-0125R-500	Plano-concave	-500	BK7	590
098-0125R-600	Plano-concave	-600	BK7	590
098-0125R-800	Plano-concave	-800	BK7	590
098-0125R-1000	Plano-concave	-1000	BK7	590
098-0125R-2000	Plano-concave	-2000	BK7	590
098-0125R-3000	Plano-concave	-3000	BK7	590
098-3125R-300	Plano-concave	-300	UV FS	690
098-3125R-400	Plano-concave	-400	UV FS	690
098-3125R-500	Plano-concave	-500	UV FS	690
098-3125R-600	Plano-concave	-600	UV FS	690
098-3125R-800	Plano-concave	-800	UV FS	690
098-3125R-1000	Plano-concave	-1000	UV FS	690
098-3125R-2000	Plano-concave	-2000	UV FS	690
098-3125R-3000	Plano-concave	-3000	UV FS	690

RELATED PRODUCTS

Curved Windows. *See page 1.8*

Kinematic Mirror Mount 840-0010
See page 7.33

Adapter for Mirror at 45° 840-0115
See page 7.41

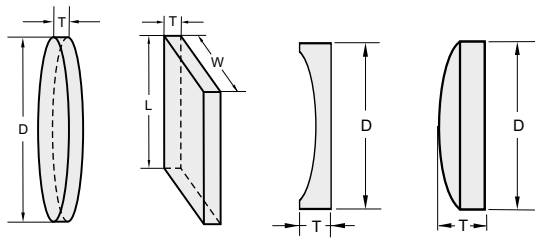
Non Standard Metal Coated Mirrors are available for fast off-the-shelf delivery. Check the availability at **www.eksmaoptics.com**

Protected Gold Mirrors

- **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

Catalogue number	Width W, mm	Length L, mm	Thickness T, mm	Substrate material	Price, EUR
091-0330	15.0	20.0	6.0	BK7	55
092-0330	20.0	30.0	6.0	BK7	69
093-0330	25.4	25.4	6.0	BK7	52
094-0330	25.4	50.8	10.0	BK7	95
095-0330	50.8	50.8	10.0	BK7	105
091-3330	15.0	20.0	6.0	UV FS	69
092-3330	20.0	30.0	6.0	UV FS	87
093-3330	25.4	25.4	6.0	UV FS	83
094-3330	25.4	50.8	10.0	UV FS	130
095-3330	50.8	50.8	10.0	UV FS	175

Flat Round Mirrors. Substrate type: plano-plano

Catalogue number	Diameter D, mm	Thickness T, mm	Substrate material	Price, EUR
091-0030	12.7	3.0	BK7	35
091-0030T6	12.7	6.0	BK7	35
092-0030	25.4	6.0	BK7	43
095-0030	50.8	8.0	BK7	115
097-0030	76.2	12.7	BK7	210
098-0030	101.6	15.0	BK7	430
091-3030	12.7	3.0	UV FS	45
091-3030T6	12.7	6.0	UV FS	45
092-3030	25.4	6.0	UV FS	47
095-3030	50.8	8.0	UV FS	97
097-3030	76.2	12.7	UV FS	245
098-3030	101.6	15.0	UV FS	510

Spherical Mirrors

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

Catalogue number	Substrate type	Radius, mm	Substrate material	Price, EUR
091-0130R-50	Plano-concave	-50	BK7	52
091-0130R-75	Plano-concave	-75	BK7	52
091-0130R-100	Plano-concave	-100	BK7	52
091-0130R-150	Plano-concave	-150	BK7	52
091-0130R-200	Plano-concave	-200	BK7	52
091-0130R-250	Plano-concave	-250	BK7	52
091-0130R-300	Plano-concave	-300	BK7	52
091-0130R-400	Plano-concave	-400	BK7	52
091-0130R-500	Plano-concave	-500	BK7	52
091-0130R-1000	Plano-concave	-1000	BK7	52
091-0130R-1500	Plano-concave	-1500	BK7	52
091-0130R-2000	Plano-concave	-2000	BK7	52
091-3130R-50	Plano-concave	-50	UV FS	52
091-3130R-75	Plano-concave	-75	UV FS	62
091-3130R-100	Plano-concave	-100	UV FS	62
091-3130R-150	Plano-concave	-150	UV FS	62
091-3130R-200	Plano-concave	-200	UV FS	62
091-3130R-250	Plano-concave	-250	UV FS	62
091-3130R-300	Plano-concave	-300	UV FS	62
091-3130R-400	Plano-concave	-400	UV FS	62
091-3130R-500	Plano-concave	-500	UV FS	62
091-3130R-1000	Plano-concave	-1000	UV FS	62
091-3130R-1500	Plano-concave	-1500	UV FS	62
091-3130R-2000	Plano-concave	-2000	UV FS	62

Catalogue number	Substrate type	Radius, mm	Substrate material	Price, EUR
091-0230R+50	Plano-convex	+50	BK7	54
091-0230R+100	Plano-convex	+100	BK7	54
091-0230R+150	Plano-convex	+150	BK7	54
091-0230R+200	Plano-convex	+200	BK7	54
091-0230R+300	Plano-convex	+300	BK7	54
091-0230R+400	Plano-convex	+400	BK7	54
091-0230R+500	Plano-convex	+500	BK7	54
091-3230R+50	Plano-convex	+50	UV FS	65
091-3230R+100	Plano-convex	+100	UV FS	65
091-3230R+150	Plano-convex	+150	UV FS	65
091-3230R+200	Plano-convex	+200	UV FS	65
091-3230R+300	Plano-convex	+300	UV FS	65
091-3230R+400	Plano-convex	+400	UV FS	65
091-2230R+500	Plano-convex	+500	UV FS	65

Spherical Mirrors

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

Catalogue number	Substrate type	Radius, mm	Substrate material	Price, EUR
092-0130R-50	Plano-concave	-50	BK7	95
092-0130R-75	Plano-concave	-75	BK7	95
092-0130R-100	Plano-concave	-100	BK7	95
092-0130R-150	Plano-concave	-150	BK7	95
092-0130R-200	Plano-concave	-200	BK7	95
092-0130R-250	Plano-concave	-250	BK7	95
092-0130R-300	Plano-concave	-300	BK7	95
092-0130R-400	Plano-concave	-400	BK7	95
092-0130R-500	Plano-concave	-500	BK7	95
092-0130R-600	Plano-concave	-600	BK7	95
092-0130R-750	Plano-concave	-750	BK7	95
092-0130R-800	Plano-concave	-800	BK7	95
092-0130R-1000	Plano-concave	-1000	BK7	95
092-0130R-1500	Plano-concave	-1500	BK7	95
092-0130R-2000	Plano-concave	-2000	BK7	95
092-0130R-2500	Plano-concave	-2500	BK7	95
092-0130R-3000	Plano-concave	-3000	BK7	95
092-0130R-4000	Plano-concave	-4000	BK7	95
092-0130R-5000	Plano-concave	-5000	BK7	95
092-0130R-6000	Plano-concave	-6000	BK7	95
092-0130R-8000	Plano-concave	-8000	BK7	95
092-3130R-50	Plano-concave	-50	UV FS	110
092-3130R-75	Plano-concave	-75	UV FS	110
092-3130R-100	Plano-concave	-100	UV FS	110
092-3130R-150	Plano-concave	-150	UV FS	110
092-3130R-200	Plano-concave	-200	UV FS	110
092-3130R-250	Plano-concave	-250	UV FS	110
092-3130R-300	Plano-concave	-300	UV FS	110
092-3130R-400	Plano-concave	-400	UV FS	110
092-3130R-500	Plano-concave	-500	UV FS	110
092-3130R-600	Plano-concave	-600	UV FS	110
092-3130R-750	Plano-concave	-750	UV FS	110
092-3130R-800	Plano-concave	-800	UV FS	110
092-3130R-1000	Plano-concave	-1000	UV FS	110
092-3130R-1500	Plano-concave	-1500	UV FS	110

Catalogue number	Substrate type	Radius, mm	Substrate material	Price, EUR
092-3130R-2000	Plano-concave	-2000	UV FS	110
092-3130R-2500	Plano-concave	-2500	UV FS	110
092-3130R-3000	Plano-concave	-3000	UV FS	110
092-3130R-4000	Plano-concave	-4000	UV FS	110
092-3130R-5000	Plano-concave	-5000	UV FS	110
092-3130R-6000	Plano-concave	-6000	UV FS	110
092-3130R-8000	Plano-concave	-8000	UV FS	110
092-0230R+50	Plano-convex	+50	BK7	99
092-0230R+100	Plano-convex	+100	BK7	99
092-0230R+150	Plano-convex	+150	BK7	99
092-0230R+200	Plano-convex	+200	BK7	99
092-0230R+300	Plano-convex	+300	BK7	99
092-0230R+400	Plano-convex	+400	BK7	99
092-0230R+500	Plano-convex	500	BK7	99
092-0230R+600	Plano-convex	+600	BK7	99
092-0230R+800	Plano-convex	+800	BK7	99
092-0230R+1000	Plano-convex	+1000	BK7	99
092-0230R+1500	Plano-convex	+1500	BK7	99
092-0230R+2000	Plano-convex	2000	BK7	99
092-0230R+4000	Plano-convex	4000	BK7	99
092-0230R+5000	Plano-convex	+5000	BK7	99
092-3230R+50	Plano-convex	+50	UV FS	115
092-3230R+100	Plano-convex	+100	UV FS	115
092-3230R+150	Plano-convex	+150	UV FS	115
092-3230R+200	Plano-convex	+200	UV FS	115
092-3230R+300	Plano-convex	+300	UV FS	115
092-3230R+400	Plano-convex	+400	UV FS	115
092-3230R+500	Plano-convex	+500	UV FS	115
092-3230R+600	Plano-convex	+600	UV FS	115
092-3230R+800	Plano-convex	+800	UV FS	115
092-3230R+1000	Plano-convex	+1000	UV FS	115
092-3230R+1500	Plano-convex	+1500	UV FS	115
092-3230R+2000	Plano-convex	+2000	UV FS	115
092-3230R+4000	Plano-convex	+4000	UV FS	115
092-3230R+5000	Plano-convex	+5000	UV FS	115

Spherical Mirrors

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

Catalogue number	Substrate type	Radius, mm	Substrate material	Price, EUR
095-0130R-100	Plano-concave	-100	BK7	174
095-0130R-150	Plano-concave	-150	BK7	174
095-0130R-200	Plano-concave	-200	BK7	174
095-0130R-250	Plano-concave	-250	BK7	174
095-0130R-300	Plano-concave	-300	BK7	174
095-0130R-400	Plano-concave	-400	BK7	174
095-0130R-500	Plano-concave	-500	BK7	174
095-0130R-600	Plano-concave	-600	BK7	174
095-0130R-800	Plano-concave	-800	BK7	174
095-0130R-1000	Plano-concave	-1000	BK7	174
095-0130R-1500	Plano-concave	-1500	BK7	174
095-0130R-2000	Plano-concave	-2000	BK7	174
095-0130R-2500	Plano-concave	-2500	BK7	174
095-0130R-3000	Plano-concave	-3000	BK7	174
095-0130R-4000	Plano-concave	-4000	BK7	174
095-0130R-5000	Plano-concave	-5000	BK7	174
095-0130R-6000	Plano-concave	-6000	BK7	174
095-0130R-8000	Plano-concave	-8000	BK7	174
095-0130R-10000	Plano-concave	-10000	BK7	174

Catalogue number	Substrate type	Radius, mm	Substrate material	Price, EUR
095-3130R-100	Plano-concave	-100	UV FS	199
095-3130R-150	Plano-concave	-150	UV FS	199
095-3130R-200	Plano-concave	-200	UV FS	199
095-3130R-250	Plano-concave	-250	UV FS	199
095-3130R-300	Plano-concave	-300	UV FS	199
095-3130R-400	Plano-concave	-400	UV FS	199
095-3130R-500	Plano-concave	-500	UV FS	199
095-3130R-600	Plano-concave	-600	UV FS	199
095-3130R-800	Plano-concave	-800	UV FS	199
095-3130R-1000	Plano-concave	-1000	UV FS	199
095-3130R-1500	Plano-concave	-1500	UV FS	199
095-3130R-2000	Plano-concave	-2000	UV FS	199
095-3130R-2500	Plano-concave	-2500	UV FS	199
095-3130R-3000	Plano-concave	-3000	UV FS	199
095-3130R-4000	Plano-concave	-4000	UV FS	199
095-3130R-5000	Plano-concave	-5000	UV FS	199
095-3130R-6000	Plano-concave	-6000	UV FS	199
095-3130R-8000	Plano-concave	-8000	UV FS	199
095-3130R-10000	Plano-concave	-10000	UV FS	199

Catalogue number	Substrate type	Radius, mm	Substrate material	Price, EUR
095-0230R+100	Plano-convex	+100	BK7	173
095-0230R+150	Plano-convex	+150	BK7	173
095-0230R+200	Plano-convex	+200	BK7	173
095-0230R+300	Plano-convex	+300	BK7	173
095-0230R+400	Plano-convex	+400	BK7	173
095-0230R+500	Plano-convex	+500	BK7	173
095-0230R+600	Plano-convex	+600	BK7	173
095-0230R+800	Plano-convex	+800	BK7	173
095-0230R+1000	Plano-convex	+1000	BK7	173
095-0230R+1500	Plano-convex	+1500	BK7	173
095-0230R+2000	Plano-convex	+2000	BK7	173

Catalogue number	Substrate type	Radius, mm	Substrate material	Price, EUR
095-3230R+100	Plano-convex	+100	UV FS	209
095-3230R+150	Plano-convex	+150	UV FS	209
095-3230R+200	Plano-convex	+200	UV FS	209
095-3230R+300	Plano-convex	+300	UV FS	209
095-3230R+400	Plano-convex	+400	UV FS	209
095-3230R+500	Plano-convex	+500	UV FS	209
095-3230R+600	Plano-convex	+600	UV FS	209
095-3230R+800	Plano-convex	+800	UV FS	209
095-3230R+1000	Plano-convex	+1000	UV FS	209
095-3230R+1500	Plano-convex	+1500	UV FS	209
095-3230R+2000	Plano-convex	+2000	UV FS	209

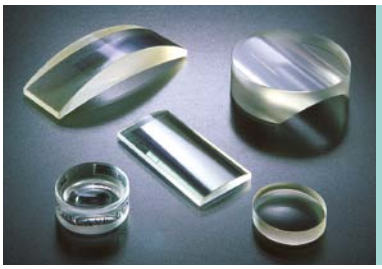
RELATED PRODUCTS

Curved Windows. *See page 1.8*

Kinematic Mirror Mount 840-0010
See page 7.33

Adapter for Mirror at 45° 840-0115
See page 7.41

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

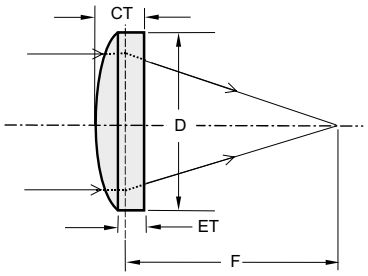
- **Positive focal length**
- **Converge incident light**
- **Form both real and virtual images**
- **Very close to the form minimising spherical aberration for infinite conjugate applications**

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

Catalogue number BK7	Diameter D, mm	Focal length F, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Price, EUR
110-0104E	12.7	20.0	4.5	2.3	10.4	15
110-0105E	12.7	25.0	4.0	2.3	13.0	15
110-0107E	12.7	40.0	3.0	2.0	20.7	15
110-0109E	12.7	50.0	3.0	2.2	25.9	15
110-0111E	12.7	60.0	3.0	2.3	31.1	15
110-0115E	12.7	75.0	3.0	2.5	38.9	15
110-0117E	12.7	100.0	3.0	2.6	51.9	15
110-0121E	12.7	150.0	3.0	2.7	77.8	15
110-0123E	12.7	200.0	3.0	2.8	103.7	15
110-0125E	12.7	250.0	3.0	2.8	129.7	15
110-0129E	12.7	500.0	2.1	2.0	259.4	15
110-0135E	12.7	1000.0	2.1	2.1	518.7	15
110-0145E	12.7	1500.0	2.1	2.1	778.1	15
110-0205E	25.4	30.0	8.5	1.9	15.6	25
110-0207E	25.4	40.0	6.1	1.8	20.7	20
110-0209E	25.4	50.0	5.0	1.7	25.9	19
110-0211E	25.4	60.0	4.4	1.7	31.1	19
110-0215E	25.4	75.0	4.0	1.9	38.9	19
110-0218E	25.4	90.0	3.0	1.2	46.7	19
110-0219E	25.4	100.0	3.5	1.9	51.9	19
110-0223E	25.4	125.0	3.2	1.9	64.8	19
110-0227E	25.4	150.0	3.0	2.0	77.8	19
110-0229E	25.4	175.0	3.0	2.1	90.8	18
110-0231E	25.4	200.0	3.0	2.2	103.7	18
110-0235E	25.4	250.0	3.0	2.4	129.7	18
110-0239E	25.4	300.0	3.0	2.5	155.6	18
110-0241E	25.4	350.0	3.0	2.6	181.6	18
110-0243E	25.4	400.0	3.0	2.6	207.5	18
110-0245E	25.4	450.0	3.0	2.7	233.4	18
110-0247E	25.4	500.0	3.0	2.7	259.4	18
110-0248E	25.4	550.0	3.0	2.7	285.3	18
110-0249E	25.4	600.0	3.0	2.7	311.2	18

Catalogue number BK7	Diameter D, mm	Focal length F, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Price, EUR
110-0251E	25.4	700.0	3.0	2.8	363.1	18
110-0255E	25.4	800.0	3.0	2.8	415.0	18
110-0257E	25.4	900.0	3.0	2.8	466.8	18
110-0259E	25.4	1000.0	3.0	2.8	518.7	18
110-0263E	25.4	1200.0	3.0	2.9	622.5	18
110-0264E	25.4	1250.0	3.0	2.9	648.4	18
110-0265E	25.4	1300.0	3.0	2.9	674.3	18
110-0266E	25.4	1400.0	3.0	2.9	726.2	18
110-0267E	25.4	1500.0	3.0	2.9	778.1	18
110-0268E	25.4	1600.0	3.0	2.9	830.0	18
110-0270E	25.4	1900.0	3.0	2.9	985.6	18
110-0271E	25.4	2000.0	3.0	2.9	1037.4	18
110-0275E	25.4	2500.0	3.0	2.9	1296.8	18
110-0281E	25.4	3000.0	3.0	2.9	1556.2	18
110-0285E	25.4	4000.0	3.0	3.0	2074.9	18
110-0289E	25.4	5000.0	3.0	3.0	2593.6	18
110-0295E	25.4	10000.0	3.0	3.0	5187.2	18
110-0405E	38.1	50.0	12.0	3.7	25.9	37
110-0406E	38.1	63.5	8.0	1.9	32.9	32
110-0407E	38.1	75.0	7.3	2.3	38.9	32
110-0409E	38.1	100.0	6.5	2.9	51.9	29
110-0411E	38.1	150.0	5.1	2.7	77.8	29
110-0415E	38.1	200.0	4.3	2.5	103.7	29
110-0417E	38.1	250.0	4.0	2.6	129.7	29
110-0419E	38.1	300.0	4.0	2.8	155.6	29
110-0423E	38.1	400.0	4.0	3.1	207.5	29
110-0427E	38.1	500.0	4.0	3.3	259.4	29
110-0435E	38.1	700.0	4.0	3.5	363.1	28
110-0445E	38.1	1000.0	4.0	3.7	518.7	28
110-0455E	38.1	5000.0	4.0	3.9	2593.6	28

Catalogue number BK7	Diameter D, mm	Focal length F, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Price, EUR
110-0502E	50.8	75.0	12.3	2.9	38.9	55
110-0505E	50.8	100.0	10.4	3.8	51.9	49
110-0507E	50.8	150.0	7.2	2.9	77.8	46
110-0509E	50.8	200.0	6.1	2.9	103.7	45
110-0511E	50.8	250.0	5.4	2.9	129.7	45
110-0515E	50.8	300.0	5.0	2.9	155.6	45
110-0519E	50.8	350.0	4.7	2.9	181.6	45
110-0523E	50.8	400.0	5.5	3.9	207.5	45
110-0525E	50.8	500.0	5.2	4.0	259.4	45
110-0527E	50.8	600.0	5.0	4.0	311.2	45
110-0528E	50.8	650.0	5.0	4.0	337.2	45
110-0529E	50.8	700.0	5.0	4.1	363.1	45
110-0531E	50.8	800.0	5.0	4.2	415.0	45
110-0535E	50.8	1000.0	5.0	4.4	518.7	45
110-0540E	50.8	1500.0	5.0	4.6	778.1	45
110-0545E	50.8	2000.0	5.0	4.7	1037.4	45
110-0555E	50.8	5000.0	5.0	4.9	2593.6	45
110-0565E	50.8	10000.0	5.0	4.9	5187.2	45
110-0711E	76.2	250.0	12.7	7.0	129.7	120
110-0715E	76.2	300.0	11.7	7.0	155.6	120
110-0723E	76.2	400.0	10.5	7.0	207.5	120
110-0725E	76.2	500.0	9.8	7.0	259.4	120
110-0730E	76.2	750.0	8.9	7.0	389.0	120
110-0735E	76.2	1000.0	8.4	7.0	518.7	120
110-0740E	76.2	1500.0	7.9	7.0	778.1	120
110-0745E	76.2	2000.0	7.7	7.0	1037.4	120
110-0748E	76.2	3000.0	7.5	7.0	1556.2	120

UV FS Plano-Convex Lenses

Catalogue number UV FS	Diameter D, mm	Focal length F, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Price, EUR
110-1105E	12.7	25.0	4.0	2.2	11.9	48
110-1106E	12.7	30.0	3.7	2.2	14.3	48
110-1109E	12.7	50.0	3.0	2.1	23.8	48
110-1111E	12.7	75.0	3.0	2.4	35.7	48
110-1112E	12.7	80.0	3.5	2.5	38.0	48
110-1114E	12.7	90.0	3.5	3.0	42.8	48
110-1115E	12.7	100.0	3.0	2.6	47.6	48
110-1117E	12.7	125.0	3.0	2.7	59.4	47
110-1119E	12.7	150.0	3.0	2.7	71.3	47
110-1121E	12.7	175.0	3.0	2.8	83.2	47
110-1123E	12.7	200.0	3.0	2.8	95.1	47
110-1127E	12.7	250.0	3.0	2.8	118.9	47
110-1129E	12.7	300.0	3.0	2.9	142.7	47
110-1131E	12.7	350.0	3.0	2.9	166.4	47
110-1133E	12.7	400.0	3.0	2.9	190.2	47
110-1203E	25.4	30.0	9.75	2.0	14.3	70
110-1205E	25.4	50.0	6.0	2.3	23.8	70
110-1207E	25.4	60.0	5.0	2.0	28.5	70
110-1209E	25.4	75.0	4.5	2.2	35.7	70
110-1210E	25.4	80.0	4.6	2.4	38.0	70
110-1211E	25.4	100.0	4.0	2.3	47.6	70
110-1216E	25.4	125.0	4.0	2.6	59.4	70
110-1217E	25.4	150.0	4.0	2.9	71.3	65
110-1218E	25.4	175.0	4.0	3.0	83.2	65
110-1219E	25.4	200.0	4.0	3.1	95.1	65
110-1221E	25.4	250.0	4.0	3.3	118.9	65
110-1223E	25.4	300.0	4.0	3.4	142.7	65
110-1225E	25.4	350.0	4.0	3.5	166.4	65
110-1227E	25.4	400.0	4.0	3.6	190.2	60
110-1233E	25.4	500.0	4.0	3.7	237.8	60
110-1234E	25.4	550.0	4.0	3.7	261.5	60

Catalogue number UV FS	Diameter D, mm	Focal length F, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Price, EUR
110-1235E	25.4	600.0	4.0	3.7	285.3	60
110-1238E	25.4	700.0	4.0	3.8	332.9	60
110-1239E	25.4	750.0	4.0	3.8	356.6	60
110-1240E	25.4	800.0	4.0	3.8	380.4	60
110-1245E	25.4	1000.0	4.0	3.8	475.5	60
110-1246E	25.4	1100.0	4.0	3.8	523.1	60
110-1255E	25.4	1500.0	4.0	3.9	713.3	60
110-1265E	25.4	2000.0	4.0	3.9	951.0	60
110-1275E	25.4	5000.0	4.0	4.0	2377.5	60
110-1405E	38.1	50.0	13.5	3.9	23.8	113
110-1409E	38.1	75.0	8.6	3.1	35.7	113
110-1411E	38.1	100.0	6.9	2.9	47.6	113
110-1415E	38.1	150.0	5.4	2.8	71.3	113
110-1419E	38.1	200.0	4.0	2.1	95.1	113
110-1423E	38.1	250.0	4.0	2.5	118.9	113
110-1427E	38.1	300.0	4.0	2.7	142.7	111
110-1431E	38.1	400.0	4.0	3.0	190.2	111
110-1435E	38.1	500.0	4.0	3.2	237.8	111
110-1439E	38.1	600.0	4.0	3.4	285.3	111
110-1445E	38.1	1000.0	4.0	3.6	475.5	111
110-1455E	38.1	1500.0	4.0	3.7	713.3	111
110-1465E	38.1	3000.0	4.0	3.9	1426.5	111
110-1475E	38.1	5000.0	4.0	3.9	2377.5	111
110-1505E	50.8	75.0	12.2	1.6	35.7	141
110-1509E	50.8	100.0	9.6	2.2	47.6	138
110-1511E	50.8	150.0	6.5	1.8	71.3	138
110-1515E	50.8	200.0	6.0	2.5	95.1	138
110-1517E	50.8	250.0	6.0	3.3	118.9	138
110-1519E	50.8	300.0	6.0	3.7	142.7	138
110-1523E	50.8	400.0	6.0	4.3	190.2	138
110-1527E	50.8	500.0	6.0	4.6	237.8	138

Catalogue number UV FS	Diameter D, mm	Focal length F, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Price, EUR
110-1531E	50.8	600.0	6.0	4.9	285.3	138
110-1533E	50.8	700.0	6.0	5.0	332.9	138
110-1535E	50.8	800.0	6.0	5.2	380.4	138
110-1545E	50.8	1000.0	6.0	5.3	475.5	138
110-1550E	50.8	1500.0	6.0	5.5	713.3	138
110-1555E	50.8	2000.0	6.0	5.7	951.0	138
110-1565E	50.8	2500.0	6.0	5.7	1188.8	138
110-1564E	50.8	3000.0	6.0	5.8	1426.5	138
110-1566E	50.8	4000.0	6.0	5.8	1902.0	138
110-1567E	50.8	5000.0	5.0	4.9	2377.5	138
110-1717E	76.2	250.0	9.0	2.7	118.9	350
110-1719E	76.2	300.0	8.0	2.8	142.7	350
110-1727E	76.2	500.0	7.0	3.9	237.8	350
110-1745E	76.2	1000.0	6.0	4.5	475.5	350
110-1750E	76.2	1500.0	6.0	5.0	713.3	350
110-1755E	76.2	2000.0	6.0	5.2	951.0	350

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

Coated Lenses Ordering Information

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

Price: 15 + 56 EUR= 71 EUR/pc.

Lens price | Coating price

For lenses Ø12.5 – 25.4 mm please add Ø25 coating price

For lenses Ø38.1 – 50.8 mm please add Ø50 coating price

CaF_2 Plano-Convex Lenses

Catalogue number CaF_2	Diameter D, mm	Focal length F, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Price, EUR
110-5105E	12.7	25.0	4.1	2.0	10.5	70
110-5109E	12.7	50.0	3.0	2.0	20.9	70
110-5111E	12.7	75.0	2.6	2.0	31.4	70
110-5115E	12.7	100.0	2.5	2.0	41.8	70
110-5119E	12.7	150.0	2.3	2.0	62.7	70
110-5123E	12.7	200.0	2.2	2.0	83.6	70
110-5127E	12.7	250.0	2.2	2.0	104.6	70
110-5135E	12.7	500.0	2.1	2.0	209.1	70
110-5145E	12.7	1000.0	3.0	3.0	418.2	70
110-5204E	25.4	40.0	7.9	2.1	16.7	75
110-5205E	25.4	50.0	7.3	3.0	20.9	75
110-5209E	25.4	75.0	5.7	3.0	31.4	75
110-5211E	25.4	100.0	5.0	3.0	41.8	75
110-5213E	25.4	125.0	5.0	3.4	52.3	75
110-5217E	25.4	150.0	4.3	3.0	62.7	75
110-5219E	25.4	200.0	4.0	3.0	83.6	75
110-5221E	25.4	250.0	3.8	3.0	104.6	75
110-5222E	25.4	300.0	3.7	3.1	125.5	75
110-5228E	25.4	400.0	3.5	3.0	167.3	75
110-5223E	25.4	500.0	3.4	3.0	209.1	75
110-5229E	25.4	650.0	3.3	3.0	271.8	75
110-5225E	25.4	750.0	3.0	2.7	313.7	75
110-5227E	25.4	1000.0	3.2	3.0	418.2	75
110-5235E	25.4	1500.0	3.2	3.1	627.3	75
110-5240E	25.4	2000.0	3.1	3.0	836.5	75
110-5245E	25.4	3000.0	3.1	3.0	1254.7	75

Catalogue number CaF_2	Diameter D, mm	Focal length F, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Price, EUR
110-5509E	50.8	75.0	15.9	2.9	31.4	320
110-5511E	50.8	100.0	11.6	3.0	41.8	280
110-5517E	50.8	150.0	8.4	3.0	62.7	260
110-5519E	50.8	200.0	7.0	3.1	83.6	250
110-5520E	50.8	250.0	5.6	2.5	104.6	250
110-5522E	50.8	300.0	5.6	3.0	125.5	250
110-5524E	50.8	400.0	5.6	3.7	167.3	250
110-5523E	50.8	500.0	5.0	3.5	209.1	250
110-5528E	50.8	750.0	5.0	4.0	313.7	250
110-5535E	50.8	1000.0	5.0	4.2	418.2	250
110-5545E	50.8	1500.0	5.0	4.5	627.3	250
110-5550E	50.8	1700.0	5.0	4.5	711.0	250
110-5555E	50.8	2000.0	5.0	4.6	836.5	250

HOUSING ACCESSORIES

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

See page 7.25

EKSMA OPTICS • Tel.: +370 5 272 99 00 • Fax: +370 5 272 92 99 • info@eksmaoptics.com • www.eksmaoptics.com

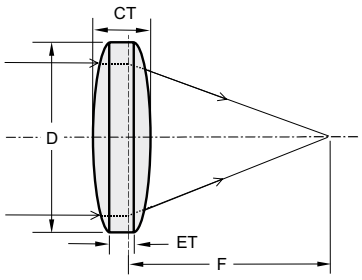
BICONVEX LENSES

- **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

Catalogue number BK7	Diameter D, mm	Focal length F, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Price, EUR
111-0104E	12.7	12.7	4.8	1.3	12.3	16
111-0108E	12.7	25.0	3.5	1.9	25.3	16
111-0114E	12.7	40.0	2.5	1.5	41.1	16
111-0116E	12.7	50.0	2.5	1.7	51.4	16
111-0118E	12.7	60.0	2.5	1.8	61.8	16
111-0120E	12.7	75.0	2.5	2.0	77.4	15
111-0124E	12.7	100.0	2.0	1.6	103.4	15
111-0128E	12.7	125.0	2.0	1.7	129.3	15
111-0132E	12.7	150.0	2.0	1.7	155.3	15
111-0136E	12.7	200.0	2.0	1.8	207.1	15
111-0140E	12.7	250.0	2.0	1.8	259.0	15
111-0144E	12.7	300.0	2.0	1.9	310.9	15
111-0148E	12.7	400.0	2.0	1.9	414.6	15
111-0152E	12.7	500.0	3.0	2.9	518.2	15
111-0204E	25.4	25.0	9.0	1.8	24.3	21
111-0206E	25.4	30.0	7.5	1.8	29.8	21
111-0208E	25.4	40.0	6.0	1.9	40.4	21
111-0210E	25.4	50.0	6.0	2.8	50.8	19
111-0214E	25.4	60.0	4.0	1.4	61.6	19
111-0216E	25.4	75.0	4.0	1.9	77.1	19
111-0218E	25.4	100.0	4.0	2.4	103.1	17
111-0222E	25.4	150.0	4.0	3.0	154.9	17
111-0226E	25.4	200.0	4.0	3.2	206.8	17
111-0228E	25.4	250.0	4.0	3.4	258.7	17
111-0229E	25.4	300.0	4.0	3.5	310.5	17
111-0234E	25.4	500.0	4.0	3.7	518.0	17
111-0240E	25.4	700.0	4.0	3.8	725.5	17
111-0250E	25.4	1000.0	4.0	3.8	1036.8	17

Catalogue number BK7	Diameter D, mm	Focal length F, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Price, EUR
111-0404E	38.1	50.0	10.5	3.0	50.0	31
111-0410E	38.1	100.0	6.0	2.4	102.7	31
111-0414E	38.1	150.0	5.0	2.6	154.8	31
111-0418E	38.1	200.0	5.0	3.2	206.6	31
111-0422E	38.1	250.0	5.0	3.6	258.5	31
111-0426E	38.1	300.0	5.0	3.8	310.4	31
111-0430E	38.1	400.0	5.0	4.1	414.1	31
111-0434E	38.1	500.0	5.0	4.3	517.9	30
111-0440E	38.1	700.0	5.0	4.5	725.4	30
111-0450E	38.1	1000.0	5.0	4.6	1036.6	30
111-0504E	50.8	50.0	15.0	0.9	49.2	51
111-0508E	50.8	75.0	10.0	1.3	76.1	48
111-0510E	50.8	100.0	8.5	2.1	102.3	48
111-0512E	50.8	150.0	6.1	1.9	154.6	47
111-0514E	50.8	200.0	5.0	1.9	206.6	47
111-0518E	50.8	300.0	5.0	2.9	310.4	47
111-0522E	50.8	400.0	5.0	3.4	414.1	47
111-0526E	50.8	500.0	5.0	3.8	517.9	47
111-0534E	50.8	750.0	5.0	4.2	777.2	47
111-0544E	50.8	1000.0	5.0	4.4	1036.6	47
111-0550E	50.8	1200.0	5.0	4.5	1244.1	47

HOUSING ACCESSORIES

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

See page 7.25

UV FS Biconvex Lenses

Catalogue number UV FS	Diameter D, mm	Focal length F, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Price, EUR
111-1104E	12.7	12.7	6.0	2.0	11.0	49
111-1108E	12.7	25.0	3.5	1.7	23.2	48
111-1114E	12.7	50.0	3.0	2.1	47.1	48
111-1118E	12.7	75.0	2.5	1.9	70.9	48
111-1122E	12.7	100.0	2.3	1.9	94.7	48
111-1126E	12.7	150.0	2.2	1.9	142.3	48
111-1204E	25.4	25.0	10.0	1.9	22.0	71
111-1207E	25.4	40.0	7.1	2.6	36.9	71
111-1210E	25.4	50.0	6.0	2.5	46.6	71
111-1214E	25.4	75.0	4.0	1.7	70.7	65
111-1218E	25.4	100.0	4.0	2.3	94.5	65
111-1222E	25.4	150.0	3.2	2.1	142.1	65
111-1226E	25.4	200.0	3.0	2.1	189.7	65
111-1230E	25.4	250.0	3.0	2.3	237.3	65
111-1234E	25.4	300.0	3.0	2.4	284.8	60
111-1238E	25.4	400.0	3.0	2.6	379.9	60
111-1240E	25.4	500.0	3.0	2.7	475.0	60
111-1250E	25.4	750.0	3.0	2.8	712.8	60
111-1260E	25.4	1000.0	3.0	2.8	950.5	60

Catalogue number UV FS	Diameter D, mm	Focal length F, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Price, EUR
111-1404E	38.1	50.0	11.0	2.7	45.7	116
111-1410E	38.1	100.0	5.0	1.1	94.3	116
111-1414E	38.1	150.0	5.0	2.4	141.8	116
111-1418E	38.1	200.0	5.0	3.1	189.4	116
111-1422E	38.1	250.0	4.0	2.5	237.1	114
111-1426E	38.1	300.0	5.0	3.7	284.5	114
111-1430E	38.1	400.0	5.0	4.0	379.6	114
111-1434E	38.1	500.0	5.0	4.2	474.7	113
111-1440E	38.1	700.0	5.0	4.5	664.9	113
111-1460E	38.1	1000.0	4.7	4.3	950.2	113
111-1504E	50.8	50.0	16.2	1.0	44.8	149
111-1508E	50.8	75.0	10.3	1.1	69.6	148
111-1514E	50.8	100.0	10.0	2.9	93.5	147
111-1517E	50.8	150.0	7.5	3.0	141.4	147
111-1520E	50.8	175.0	6.6	3.0	165.4	147
111-1522E	50.8	200.0	7.0	3.5	189.1	147
111-1526E	50.8	250.0	6.0	3.8	236.8	147
111-1530E	50.8	300.0	6.0	3.7	284.3	146
111-1534E	50.8	500.0	6.0	4.8	474.5	146
111-1550E	50.8	1000.0	6.0	5.4	950.0	146

Coated Lenses Ordering Information

Examples:

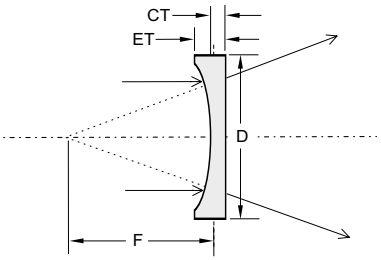
Please choose relevant coating from anti-reflection coatings section *(pages 1.5 - 1.6)*. The coating code and price should be added to the lens code and price.

1) BK7 bi/cx lens Ø12.7 mm, F=400 mm, coated AR/AR@400-700 nm, AOI=0°
Code: **111-0148E** + **ARB550**, Price: 15 + 56 EUR= 71 EUR/pc.
(Lens code / Coating code; Lens price / Coating price)
For lenses Ø12.5 – 25.4 mm please add Ø25 coating price

2) BK7 bi/cx lens Ø38.1 mm, F=1000 mm, coated AR/AR@400-700 nm, AOI=0°
Code: **111-0450E** + **ARB550**, Price: 30 + 67 EUR= 97 EUR/pc.
(Lens code / Coating code; Lens price / Coating price)
For lenses Ø38.1 – 50.8 mm please add Ø50 coating price

PLANO-CONCAVE LENSES

- **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.

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

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

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

Catalogue number BK7	Diameter D, mm	Focal length F, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Price, EUR
112-0105E	12.7	-25.0	1.9	3.5	-13.0	14
112-0109E	12.7	-50.0	2.7	3.5	-25.9	14
112-0112E	12.7	-60.0	2.4	3.1	-31.1	14
112-0115E	12.7	-75.0	2.9	3.4	-38.9	14
112-0117E	12.7	-100.0	3.0	3.4	-51.9	14
112-0119E	12.7	-125.0	3.1	3.4	-64.8	14
112-0121E	12.7	-150.0	3.2	3.5	-77.8	14
112-0123E	12.7	-200.0	3.3	3.5	-103.7	14
112-0125E	12.7	-250.0	3.3	3.5	-129.7	14
112-0127E	12.7	-300.0	2.9	3.0	-155.6	14
112-0205E	25.4	-30.0	1.4	7.9	-15.6	18
112-0207E	25.4	-40.0	1.7	5.9	-20.7	18
112-0209E	25.4	-50.0	2.8	6.0	-25.9	18
112-0215E	25.4	-75.0	2.9	4.9	-38.9	17
112-0219E	25.4	-100.0	3.1	4.6	-51.9	17
112-0223E	25.4	-125.0	3.0	4.2	-64.8	17
112-0227E	25.4	-150.0	2.7	3.7	-77.8	17

Catalogue number BK7	Diameter D, mm	Focal length F, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Price, EUR
112-0231E	25.4	-200.0	3.0	3.8	-103.7	17
112-0235E	25.4	-250.0	3.1	3.7	-129.7	17
112-0239E	25.4	-300.0	3.1	3.6	-155.6	17
112-0243E	25.4	-400.0	3.6	4.0	-207.5	17
112-0245E	25.4	-450.0	3.6	3.9	-233.4	17
112-0247E	25.4	-500.0	3.7	4.0	-259.4	17
112-0250E	25.4	-650.0	3.7	3.9	-337.2	17
112-0252E	25.4	-750.0	3.8	4.0	-389.0	17
112-0259E	25.4	-1000.0	3.8	4.0	-518.7	17
112-0260E	25.4	-1500.0	3.9	4.0	-778.1	17
112-0261E	25.4	-2000.0	3.9	4.0	-1037.4	17
112-0263E	25.4	-3000.0	3.9	4.0	-1556.2	17
112-0265E	25.4	-5000.0	3.9	3.9	-2593.6	17
112-0409E	38.1	-100.0	2.0	5.5	-51.9	28
112-0411E	38.1	-150.0	3.3	5.6	-77.8	28
112-0415E	38.1	-200.0	4.1	5.8	-103.7	28
112-0419E	38.1	-300.0	4.7	5.8	-155.6	28

UV FS Plano-Concave Lenses

Catalogue number UV FS	Diameter D, mm	Focal length F, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Price, EUR
112-1105E	12.7	-25.0	1.3	3.0	-11.9	47
112-1109E	12.7	-50.0	2.2	3.0	-23.8	47
112-1110E	12.7	-60.0	2.4	3.0	-28.5	47
112-1111E	12.7	-75.0	2.5	3.0	-35.7	46
112-1112E	12.7	-80.0	2.6	3.0	-38.0	46
112-1114E	12.7	-90.0	2.6	3.0	-42.8	46
112-1115E	12.7	-100.0	2.7	3.0	-47.6	46
112-1117E	12.7	-125.0	2.7	3.0	-59.4	46
112-1119E	12.7	-150.0	2.7	3.0	-71.3	46
112-1121E	12.7	-175.0	2.8	3.0	-83.2	46
112-1123E	12.7	-200.0	2.8	3.0	-95.1	46
112-1127E	12.7	-250.0	2.8	3.0	-118.9	46
112-1203E	25.4	-30.0	1.6	9.0	-14.3	75
112-1205E	25.4	-50.0	1.9	5.5	-23.8	70
112-1209E	25.4	-75.0	3.1	5.3	-35.7	70
112-1211E	25.4	-100.0	3.0	4.7	-47.6	70
112-1215E	25.4	-125.0	3.0	4.4	-59.4	70

Catalogue number UV FS	Diameter D, mm	Focal length F, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Price, EUR
112-1217E	25.4	-150.0	3.1	4.2	-71.3	65
112-1219E	25.4	-200.0	3.1	4.0	-95.1	65
112-1221E	25.4	-250.0	3.3	4.0	-118.9	65
112-1223E	25.4	-300.0	3.4	4.0	-142.7	65
112-1227E	25.4	-400.0	3.6	4.0	-190.2	60
112-1233E	25.4	-500.0	3.7	4.0	-237.8	60
112-1239E	25.4	-750.0	3.8	4.0	-356.6	60
112-1245E	25.4	-1000.0	3.8	4.0	-475.5	60
112-1255E	25.4	-5000.0	2.0	4.0	-2377.5	60
112-1411E	38.1	-100.0	2.4	6.4	-47.6	110
112-1415E	38.1	-150.0	3.0	5.5	-71.3	110
112-1419E	38.1	-200.0	3.0	4.9	-95.1	110
112-1427E	38.1	-300.0	4.3	5.6	-142.7	110
112-1509E	50.8	-100.0	5.0	11.9	-47.6	138
112-1517E	50.8	-250.0	3.1	5.7	-118.9	138
112-1527E	50.8	-500.0	4.7	6.0	-237.8	138
112-1540E	50.8	-2000.0	5.8	6.0	-951.0	138

CaF_2 Plano-Concave Lenses

Catalogue number CaF_2	Diameter D, mm	Focal length F, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Price, EUR
112-5105E	12.7	-25.0	1.9	4.0	-10.5	70
112-5109E	12.7	-50.0	2.0	3.0	-20.9	70
112-5111E	12.7	-75.0	2.4	3.0	-31.4	70
112-5115E	12.7	-100.0	2.5	3.0	-41.8	70
112-5120E	12.7	-150.0	2.7	3.0	-62.7	70
112-5125E	12.7	-200.0	1.8	2.0	-83.6	70
112-5130E	12.7	-250.0	1.8	2.0	-104.6	70
112-5135E	12.7	-500.0	1.9	2.0	-209.1	70
112-5204E	25.4	-40.0	2.5	7.8	-16.7	75
112-5205E	25.4	-50.0	2.7	7.0	-20.9	75
112-5209E	25.4	-75.0	2.8	5.5	-31.4	75
112-5211E	25.4	-100.0	3.0	5.0	-41.8	75
112-5217E	25.4	-150.0	2.7	4.0	-62.7	75
112-5219E	25.4	-200.0	3.0	4.0	-83.6	75
112-5223E	25.4	-250.0	3.2	4.0	-104.6	75
112-5225E	25.4	-300.0	3.4	4.0	-125.5	75
112-5228E	25.4	-400.0	3.5	4.0	-167.3	75
112-5230E	25.4	-500.0	2.6	3.0	-209.1	75
112-5235E	25.4	-1000.0	2.8	3.0	-418.2	75
112-5519E	50.8	-200.0	3.6	7.2	-83.6	180
112-5525E	50.8	-300.0	3.0	5.6	-125.5	180
112-5530E	50.8	-500.0	4.0	5.5	-209.1	180

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
See page 7.28

Coated Lenses Ordering Information

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**, Price: 14 + 56 EUR= 70 EUR/pc.

Lens code | Coating code | Lens price | Coating price

For lenses Ø12.5 – 25.4 mm please add Ø25 coating price

For lenses Ø38.1 – 50.8 mm please add Ø50 coating price

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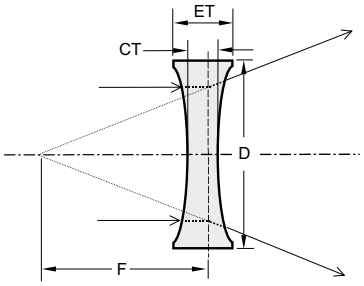
BICONCAVE LENSES

- **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

Catalogue number BK7	Diameter D, mm	Focal length F, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Price, EUR
114-0104E	12.7	-12.7	3.2	5.5	-13.7	15
114-0106E	12.7	-25.0	2.2	3.2	-26.3	15
114-0108E	12.7	-40.0	2.4	3.1	-41.9	15
114-0110E	12.7	-50.0	2.6	3.1	-52.3	15
114-0112E	12.7	-60.0	2.6	3.0	-62.7	15
114-0114E	12.7	-75.0	2.7	3.0	-78.3	15
114-0118E	12.7	-100.0	2.8	3.0	-104.2	15
114-0120E	12.7	-125.0	1.7	2.0	-130.0	14
114-0124E	12.7	-150.0	1.8	2.0	-155.9	14
114-0128E	12.7	-200.0	1.8	2.0	-207.8	14
114-0132E	12.7	-250.0	1.8	2.0	-259.7	14
114-0204E	25.4	-25.0	4.8	10.2	-26.7	19
114-0206E	25.4	-40.0	3.0	6.5	-42.0	19
114-0208E	25.4	-50.0	4.5	7.5	-52.6	19
114-0210E	25.4	-60.0	2.8	5.2	-62.7	19
114-0212E	25.4	-75.0	3.7	5.5	-78.4	18
114-0214E	25.4	-100.0	3.2	4.6	-104.3	17
114-0218E	25.4	-125.0	3.1	4.1	-130.2	17
114-0220E	25.4	-150.0	3.0	4.0	-156.1	17
114-0224E	25.4	-200.0	2.8	3.6	-208.0	17
114-0228E	25.4	-250.0	2.9	3.5	-259.9	17
114-0234E	25.4	-400.0	3.2	3.6	-415.5	17
114-0238E	25.4	-500.0	3.2	3.5	-519.3	17

HOUSING ACCESSORIES

Variable Lens Holder 830-0040

See page 7.30

Coated Lenses Ordering Information

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**, Price: 14 + 56 EUR= 70 EUR/pc.

Lens code | Coating code | Lens price | Coating price

For lenses Ø12.5 – 25.4 mm please add Ø25 coating price

UV FS Biconcave Lenses

Catalogue number UV FS	Diameter D, mm	Focal length F, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Price, EUR
114-1104E	12.7	-12.7	3.7	6.7	-12.6	49
114-1108E	12.7	-25.0	2.8	4.0	-24.2	49
114-1110E	12.7	-30.0	3.0	4.0	-29.0	49
114-1114E	12.7	-50.0	2.6	3.2	-48.0	49
114-1118E	12.7	-75.0	2.7	3.1	-71.8	49
114-1122E	12.7	-100.0	2.8	3.0	-95.5	47
114-1204E	25.4	-25.0	5.3	12.0	-24.6	71
114-1205E	25.4	-30.0	3.0	7.5	-29.0	71
114-1208E	25.4	-50.0	2.6	6.0	-48.0	71
114-1212E	25.4	-75.0	3.8	6.1	-71.9	71
114-1216E	25.4	-100.0	3.6	5.3	-95.7	71
114-1220E	25.4	-150.0	4.4	5.3	-143.4	71
114-1224E	25.4	-200.0	3.0	3.8	-190.7	70

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

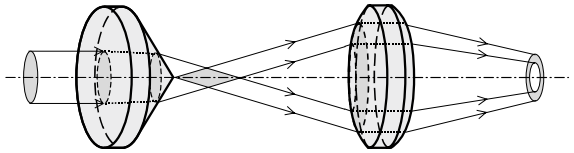
CONICAL LENSES (AXICONS)

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

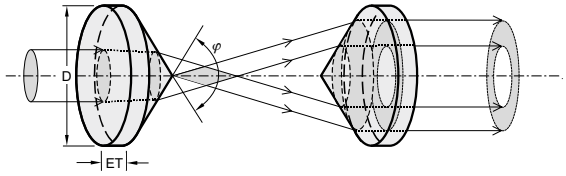
We can supply custom cutting, edging, coating or complete fabrication if required.

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

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
Edge thickness	3.5 mm
Angle tolerance	±0.05° (±3 arcmin)
Surface irregularity	λ/4 @ 633 nm
Apex rounding	< Ø0.4 mm

Catalogue number	Diameter D, mm	Apex angle φ, deg	Edge thickness ET, mm	Centre thickness CT, mm	Price, EUR
131-1230	25.4	130	3.5	9.4	360
131-1240	25.4	140	3.5	8.1	360
131-1260	25.4	160	3.5	5.7	360
131-1265	25.4	165	3.5	5.2	360
131-1270	25.4	170	3.5	4.6	360
131-1275	25.4	175	3.5	4.1	360
131-1276	25.4	176	3.5	3.9	360
131-1277	25.4	177	3.5	3.8	360
131-1278	25.4	178	3.5	3.7	360
131-1279	25.4	179	3.5	3.6	360
131-1560	50.8	160	5	9.4	685
131-1570	50.8	170	5	7.2	685
131-1576	50.8	176	5	5.9	685
131-1578	50.8	178	5	5.4	685
131-1579	50.8	179	5	5.2	685

HOUSING ACCESSORIES

Universal Adjustable Lens/Optics Mount 830-0035

See page 7.28

Standard Plano-Convex Axicons

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	1 λ @ 633 nm

Catalogue number BK7	Catalogue number UV FS	Diameter D, mm	Apex angle φ, deg	Edge thickness ET, mm	Centre thickness CT, mm	Price, EUR BK7 / UV FS
130-0240	130-1240	25.4	140	8	12.6	160 / 283
130-0260	130-1260	25.4	160	8	10.2	160 / 283
130-0265	130-1265	25.4	165	8	9.7	160 / 283
130-0270	130-1270	25.4	170	8	9.1	160 / 283
130-0275	130-1275	25.4	175	8	8.6	160 / 283
130-0278	130-1278	25.4	178	8	8.2	160 / 283

Coated Lenses Ordering Information

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 axicon Ø30 mm, apex 160°, coated AR/AR@400-700 nm, AOI=0°

Code: **130-0360** + **ARB550**, Price: 197 + 67 EUR= 264 EUR/pc.

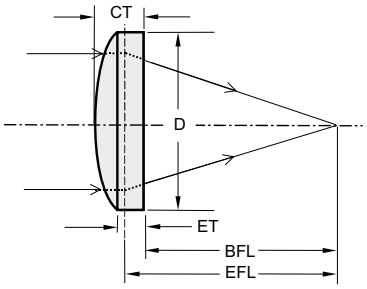
Lens code | Coating code | Lens price | Coating price

For lenses Ø25.4 mm please add Ø25 coating price

For lenses Ø30 mm please add Ø50 coating price

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

Catalogue number	Substrate	D, mm	EFL, mm	BFL, mm	CT, mm	CA, mm	NA	Price, EUR
116-1210	S-LAH64	12.5	10	7.6	4.3	11.3	0.544	130
115-1225	N-BK7	12.5	25	22.4	4.0	11.3	0.227	130
117-1240	UVFS	12.7	40	36.2	5.5	11.4	0.144	245
116-2520	S-LAH64	25	20	15.7	7.6	22.5	0.543	170
115-2550	N-BK7	25	50	46	6.0	22.5	0.232	170
115-2532	N-BK7	25	32	27.4	7.0	22.5	0.359	170
117-2530	UVFS	25.4	30	24.5	8.0	22.9	0.398	320
117-2540	UVFS	25.4	40	35.9	6.0	22.9	0.292	320
117-2550	UVFS	25.4	50	46.6	5.0	22.9	0.232	320
117-2560	UVFS	25.4	60	56.6	5.0	22.9	0.192	320
116-5040	S-LAH64	50	40	31.3	15.5	45.0	0.554	310
115-5100	N-BK7	50	100	93.4	10.0	45.0	0.237	310

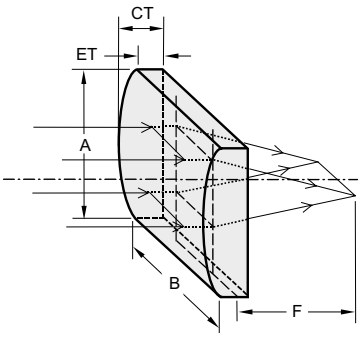
PLANO-CYLINDRICAL LENSES

- **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.



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

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

BK7 Plano-Convex Cylindrical Lenses

Catalogue number BK7	Dimensions A, mm	B, mm	Focal length F, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Price, EUR
120-0105E	12.7	12.7	15	4.8	1.5	7.8	40
120-0110E	19.1	25.4	25	6.1	2.0	13.0	60
120-0202E	25.4	25.4	25	14	2.5	13.0	60
120-0201E	25.4	25.4	30	8.5	2.0	15.6	60
120-0203E	25.4	25.4	40	6.4	2.0	20.7	60
120-0204E	25.4	25.4	50	5.2	2.0	25.9	55
120-0205E	25.4	50.8	50	5.2	2.0	25.9	85
120-0209E	25.4	25.4	75	4.1	2.0	38.9	55
120-0210E	25.4	50.8	75	4.1	2.0	38.9	85
120-0214E	25.4	25.4	100	3.5	2.0	51.9	55
120-0215E	25.4	50.8	100	3.5	2.0	51.9	85
120-0219E	25.4	25.4	150	3.0	2.0	77.8	55
120-0220E	25.4	50.8	150	3.0	2.0	77.8	85
120-0224E	25.4	25.4	200	2.8	2.0	103.7	55
120-0225E	25.4	50.8	200	2.8	2.0	103.7	85
120-0229E	25.4	25.4	300	2.5	2.0	155.6	55
120-0230E	25.4	50.8	300	2.5	2.0	155.6	85
120-0234E	25.4	25.4	500	2.4	2.0	259.4	55
120-0235E	25.4	50.8	500	2.4	2.0	259.4	95
120-0239E	25.4	25.4	1000	2.3	2.0	518.7	59
120-0240E	25.4	50.8	1000	2.3	2.0	518.7	95
120-0244E	25.4	25.4	1500	2.2	2.0	778.1	59
120-0245E	25.4	50.8	1500	2.2	2.0	778.1	95

UV FS Plano-Convex Cylindrical Lenses

Catalogue number UV FS	Dimensions A, mm	B, mm	Focal length F, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Price, EUR
120-1104E	12.7	12.7	15	4.9	2.0	7.1	69
120-1105E	19.1	25.4	25	8.0	3.0	11.9	97
120-1201E	25.4	25.4	30	10.0	2.5	14.3	97
120-1203E	25.4	25.4	40	8.0	3.1	19.0	97
120-1204E	25.4	25.4	50	7.1	3.5	23.8	95
120-1205E	25.4	50.8	50	7.1	3.5	23.8	170
120-1209E	25.4	25.4	75	5.6	3.3	35.7	91
120-1210E	25.4	50.8	75	5.6	3.3	35.7	170
120-1214E	25.4	25.4	100	4.7	3.0	47.6	87
120-1215E	25.4	50.8	100	4.7	3.0	47.6	161
120-1219E	25.4	25.4	150	4.1	3.0	71.3	87
120-1220E	25.4	50.8	150	4.1	3.0	71.3	161
120-1224E	25.4	25.4	200	4.3	3.5	95.1	87
120-1225E	25.4	50.8	200	4.3	3.5	95.1	161
120-1226E	25.4	25.4	250	4.2	3.5	118.9	87
120-1227E	25.4	50.8	250	4.2	3.5	118.9	161
120-1229E	25.4	25.4	300	4.1	3.5	142.7	87
120-1230E	25.4	50.8	300	4.1	3.5	142.7	161
120-1234E	25.4	25.4	500	3.8	3.5	237.8	96
120-1235E	25.4	50.8	500	3.8	3.5	237.8	179
120-1239E	25.4	25.4	1000	2.5	2.3	475.5	95
120-1240E	25.4	50.8	1000	2.5	2.3	475.5	177
120-1244E	25.4	25.4	1500	2.2	2.0	713.3	95
120-1245E	25.4	50.8	1500	2.2	2.0	713.3	177

BK7 Plano-Concave Cylindrical Lenses

Catalogue number BK7	Dimensions A, mm	B, mm	Focal length F, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Price, EUR
122-0105E	12.7	12.7	-15	1.4	3.7	-7.8	40
122-0110E	19.1	25.4	-25	2.0	6.0	-13.0	60
122-0204E	25.4	25.4	-50	2.0	5.2	-25.9	55
122-0209E	25.4	25.4	-75	2.0	4.1	-38.9	55
122-0210E	25.4	50.8	-75	2.0	4.1	-38.9	85
122-0214E	25.4	25.4	-100	2.0	3.5	-51.9	55
122-0215E	25.4	50.8	-100	2.0	3.5	-51.9	85
122-0219E	25.4	25.4	-150	2.0	3.0	-77.8	55
122-0220E	25.4	50.8	-150	2.0	3.0	-77.8	85
122-0224E	25.4	25.4	-200	2.0	2.8	-103.7	55
122-0225E	25.4	50.8	-200	2.0	2.8	-103.7	85
122-0226E	25.4	25.4	-250	2.0	2.7	-129.7	55
122-0227E	25.4	50.8	-250	2.0	2.7	-129.7	85
122-0229E	25.4	25.4	-300	2.0	2.5	-155.6	55
122-0230E	25.4	50.8	-300	2.0	2.5	-155.6	85
122-0234E	25.4	25.4	-500	2.0	2.4	-259.4	59
122-0235E	25.4	50.8	-500	2.0	2.4	-259.4	95

UV FS Plano-Concave Cylindrical Lenses

Catalogue number UV FS	Dimensions A, mm	B, mm	Focal length F, mm	Centre thickness CT, mm	Edge thickness ET, mm	Radius, mm	Price, EUR
122-1104E	12.7	12.7	-15	2.0	4.9	-7.1	69
122-1105E	19.1	25.4	-25	3.0	8.0	-11.9	97
122-1201E	25.4	25.4	-30	2.5	10.0	-14.3	97
122-1204E	25.4	25.4	-50	3.5	7.1	-23.8	95
122-1205E	25.4	50.8	-50	3.5	7.1	-23.8	199
122-1209E	25.4	25.4	-75	3.3	5.6	-35.7	95
122-1210E	25.4	50.8	-75	3.3	5.6	-35.7	199
122-1214E	25.4	25.4	-100	3.0	4.7	-47.6	95
122-1215E	25.4	50.8	-100	3.0	4.7	-47.6	199
122-1219E	25.4	25.4	-150	3.0	4.1	-71.3	95
122-1220E	25.4	50.8	-150	3.0	4.1	-71.3	199
122-1224E	25.4	25.4	-200	3.8	4.6	-95.1	95
122-1225E	25.4	50.8	-200	3.8	4.6	-95.1	199
122-1229E	25.4	25.4	-300	3.5	4.1	-142.7	95
122-1230E	25.4	50.8	-300	3.5	4.1	-142.7	199
122-1234E	25.4	25.4	-500	3.5	3.8	-237.8	113
122-1235E	25.4	50.8	-500	3.5	3.8	-237.8	209

Coated Lenses Ordering Information

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.

Examples:

1) BK7 pl/cx cylindrical lens, dimensions: 10x10 mm, F=15 mm, coated AR/AR@400-700 nm, AOI=0°

Code: **120-0105 E + ARB550**, Price: 40 + 56 EUR= 96 EUR/pc.

Lens code | Coating code | Lens price | Coating price

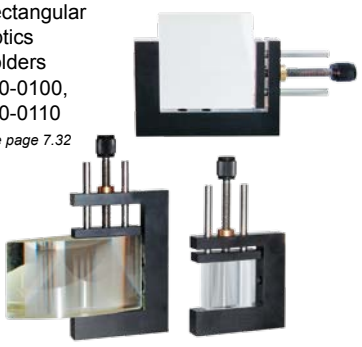
English or Metric Dimensions. *Can be omitted if not important*

For lenses maximum side length <25.4 mm please add Ø25 coating price

HOUSING ACCESSORIES

Rectangular Optics Holders 830-0100, 830-0110

See page 7.32



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

See page 7.47

LENS KITS

Lens kits contain different types (plano-convex, biconvex, plano-concave, bicon-cave) 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.

BK7 Lenses Kits

Small Lens Kit

Large kit of 40 pcs. N-BK7 lenses:

Code	Coating	Price, EUR
140-0240	uncoated	780
140-0240-AR400-700	BBAR @ 400–700 nm, R<0.9%	1820
140-0240-AR650-1100	BBAR @ 650–1100 nm, R<1.0%	1930
140-0240-AR1050-1700	BBAR @ 1050–1700 nm, R<1.0%	2030
140-0240-AR532+1064	AR @ 532+1064 nm, R<0.5%	1750
140-0240-AR1064	AR @ 1064 nm, R<0.25%	1550
140-0240-AR532	AR @ 532 nm, R<0.25%	1550

Small kit of 15 pcs. N-BK7 lenses:

Code	Coating	Price, EUR
140-0215	uncoated	310
140-0215-AR400-700	BBAR @ 400–700 nm, R<0.9%	990
140-0215-AR650-1100	BBAR @ 650–1100 nm, R<1.0%	1050
140-0215-AR1050-1700	BBAR @ 1050–1700 nm, R<1.0%	1150
140-0215-AR532+1064	AR @ 532+1064 nm, R<0.5%	770
140-0215-AR1064	AR @ 1064 nm, R<0.25%	700
140-0215-AR532	AR @ 532 nm, R<0.25%	700

Small BK7 Lens Kit

Code	Type	Dia, mm	F, mm
110-0205E	pl/cx	25.4	30
110-0207E	pl/cx	25.4	40
110-0209E	pl/cx	25.4	50
110-0211E	pl/cx	25.4	60
110-0215E	pl/cx	25.4	75
110-0219E	pl/cx	25.4	100
110-0227E	pl/cx	25.4	150
110-0231E	pl/cx	25.4	200
110-0247E	pl/cx	25.4	500
110-0259E	pl/cx	25.4	1000
112-0207E	pl/cv	25.4	-40
112-0209E	pl/cv	25.4	-50
112-0215E	pl/cv	25.4	-75
112-0219E	pl/cv	25.4	-100
112-0227E	pl/cv	25.4	-150

Large BK7 Lens Kit

Code	Type	Dia, mm	F, mm
110-0205E	pl/cx	25.4	30
110-0207E	pl/cx	25.4	40
110-0209E	pl/cx	25.4	50
110-0211E	pl/cx	25.4	60
110-0215E	pl/cx	25.4	75
110-0219E	pl/cx	25.4	100
110-0223E	pl/cx	25.4	125
110-0227E	pl/cx	25.4	150
110-0231E	pl/cx	25.4	200
110-0235E	pl/cx	25.4	250
110-0239E	pl/cx	25.4	300
110-0241E	pl/cx	25.4	350
110-0243E	pl/cx	25.4	400
110-0247E	pl/cx	25.4	500
110-0251E	pl/cx	25.4	700
110-0259E	pl/cx	25.4	1000
111-0204E	bi/cx	25.4	25
111-0206E	bi/cx	25.4	30
111-0208E	bi/cx	25.4	40
111-0210E	bi/cx	25.4	50

Code	Type	Dia, mm	F, mm
111-0214E	bi/cx	25.4	60
111-0216E	bi/cx	25.4	75
111-0218E	bi/cx	25.4	100
111-0222E	bi/cx	25.4	150
111-0226E	bi/cx	25.4	200
111-0228E	bi/cx	25.4	250
111-0234E	bi/cx	25.4	500
111-0250E	bi/cx	25.4	1000
112-0207E	pl/cv	25.4	-40
112-0209E	pl/cv	25.4	-50
112-0215E	pl/cv	25.4	-75
112-0219E	pl/cv	25.4	-100
112-0227E	pl/cv	25.4	-150
112-0231E	pl/cv	25.4	-200
114-0204E	bi/cv	25.4	-25
114-0208E	bi/cv	25.4	-50
114-0212E	bi/cv	25.4	-75
114-0214E	bi/cv	25.4	-100
114-0220E	bi/cv	25.4	-150
114-0224E	bi/cv	25.4	-200

*Please refer to **Nd:YAG Laser Line** (see page 4.12) or **Femtoline** (see page 5.15) section for lens kits with AR coated lenses for particular laser applications.*

UV FS Lenses Kits

Large Lens Kit

Large kit of 40 pcs. UV FS lenses:

Code	Coating	Price, EUR
140-1240	uncoated	2160
140-1240-AR210-400	BBAR @ 210–400 nm, R<2%	3490
140-1240-AR350-900	BBAR @ 350–900 nm, R<1.5%	3290
140-1240-AR760-840	BBAR @ 760–840 nm, R<0.4%	3040
140-1240-AR700-900	BBAR @ 700–900 nm, R<0.8%	3210
140-1240-AR650-1100	BBAR @ 650–1100 nm, R<1%	3310
140-1240-AR532+1064	AR @ 532+1064 nm, R<0.5%	3130
140-1240-AR1064	AR @ 1064 nm, R<0.25%	2930
140-1240-AR532	AR @ 532 nm, R<0.25%	2930
140-1240-AR355	AR @ 355 nm, R<0.25%	3030
140-1240-AR266	AR @ 266 nm, R<0.4%	3130
140-1240-AR1030	AR @ 1030 nm, R<0.25%	2930
140-1240-AR515	AR @ 515 nm, R<0.25%	2930
140-1240-AR343	AR @ 343 nm, R<0.3%	3030
140-1240-AR258	AR @ 258 nm, R<0.4%	3130

Small kit of 15 pcs. UV FS lenses:

Code	Coating	Price, EUR
140-1215	uncoated	930
140-1215-AR210-400	BBAR @ 210–400 nm, R<2%	1830
140-1215-AR350-900	BBAR @ 350–900 nm, R<1.5%	1660
140-1215-AR760-840	BBAR @ 760–840 nm, R<0.4%	1530
140-1215-AR700-900	BBAR @ 700–900 nm, R<0.8%	1610
140-1215-AR650-1100	BBAR @ 650–1100 nm, R<1%	1670
140-1215-AR532+1064	AR @ 532+1064 nm, R<0.5%	1390
140-1215-AR1064	AR @ 1064 nm, R<0.25%	1320
140-1215-AR532	AR @ 532 nm, R<0.25%	1320
140-1215-AR355	AR @ 355 nm, R<0.25%	1350
140-1215-AR266	AR @ 266 nm, R<0.4%	1380
140-1215-AR1030	AR @ 1030 nm, R<0.25%	1320
140-1215-AR515	AR @ 515 nm, R<0.25%	1320
140-1215-AR343	AR @ 343 nm, R<0.3%	1350
140-1215-AR258	AR @ 258 nm, R<0.4%	1380

Small UV FS Lens Kit

Code	Type	Dia, mm	F, mm
110-1203E	pl/cx	25.4	30
110-1205E	pl/cx	25.4	50
110-1209E	pl/cx	25.4	75
110-1211E	pl/cx	25.4	100
110-1216E	pl/cx	25.4	125
110-1217E	pl/cx	25.4	150
110-1219E	pl/cx	25.4	200
110-1223E	pl/cx	25.4	300
110-1233E	pl/cx	25.4	500
110-1245E	pl/cx	25.4	1000
112-1205E	pl/cv	25.4	-50
112-1209E	pl/cv	25.4	-75
112-1211E	pl/cv	25.4	-100
112-1215E	pl/cv	25.4	-125
112-1217E	pl/cv	25.4	-150

Large UV FS Lens Kit

Code	Type	Dia, mm	F, mm
110-1203E	pl/cx	25.4	30
110-1205E	pl/cx	25.4	50
110-1209E	pl/cx	25.4	75
110-1210E	pl/cx	25.4	80
110-1211E	pl/cx	25.4	100
110-1216E	pl/cx	25.4	125
110-1217E	pl/cx	25.4	150
110-1219E	pl/cx	25.4	200
110-1221E	pl/cx	25.4	250
110-1223E	pl/cx	25.4	300
110-1225E	pl/cx	25.4	350
110-1227E	pl/cx	25.4	400
110-1233E	pl/cx	25.4	500
110-1235E	pl/cx	25.4	600
110-1239E	pl/cx	25.4	750
110-1245E	pl/cx	25.4	1000
111-1204E	bi/cx	25.4	25
111-1207E	bi/cx	25.4	40
111-1210E	bi/cx	25.4	50
111-1214E	bi/cx	25.4	75

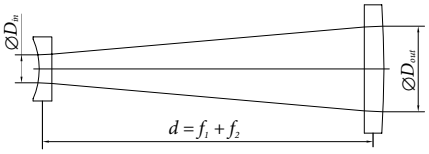
Code	Type	Dia, mm	F, mm
111-1218E	bi/cx	25.4	100
111-1222E	bi/cx	25.4	150
111-1226E	bi/cx	25.4	200
111-1230E	bi/cx	25.4	250
111-1234E	bi/cx	25.4	300
111-1238E	bi/cx	25.4	400
111-1240E	bi/cx	25.4	500
111-1260E	bi/cx	25.4	1000
112-1205E	pl/cv	25.4	-50
112-1209E	pl/cv	25.4	-75
112-1211E	pl/cv	25.4	-100
112-1217E	pl/cv	25.4	-150
112-1219E	pl/cv	25.4	-200
112-1223E	pl/cv	25.4	-300
114-1204E	bi/cv	25.4	-25
114-1208E	bi/cv	25.4	-50
114-1212E	bi/cv	25.4	-75
114-1216E	bi/cv	25.4	-100
114-1220E	bi/cv	25.4	-150
114-1224E	bi/cv	25.4	-200

RELATED PRODUCTS

Tweezers/Forceps for Optical Components 260-1050

See page A.4

SIMPLE TELESCOPE KIT



Simple lenses are subject to optical aberrations. In many cases these aberrations can be compensated for to a great extent by using a combination of simple lenses with complementary aberrations. A compound lens is a collection of simple lenses of different shapes and made of materials of different refractive indices, arranged one after the other with a common axis.

If two thin lenses are separated in air by some distance d (where d is smaller than the focal length of the first lens), the focal length for the combined system is given by

$$\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2} - \frac{d}{f_1 \cdot f_2}$$

The distance from the second lens to the focal point of the combined lenses is called the back focal length (BFL).

$$BFL = \frac{f_2 \cdot (d - f_1)}{d - (f_1 + f_2)}$$

If the separation distance is equal to the sum of the focal lengths $(d = f_1 + f_2)$, the combined focal length and BFL are infinite. This corresponds to a pair of lenses that transform a parallel (collimated) beam into another collimated beam. This type of system is called an afocal system, since it produces no net convergence or divergence of the beam. Two lenses at this separation form the simplest type of optical telescope. Although the system does not alter the divergence of a collimated beam, it does alter the width of the beam. The magnification of such a telescope is given by

$$M = -\frac{f_2}{f_1} = \frac{D_{out}}{D_{in}} \quad \frac{(exit\ diameter)}{(input\ diameter)}$$

which is the ratio of the input beam width to the output beam width. Note the sign convention: a telescope with two convex lenses $(f_1 > 0, f_2 > 0)$ produces a negative magnification, indicating an inverted image. A concave plus a convex lens $(f_1 < 0 < f_2)$ produces a positive magnification and the image is upright.

Code	Material	Coating	Price, EUR
140-0008	BK7	Uncoated	771
141-0008	BK7	1064 nm, R<0.2%	1075
142-0008	BK7	532 nm + 1064 nm, R<0.5%	1110
147-0008	BK7	400-700 nm, R<0.9%	1260
140-1008	UV FS	Uncoated	1170
144-1008	UV FS	266 nm, R<0.4%	1470
149-1008	UV FS	266 nm + 355 nm, R<0.6%	1480
146-1008	UV FS	210-400 nm, R<1.5%	1680
143-1008	UV FS	355 nm, R<0.25%	1465
141-1008	UV FS	532 nm + 1064 nm, R<0.5%	1485
145-1008	UV FS	350-900 nm, R<1.5%	1685
148-1008	UV FS	650-950 nm, R<1%	1645

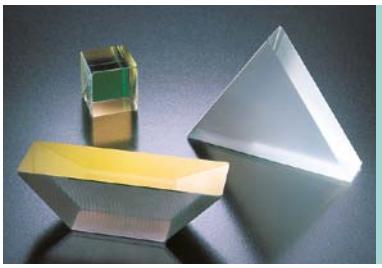
Any other antireflection coating wavelength region is available on request.

Each kit includes 8 lenses, Aluminium Optical Rail 810-0005-02, two Aluminium Rail Carriers 810-0007-06, Self Centering Lens Mounts 830-0010 and 830-0020, two Rod Holders 820-0050-02 and two Rods 820-0010-02. Net weight: 1.4 kg

Simple Telescope Kit

Material: BK7		Material: UV FS		Focal length f_1, mm	Focal length f_2, mm	Distance between lenses $d=f_1+f_2$, mm *	Magnification, M
Lens 1	Lens 2	Lens 1	Lens 2				
BK7 bi/cv Ø12.7 mm 114-0104	BK7 pl/cx Ø50.8 mm	UV FS bi/cv Ø12.7 mm 114-1104	UV FS pl/cx Ø50.8 mm	-12.7			
	110-0502		110-1505		+75	62	5.9
	110-0505		110-1509		+100	87	7.7
	110-0507		110-1511		+150	137	11.8
	110-0509		110-1515		+200	187	15.7
	110-0511		110-1517		+250	237	19.7
BK7 bi/cv Ø25.4 mm 114-0204	BK7 pl/cx Ø50.8 mm	UV FS bi/cv Ø25.4 mm 114-1204	UV FS pl/cx Ø50.8 mm	-25			
	110-0502		110-1505		+75	50	3
	110-0505		110-1509		+100	75	4
	110-0507		110-1511		+150	125	6
	110-0509		110-1515		+200	175	8
	110-0511		110-1517		+250	225	10
BK7 pl/cv Ø25.4 mm 112-0209	BK7 pl/cx Ø50.8 mm	UV FS pl/cv Ø25.4 mm 112-1205	UV FS pl/cx Ø50.8 mm	-50			
	110-0502		110-1505		+75	25	1.5
	110-0505		110-1509		+100	50	2
	110-0507		110-1511		+150	100	3
	110-0509		110-1515		+200	150	4
	110-0511		110-1517		+250	200	5

* Note that distance between lenses d is the distance between focal planes of the lenses and is given theoretically (the thickness of lenses is not included into calculation). It, also, depends on wavelength. The distance should be adjusted ±10 mm in each particular case.



Prisms

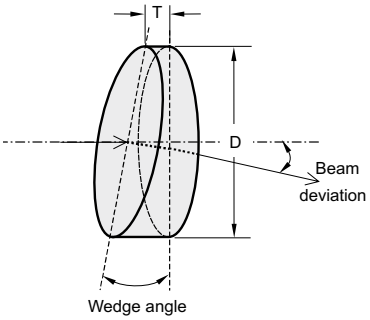
WEDGE PRISMS

- **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 @633nm

Catalogue number BK7		**Wedge,** deg	**Beam Deviation,** deg		**Price,** EUR
Ø12.7 × 3 mm	Ø25.4 × 3 mm		@ 1064	@ 532	Ø12.7 / Ø25.4
310-0100E	310-0200E	0.5	0.25	0.26	25 / 30
310-0101E	310-0201E	1	0.51	0.52	25 / 30
310-0102E	310-0202E	2	1.01	1.04	25 / 30
310-0103E	310-0203E	3	1.52	1.56	25 / 30
310-0105E	310-0205E	5	2.54	2.60	25 / 30

Catalogue number UV FS		**Wedge,** deg	**Beam Deviation,** deg			**Price,** EUR
Ø12.7 × 3 mm	Ø25.4 × 3 mm		@ 1064	@ 532	@ 355	Ø12.7 / Ø25.4
310-1100E	310-1200E	0.5	0.22	0.23	0.24	40 / 50
310-1101E	310-1201E	1	0.45	0.46	0.48	40 / 50
310-1102E	310-1202E	2	0.90	0.92	0.95	40 / 50
310-1103E	310-1203E	3	1.35	1.38	1.43	40 / 50
310-1105E	310-1205E	5	2.26	2.31	2.39	40 / 50

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 @633nm

Catalogue number BK7		Wedge,	Beam Deviation, deg		Price, EUR
Ø12.7 × 3 mm	Ø25.4 × 6 mm	deg	@ 1064	@ 532	Ø12.7 / Ø25.4
311-0100E	311-0200E	0.5	0.25	0.26	35 / 45
311-0101E	311-0201E	1	0.51	0.52	35 / 45
311-0102E	311-0202E	2	1.01	1.04	35 / 45
311-0103E	311-0203E	3	1.52	1.56	35 / 45
311-0105E	311-0205E	5	2.54	2.60	35 / 45

Catalogue number UV FS		Wedge,	Beam Deviation, deg			Price, EUR
Ø12.7 × 3 mm	Ø25.4 × 6 mm	deg	@ 1064	@ 532	@ 355	Ø12.7 / Ø25.4
311-1100E	311-1200E	0.5	0.22	0.23	0.24	50 / 60
311-1101E	311-1201E	1	0.45	0.46	0.48	50 / 60
311-1102E	311-1202E	2	0.90	0.92	0.95	50 / 60
311-1103E	311-1203E	3	1.35	1.38	1.43	50 / 60
311-1105E	311-1205E	5	2.26	2.31	2.39	50 / 60

HOUSING ACCESSORIES

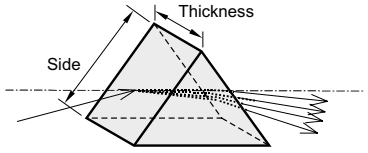
Stable Steel Mirror/Beamsplitter Mount 840-0036

See page 7.36

LASER DISPERSING PRISMS

- **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	Catalogue number	Maximum input beam diameter, mm	Side length, mm	Thickness, mm	Apex angle	Price, EUR
BK7	320-0110	6.0	15	10	67°	40
UV FS	320-1110	6.0	15	10	69°	72
SF11	320-8110	6.0	15	10	59°	49
BK7	320-0218	12.0	25	18	67°	69
UV FS	320-1218	12.0	25	18	69°	125
SF11	320-8218	12.0	25	18	59°	95
BK7	320-0525	22.0	50	25	67°	140
UV FS	320-1525	22.0	50	25	69°	260
SF11	320-8525	22.0	50	25	59°	195

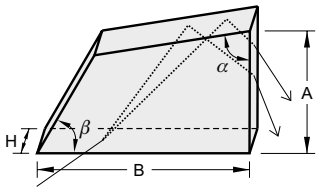
PELLIN-BROCA PRISMS

- **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.

Material	Catalogue number	A, mm	B, mm	H, mm	Price, EUR
BK7	325-0206	11.0	20.0	6.4	57
	325-0412	23.5	40.0	12.7	63
UV FS	325-1206	11.0	20.0	6.4	110
	325-1215	15.0	26.0	15.0	121
	325-1412	23.5	40.0	12.7	150

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



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

HOUSING ACCESSORIES

Tilt/Rotation Stage 860-0110

See page 7.80

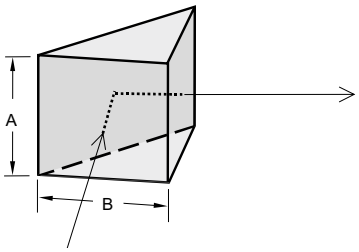
RIGHT ANGLE PRISMS

- **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.

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



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

Catalogue number BK7	Catalogue number UV FS	Size of face, A × B mm	90° angle tolerance	Pyramidal tolerance	Price, EUR BK7 / UV FS
330-0052	330-1052	5.0 × 5.0	2 arcmin	1 arcmin	18 / 45
330-0102	330-1102	10.0 × 10.0	2 arcmin	1 arcmin	20 / 49
330-0122	330-1122	12.5 × 12.5	2 arcmin	1 arcmin	22 / 51
330-0152	330-1152	15.0 × 15.0	2 arcmin	1 arcmin	25 / 55
330-0202	330-1202	20.0 × 20.0	2 arcmin	1 arcmin	31 / 59
330-0252	330-1252	25.0 × 25.0	2 arcmin	1 arcmin	37 / 70
330-0105	330-1105	10.0 × 10.0	5 arcsec	30 arcsec	42 / 93
330-0125	330-1125	12.5 × 12.5	5 arcsec	30 arcsec	44 / 95
330-0155	330-1155	15.0 × 15.0	5 arcsec	30 arcsec	50 / 103
330-0205	330-1205	20.0 × 20.0	5 arcsec	30 arcsec	57 / 116
330-0255	330-1255	25.0 × 25.0	5 arcsec	30 arcsec	73 / 142

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

HOUSING ACCESSORIES

Prism Holders 840-0160, 840-0170

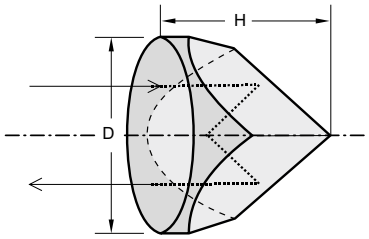
See page 7.47

CORNER CUBES

- **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%
Uncoated	

Material	Catalogue Number	Diameter D, mm	Height H, mm	Price, EUR
BK7	340-0217	22.0	17.5	120
	340-0217M	25.4	17.5	140
	340-0219	25.4	19.0	135
	340-0329	38.1	28.5	175
	340-0538	50.8	38.0	180
	340-0648	63.5	48.0	250
UV FS	340-1217	22.0	17.5	165
	340-1217M	25.4	17.5	185

Models **340-0217M** and **340-1217M** are mounted into black anodized aluminium ring Ø25.4mm and clear aperture Ø17mm.

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

Mounting Suggestion

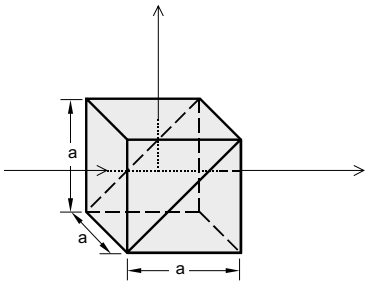
HOUSING ACCESSORIES

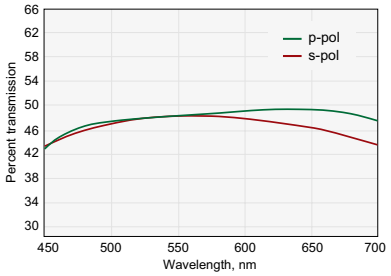
Kinematic Mirror and Beamsplitter Mount 840-0020

See page 7.33

NON-POLARIZING BROADBAND CUBE BEAMSPLITTERS

- **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**





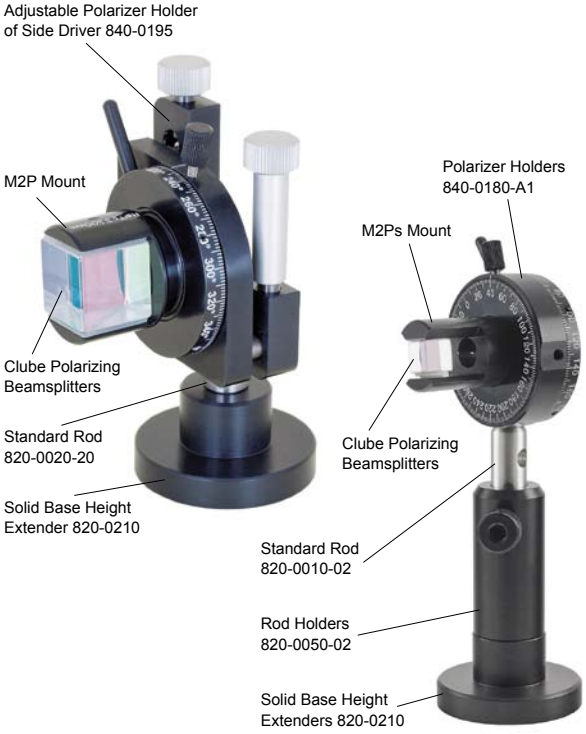
Typical transmission curve @ 450–700 nm

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	$T_p = T_s = 45 \pm 5\%$

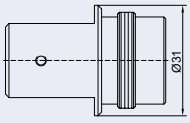
Catalogue number		Operating wavelength, nm	Size, mm	Price, EUR	
Unmounted	Mounted			Unmounted	Mounted
351-0107	351-0107-M2Ps	450–700	10 × 10	135	185
351-0157	351-0157-M2Ps	450–700	15 × 15	150	205
351-0207	351-0207-M2P	450–700	20 × 20	155	225
351-0257	351-0257-M2P	450–700	25 × 25	170	245
351-0108	351-0108-M2Ps	750–1100	10 × 10	135	185
351-0158	351-0158-M2Ps	750–1100	15 × 15	150	205
351-0208	351-0208-M2P	750–1100	20 × 20	155	225
351-0258	351-0258-M2P	750–1100	25 × 25	170	245

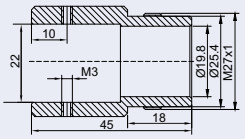
Mounting Suggestion



MOUNTING

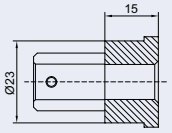
Example of **M2P** mount for Clube Polarizing Beamsplitters of 20×20 mm standard dimensions.

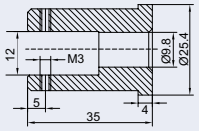




M2P mount can be used with 840-0180, 840-0195, 840-0020.

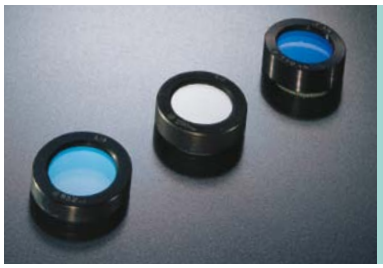
Example of **M2Ps** mount for Clube Polarizing Beamsplitters of 10×10 mm dimensions.





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

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



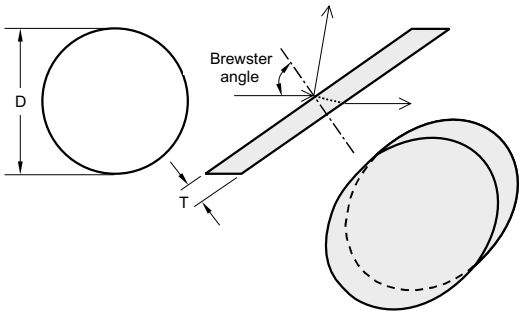
Polarizing Optics

This section describes a group of components which modify the state of polarization of optical radiation. Polarized light carries valuable information about where the light has been and the various physical parameters which have been acting upon it.

BREWSTER WINDOWS

- **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.

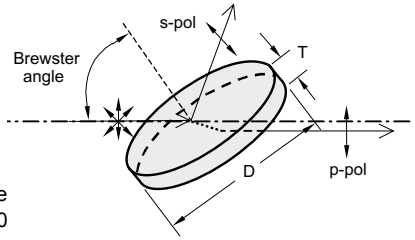
SPECIFICATIONS

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

Catalogue number BK7	Catalogue number UV FS	Minor axis D, mm	Thickness T, mm	Price, EUR BK7 / UV FS
410-0082	410-1082	8.0	2.0	53 / 70
410-0123	410-1123	12.5	3.0	65 / 87
410-0255	410-1255	25.0	5.0	75 / 145
410-0408	410-1408	40.0	8.0	99 / 195
410-0508	410-1508	50.0	8.0	130 / 250

THIN FILM LASER POLARIZERS (56° Angle of Incidence)

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

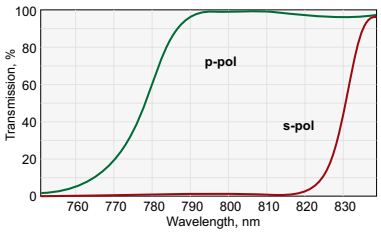


Thin Film Polarizers are designed for use in the most demanding lasers. Due to a high laser damage threshold reaching 10 J/cm² @ 1064 nm 8 ns, they are used as an alternative to Glan laser polarizing prisms or cube polarizing beamsplitters.

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.



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

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	T_p>95%
Extinction ratio T_p/T_s	>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 %

Catalogue number	Diameter D, mm	Thickness T, mm	Wavelength, nm	Price, EUR
420-0114E	12.7	3.0	515	108
420-0124E	12.7	3.0	532	108
420-0125E	12.7	3.0	633	108
420-0127E	12.7	3.0	775	108
420-0126E	12.7	3.0	800	108
420-0136E	12.7	3.0	780-820	160
420-0118E	12.7	3.0	1030	115
420-0138E	12.7	3.0	1010-1050	160
420-0128E	12.7	3.0	1064	115
420-0244E	25.4	3.0	515	128
420-0254E	25.4	3.0	532	128
420-0255E	25.4	3.0	633	128
420-0257E	25.4	3.0	775	128
420-0256E	25.4	3.0	800	128
420-0266E	25.4	3.0	780-820	189
420-0248E	25.4	3.0	1030	155
420-0268E	25.4	3.0	1010-1050	189
420-0258E	25.4	3.0	1064	155
420-0514E	50.8	6.0	515	206
420-0504E	50.8	6.0	532	206
420-0505E	50.8	6.0	633	206
420-0507E	50.8	6.0	775	215
420-0506E	50.8	6.0	800	305
420-0526E	50.8	6.0	780-820	309
420-0518E	50.8	6.0	1030	255
420-0528E	50.8	6.0	1010-1050	335
420-0508E	50.8	6.0	1064	255

BK7 Rectangular Thin Film Laser Polarizers

Rs / Tp > 99.5 / 95.0 %

Catalogue number	Rectangular dimensions Length, mm	Width, mm	Thickness T, mm	Wavelength, nm	Price, EUR
420-0274	28.6	14.3	3.0	515	142
420-0284	28.6	14.3	3.0	532	142
420-0285	28.6	14.3	3.0	633	142
420-0287	28.6	14.3	3.0	775	142
420-0286	28.6	14.3	3.0	800	142
420-0296	28.6	14.3	3.0	780-820	220
420-0278	28.6	14.3	3.0	1030	170
420-0298	28.6	14.3	3.0	1010-1050	220
420-0288	28.6	14.3	3.0	1064	170

HOUSING ACCESSORIES

Adapters for Polarizer at 56°
840-0117, 840-0118
See page 7.43

Variable Attenuators for Linearly Polarized Laser Beam
990-0070, -0071
See page 6.13

UV FS Round Thin Film Laser Polarizers

Rs / Tp > 99.5 / 95.0 %

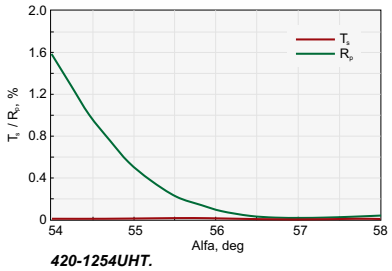
Catalogue number	Diameter D, mm	Thickness T, mm	Wavelength, nm	Price, EUR
420-1110E	12.7	3.0	266	180
420-1112E	12.7	3.0	343	164
420-1122E	12.7	3.0	355	164
420-1123E	12.7	3.0	400	131
420-1114E	12.7	3.0	515	131
420-1124E	12.7	3.0	532	131
420-1126E	12.7	3.0	800	131
420-1136E	12.7	3.0	780-820	196
420-1118E	12.7	3.0	1030	145
420-1138E	12.7	3.0	1010-1050	196
420-1128E	12.7	3.0	1064	145
420-1240E	25.4	3.0	266	200
420-1242E	25.4	3.0	343	182
420-1252E	25.4	3.0	355	182
420-1253E	25.4	3.0	400	154
420-1244E	25.4	3.0	515	154
420-1254E	25.4	3.0	532	154
420-1256E	25.4	3.0	800	154
420-1266E	25.4	3.0	780-820	231
420-1248E	25.4	3.0	1030	180
420-1268E	25.4	3.0	1010-1050	231
420-1258E	25.4	3.0	1064	180
420-1510E	50.8	6.0	266	358
420-1512E	50.8	6.0	343	325
420-1502E	50.8	6.0	355	325
420-1503E	50.8	6.0	400	295
420-1514E	50.8	6.0	515	295
420-1504E	50.8	6.0	532	295
420-1506E	50.8	6.0	800	305
420-1526E	50.8	6.0	780-820	404
420-1518E	50.8	6.0	1030	315
420-1528E	50.8	6.0	1010-1050	404
420-1508E	50.8	6.0	1064	315

UV FS Rectangular Thin Film Laser Polarizers

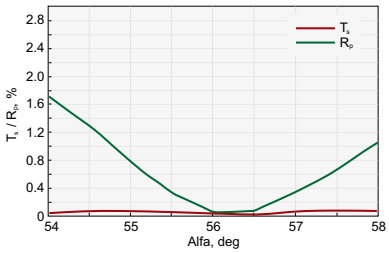
Rs / Tp > 99.5 / 95.0 %

Catalogue number	Rectangular dimensions Length, mm	Width, mm	Thickness T, mm	Wavelength, nm	Price, EUR
420-1270	28.6	14.3	3.0	266	280
420-1272	28.6	14.3	3.0	343	255
420-1282	28.6	14.3	3.0	355	255
420-1283	28.6	14.3	3.0	400	215
420-1274	28.6	14.3	3.0	515	215
420-1284	28.6	14.3	3.0	532	215
420-1286	28.6	14.3	3.0	800	215
420-1296	28.6	14.3	3.0	780-820	315
420-1278	28.6	14.3	3.0	1030	225
420-1298	28.6	14.3	3.0	1010-1050	315
420-1288	28.6	14.3	3.0	1064	225
420-1370	35.0	20.0	3.0	266	322
420-1372	35.0	20.0	3.0	343	293
420-1382	35.0	20.0	3.0	355	293
420-1383	35.0	20.0	3.0	400	247
420-1374	35.0	20.0	3.0	515	247
420-1384	35.0	20.0	3.0	532	247
420-1386	35.0	20.0	3.0	800	247
420-1396	35.0	20.0	3.0	780-820	362
420-1378	35.0	20.0	3.0	1030	259
420-1398	35.0	20.0	3.0	1010-1050	362
420-1388	35.0	20.0	3.0	1064	259

Ultra High Transmission Thin Film Polarizers



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

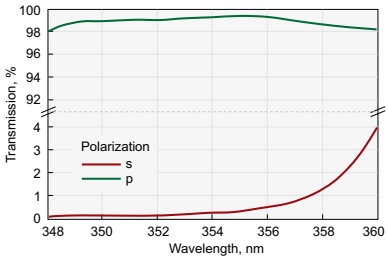


420-1258UHT.
Ultra High Transmission @ 1064 nm,
Ts<0.2%, Rp<0.2%, AOI = 56°

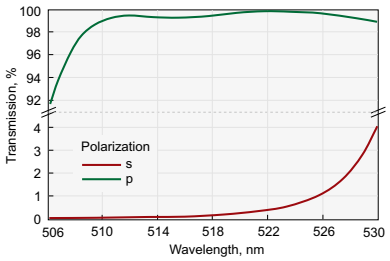
Material – UV FS; T_s < 0.2%, R_p < 0.2%

Catalogue number	Diameter D, mm	Thickness T, mm	Wavelength, nm	Price, EUR
420-1254UHT	25.4	3	532	260
420-1256UHT	25.4	3	800	260
420-1248UHT	25.4	3	1030	304
420-1258UHT	25.4	3	1064	304

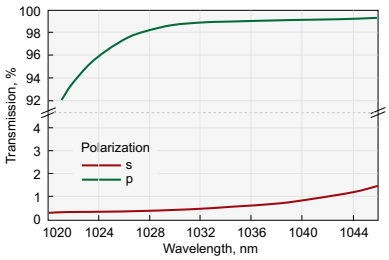
High Transmission Thin Film Polarizers



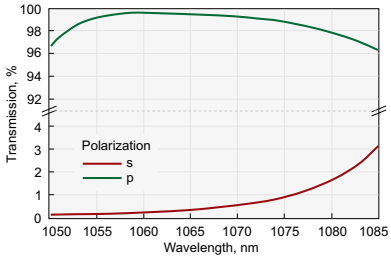
420-1252HT.
High Transmission @ 355 nm,
Rs/Tp > 99.5/99.0%



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%.

Material – UV FS; R_s / T_p > 99.5 / 99.0%

Catalogue number	Diameter D, mm	Thickness T, mm	Wavelength, nm	Price, EUR
420-1242HT	25.4	3	343	237
420-1252HT	25.4	3	355	237
420-1244HT	25.4	3	515	200
420-1254HT	25.4	3	532	200
420-1256HT	25.4	3	800	200
420-1248HT	25.4	3	1030	234
420-1258HT	25.4	3	1064	234

Material – UV FS; R_s / T_p > 99.5 / 99.0%

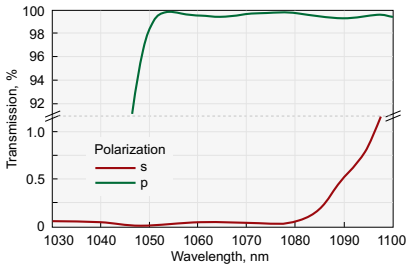
Catalogue number	Rectangular dimensions Length, mm	Width, mm	Thickness T, mm	Wavelength, nm	Price, EUR
420-1278HT	28.6	14.3	3	1030	270
420-1288HT	28.6	14.3	3	1064	270

RELATED PRODUCTS

Glan Laser Polarizing Prims
See page 1.61

Wollaston Prisms
See page 1.63

Thin Film Polarizers with High Extinction Ratio



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

Material – UV FS; T_p > 98%, T_s < 0.1%;
extinction ratio for transmitted light T_p/T_s: >1000:1

Catalogue number	Diameter D, mm	Thickness T, mm	Wavelength, nm	Price, EUR
420-1242HE	25.4	3	343	218
420-1252HE	25.4	3	355	218
420-1244HE	25.4	3	515	185
420-1254HE	25.4	3	532	185
420-1266HE	25.4	3	780-820	275
420-1256HE	25.4	3	800	185
420-1248HE	25.4	3	1030	216
420-1258HE	25.4	3	1064	216

Material – UV FS; T_p > 98%, T_s < 0.1%;
extinction ratio for transmitted light T_p/T_s: >1000:1

Catalogue number	Rectangular dimensions Length, mm	Width, mm	Thickness T, mm	Wavelength, nm	Price, EUR
420-1484HE	20	15	6	532	155
420-1584HE	30	20	6	532	210
420-1478HE	20	15	6	1030	165
420-1578HE	30	20	6	1030	220
420-1488HE	20	15	6	1064	165
420-1588HE	30	20	6	1064	220

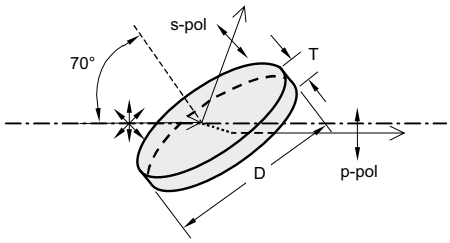
HOUSING ACCESSORIES

Adapters for Polarizer at 56°
840-0117, 840-0118
See page 7.43

Variable Attenuators for Linearly Polarized Laser Beam 990-0070, -0071
See page 6.13

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

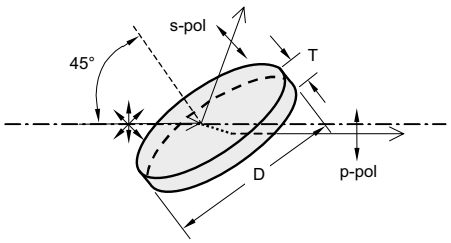
Substrate material	UV FS
Surface quality	20-10 scratch & dig (MIL-PRF-13830B)
Transmitted wavefront distortion	λ/10 @ 633 nm
Clear aperture	>90% of diameter
Angle of incidence (AOI)	70 ± 2°
Parallelism	<30 arcsec

Rectangular Polarizers. Material – UV FS. R_s / T_p > 99.5 / 95.0%.
Extinction ratio for transmitted light T_p/T_s >200:1

Catalogue number	Rectangular dimensions Length, mm	Width, mm	Thickness T, mm	Centre wavelength, nm	Operating wavelength region, nm	Price, EUR
420-1696BBi70	60.0	20.0	4.0	800	750 – 850	435
420-1698BBi70	60.0	20.0	4.0	1030	980 – 1080	435

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/cm^2 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; T_p > 98%, T_s < 0.1%; extinction ratio for transmitted light T_p/T_s: >1000:1

Catalogue number	Diameter D, mm	Thickness T, mm	Wavelength, nm	Price, EUR
420-1242i45HE	25.4	3.0	343	328
420-1252i45HE	25.4	3.0	355	328
420-1244i45HE	25.4	3.0	515	295
420-1254i45HE	25.4	3.0	532	295
420-1248i45HE	25.4	3.0	1030	315
420-1238i45HE	25.4	3.0	1053	315
420-1258i45HE	25.4	3.0	1064	315
420-1512i45HE	50.8	6.0	343	640
420-1502i45HE	50.8	6.0	355	640
420-1514i45HE	50.8	6.0	515	555
420-1504i45HE	50.8	6.0	532	555
420-1518i45HE	50.8	6.0	1030	620
420-1538i45HE	50.8	6.0	1053	620
420-1508i45HE	50.8	6.0	1064	620

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

Catalogue number	Diameter D, mm	Thickness T, mm	Wavelength, nm	Price, EUR
420-1242i45	25.4	3.0	343	238
420-1252i45	25.4	3.0	355	238
420-1244i45	25.4	3.0	515	200
420-1254i45	25.4	3.0	532	200
420-1248i45	25.4	3.0	1030	225
420-1238i45	25.4	3.0	1053	225
420-1258i45	25.4	3.0	1064	225
420-1512i45	50.8	6.0	343	455
420-1502i45	50.8	6.0	355	455
420-1514i45	50.8	6.0	515	395
420-1504i45	50.8	6.0	532	395
420-1518i45	50.8	6.0	1030	440
420-1538i45	50.8	6.0	1053	440
420-1508i45	50.8	6.0	1064	440

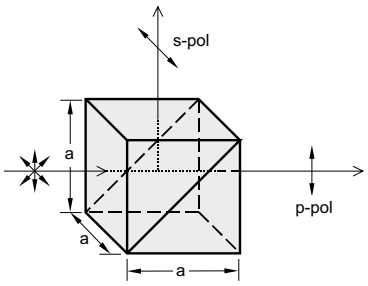
CUBE POLARIZING BEAMSPLITTERS

- **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.

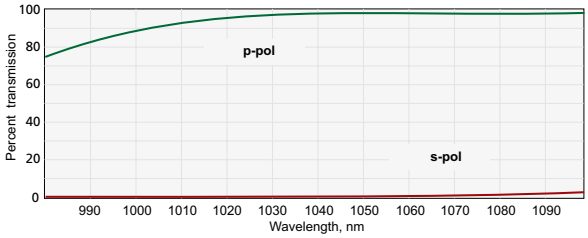
Please contact us for polarizing cubes with an extinction ratio of up to T_p/T_s>500:1

The four outer faces are all anti-reflection coated.



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



Typical transmission curve @ 1064 nm

BK7 glass, T_p/T_s>200:1

Catalogue number		Wavelength range, nm	Reflection s-pol, %	Transmission p-pol, %	Side a×a, mm	Price, EUR	
Unmounted	Mounted					Unmounted	Mounted
430-0101	430-0101-M2Ps	532	R_s>99.5	T_p>95	10 × 10	135	185
430-0151	430-0151-M2P	532	R_s>99.5	T_p>95	15 × 15	165	215
430-0201	430-0201-M2P	532	R_s>99.5	T_p>95	20 × 20	185	235
430-0251	430-0251-M2P	532	R_s>99.5	T_p>95	25 × 25	215	265
430-0104	430-0104-M2Ps	633	R_s>99.5	T_p>95	10 × 10	135	185
430-0154	430-0154-M2P	633	R_s>99.5	T_p>95	15 × 15	165	215
430-0204	430-0204-M2P	633	R_s>99.5	T_p>95	20 × 20	185	235
430-0254	430-0254-M2P	633	R_s>99.5	T_p>95	25 × 25	215	265
430-0102	430-0102-M2Ps	780	R_s>99.5	T_p>95	10 × 10	135	185
430-0152	430-0152-M2P	780	R_s>99.5	T_p>95	15 × 15	165	215
430-0202	430-0202-M2P	780	R_s>99.5	T_p>95	20 × 20	185	235
430-0252	430-0252-M2P	780	R_s>99.5	T_p>95	25 × 25	215	265
430-0103	430-0103-M2Ps	1064	R_s>99.5	T_p>95	10 × 10	135	185
430-0153	430-0153-M2P	1064	R_s>99.5	T_p>95	15 × 15	165	215
430-0203	430-0203-M2P	1064	R_s>99.5	T_p>95	20 × 20	185	235
430-0253	430-0253-M2P	1064	R_s>99.5	T_p>95	25 × 25	215	265

UV FS, T_p/T_s>100:1

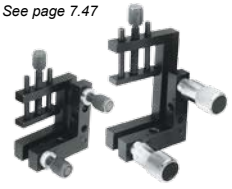
Catalogue number		Wavelength range, nm	Reflection s-pol, %	Transmission p-pol, %	Side a×a, mm	Price, EUR	
Unmounted	Mounted					Unmounted	Mounted
430-1103	430-1103-M2Ps	280	R_s>99	T_p>90	10 × 10	290	340
430-1153	430-1153-M2P	280	R_s>99	T_p>90	15 × 15	350	400
430-1203	430-1203-M2P	280	R_s>99	T_p>90	20 × 20	390	440
430-1105	430-1105-M2Ps	308	R_s>99	T_p>90	10 × 10	280	330
430-1155	430-1155-M2P	308	R_s>99	T_p>90	15 × 15	340	390
430-1205	430-1205-M2P	308	R_s>99	T_p>90	20 × 20	380	430
430-1107	430-1107-M2Ps	355	R_s>99	T_p>90	10 × 10	270	320
430-1157	430-1157-M2P	355	R_s>99	T_p>90	15 × 15	330	380
430-1207	430-1207-M2P	355	R_s>99	T_p>90	20 × 20	380	430

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
See page 7.47



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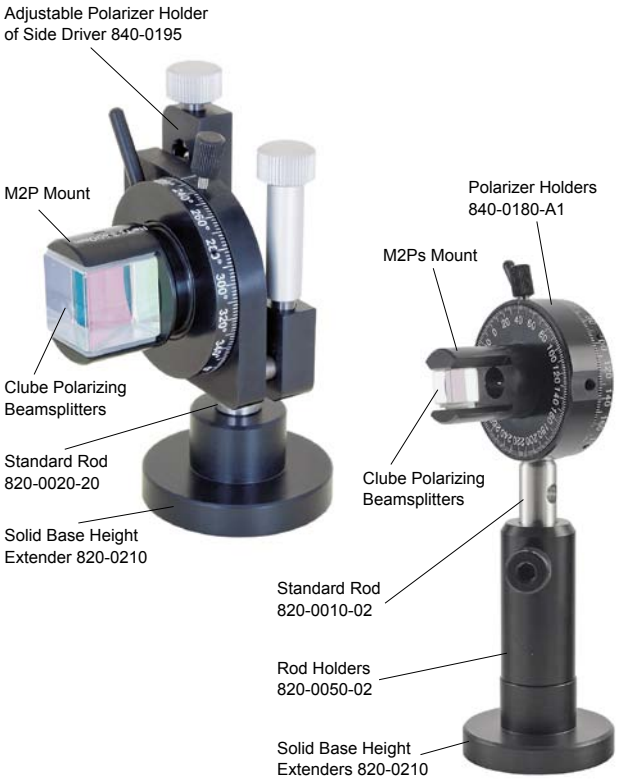
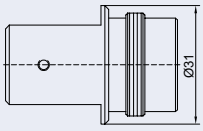
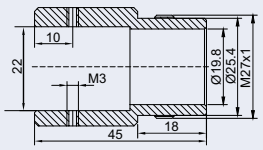
Mounting Suggestion



MOUNTING

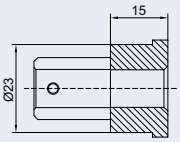
Example of **M2P** mount for Clube Polarizing Beamsplitters of 20×20 mm standard dimensions.

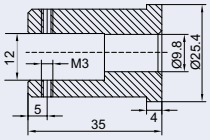




M2P mount can be used with 840-0180, 840-0195, 840-0020.

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





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

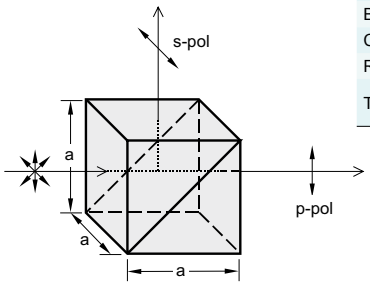
Drawings of M2P and M2Ps for prisms of other dimensions are available on request.

HIGH ENERGY POLARIZING CUBE BEAMSPLITTERS

- **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**

SPECIFICATIONS

Material	UVFS
Size	12.7×12.7×12.7 mm
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



The four outer faces are all anti-reflection coated.

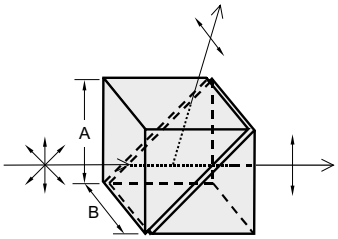
HOUSING ACCESSORIES
for unmounted cube polarizing beamsplitters

Prism Holders
840-0160, 840-0170
See page 7.47

Catalogue number		Operating wavelength, nm	Laser Damage threshold, 10 ns, 10 Hz	Price, EUR	
Unmounted	Mounted			Unmounted	Mounted
435-1127	**435-1127-M2Ps**	355	>3 J/cm² at 355 nm	375	425
435-1121	**435-1121-M2Ps**	532	>6 J/cm² at 532 nm	350	400
435-1122	**435-1123-M2Ps**	800	>8 J/cm² at 800 nm	350	400
435-1123	**435-1123-M2Ps**	1064	>15 J/cm² at 1064 nm	350	400
436-1121	**436-1121-M2Ps**	420-680	>1 J/cm² at 532 nm	375	425
436-1123	**436-1123-M2Ps**	700-1080	>2 J/cm² at 1064 nm	375	425

GLAN LASER POLARIZING PRISMS

- **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.

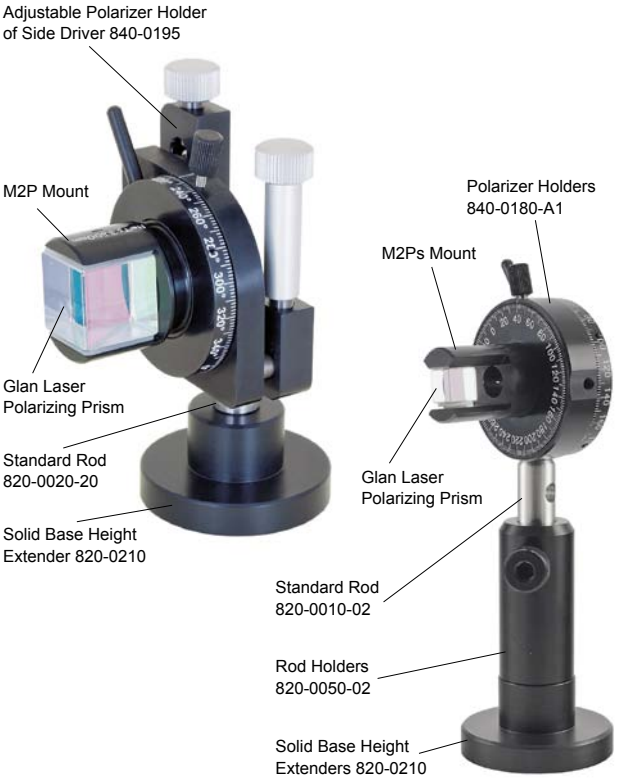
Natural Calcite Glan Laser Prisms

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	$1:10^{-5}$
Laser damage threshold	>5 J/cm², 10 ns pulses, 1064 nm

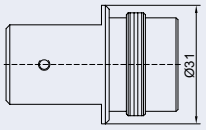
Catalogue number		Standard dimensions	Price, EUR	
unmounted	mounted	A × B, mm	unmounted	mounted
440-2010	440-2010-M2Ps	10 × 10	475	525
440-2012	440-2012-M2Ps	12 × 12	575	625
440-2014	440-2014-M2Ps	14 × 14	790	840
440-2020	440-2020-M2P	20 × 20	1900	1950

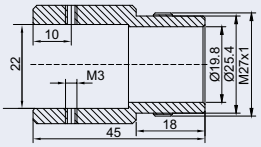
Mounting Suggestion



MOUNTING

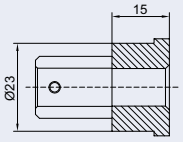
Example of **M2P** mount for Glan Laser Polarizing prisms of 20×20 mm standard dimensions.

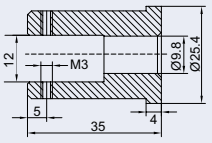




M2P mount can be used with 840-0180, 840-0195, 840-0020.

Example of **M2Ps** mount for Glan Laser Polarizing prisms 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

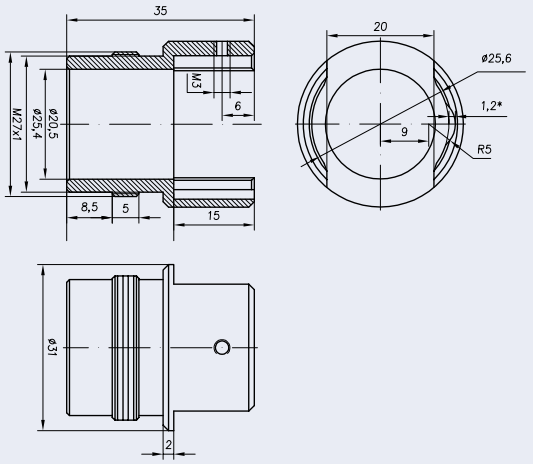
Material	α-BBO
Transmittance wavelength range	200–3500 nm
Extinction ratio	$1:10^{-5}$
Surface quality	20-10 scratch & dig (MIL-PRF-13830B)
Wavefront distortion	λ/4 at 633 nm
Beam deviation	<3 arcmin
Angular field	>6 deg
Coating	Single layer MgF_2
Mount	Black anodized aluminium

Operating wavelength range, nm	Clear aperture CA, mm	Outer mount OD, mm	Mounted, without adapter		Mounted, with adapter	
			Catalogue number	Price, EUR	Catalogue number	Price, EUR
200–270	Ø8	Ø25.4	441-2108	510	441-2108-M2Pd	560
200–270	Ø10	Ø25.4	441-2110	595	441-2110-M2Pd	645
200–270	Ø15	Ø30	441-2115	845	441-2115-M2PD	895
260–300	Ø8	Ø25.4	441-2208	490	441-2208-M2Pd	540
260–300	Ø10	Ø25.4	441-2210	580	441-2210-M2Pd	630
260–300	Ø15	Ø30	441-2215	830	441-2215-M2PD	880
300–400	Ø8	Ø25.4	441-2308	490	441-2308-M2Pd	540
300–400	Ø10	Ø25.4	441-2310	580	441-2310-M2Pd	630
300–400	Ø15	Ø30	441-2315	830	441-2315-M2PD	880

Mounting Suggestion

MOUNTING

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



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.

HOUSING ACCESSORIES

Polarizer Holders 840-0180

See page 7.48

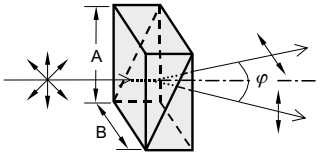
WOLLASTON PRISMS

- **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 1.61.



SPECIFICATIONS

Material	Natural calcite
Surface quality	40-20 scratch & dig (MIL-PRF-13830B)
Wavelength range	300–2200 nm
Extinction ratio	$1:10^{-5}$
Separation angle	10 or 20 deg
Dimension tolerance	±0.25 mm

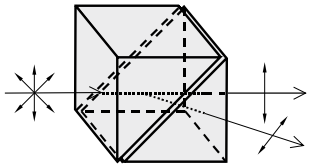
Catalogue number		Standard dimensions	Beam separation	Price, EUR	
unmounted	mounted	**A × B,** mm	**φ,** deg	unmounted	mounted
450-2101	**450-2101-M2Ps**	10 × 10	10	428	478
450-2121	**450-2121-M2Ps**	12 × 12	10	517	567
450-2141	**450-2141-M2P**	14 × 14	10	545	595
450-2102	**450-2102-M2Ps**	10 × 10	20	468	518
450-2122	**450-2122-M2Ps**	12 × 12	20	555	605
450-2142	**450-2142-M2P**	14 × 14	20	582	632

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

To order wollaston prism with a AR coating (see page 1.5) add the catalogue number and coating price to the prism code and price.

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	$1:10^{-5}$
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 @1064nm)
Coating	Single layer MgF_2
Mount	Black anodized aluminium

Catalogue number	Clear aperture Ø, mm	Outer mount Ø, mm	Price, EUR
455-2108	8.0	25.4	549
455-2110	10.0	25.4	699
455-2115	15.0	30.0	950

RETARDATION PLATES

- **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

- **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)
Parallelism	< 10 arcsec
AR coating	R < 0.4%
Laser damage threshold	> 0.5 J/cm², 10 nsec pulse, 1064 nm typical

Retardation plates are supplied mounted and have a multilayer dielectric anti-reflection coating on both sides maximising transmission.

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

Wavelength, nm	Retardation λ/2		Retardation λ/4	
	Catalogue number	Price, EUR	Catalogue number	Price, EUR
1550	460-4201D12	165	460-4401D12	165
1064	460-4205D12	165	460-4405D12	165
1030	460-4208D12	165	460-4408D12	165
852	460-4213D12	165	460-4413D12	165
800	460-4215D12	165	460-4415D12	165
780	460-4220D12	165	460-4420D12	165
633	460-4225D12	165	460-4425D12	165
532	460-4230D12	165	460-4430D12	165
515	460-4232D12	165	460-4432D12	165
488	460-4233D12	165	460-4433D12	165
400	460-4235D12	165	460-4435D12	165
355	460-4240D12	175	460-4440D12	175
343	460-4241D12	175	460-4441D12	175
266	460-4245D12	185	460-4445D12	185
257	460-4246D12	185	460-4446D12	185

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

HOUSING ACCESSORIES

Adjustable Polarizer Holder of Side Drive 840-0195

See page 7.52

Polarizer Holders 840-0180

See page 7.48

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

Wavelength, nm	Retardation λ/2		Retardation λ/4	
	Catalogue number	Price, EUR	Catalogue number	Price, EUR
1550	460-4201	245	460-4401	245
1064	460-4205	245	460-4405	245
1053	460-4206	245	460-4406	245
1030	460-4208	245	460-4408	245
950	460-4210	245	460-4410	245
852	460-4213	245	460-4413	245
800	460-4215	245	460-4415	245
780	460-4220	245	460-4420	245
770	460-4221	245	460-4421	245
633	460-4225	245	460-4425	245
589	460-4228	245	460-4428	245
532	460-4230	245	460-4430	245
527	460-4231	245	460-4431	245
515	460-4232	245	460-4432	245
488	460-4233	245	460-4433	245
400	460-4235	245	460-4435	245
355	460-4240	270	460-4440	270
343	460-4241	270	460-4441	270
266	460-4245	280	460-4445	280
257	460-4246	280	460-4446	280
244	460-4248	280	460-4448	280

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

ZERO ORDER AIR-SPACED WAVEPLATES

- **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
See page 7.48

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
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	10 J/cm², 10 nsec pulse, 1064 nm

Center wavelength, nm	Retardation λ/2		Retardation λ/4	
	Catalogue no.	Price, EUR	Catalogue no.	Price, EUR
1064	464-4205	310	464-4405	310
1030	464-4208	310	464-4408	310
800	464-4215	310	464-4415	310
780	464-4220	310	464-4420	310
532	464-4230	310	464-4430	310
515	464-4232	310	464-4432	310
400	464-4235	310	464-4435	310
355	464-4240	335	464-4440	335
343	464-4241	335	464-4441	335
266	464-4245	345	464-4445	345
257	464-4246	345	464-4446	345

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.

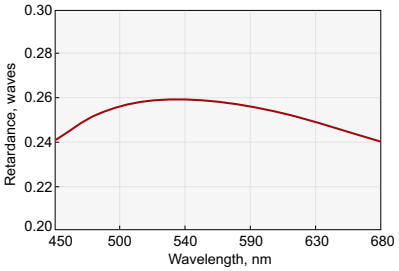
Our achromatic waveplates are available for four wavelength ranges: VIS (450-680 nm), NIR (700-1000 nm), 950-1300 nm, 1200-1650 nm. The waveplates are provided in a black anodized aluminum housing.

SPECIFICATIONS

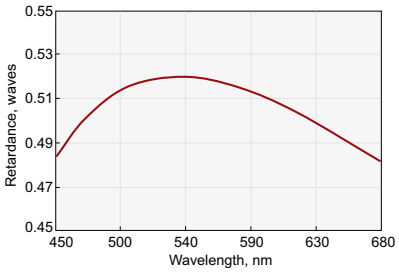
Material	Single crystal quartz and MgF_2
Clear aperture	Ø12.7 mm
Ring mount outer diameter	25.4 +0.0 / -0.12 mm
Ring mount thickness	8.0 ± 0.2 mm
Retardation tolerance	<λ/100 over wavelength range
Surface quality	40-20 scratch & dig (MIL-PRF-13830B)
Wavefront distortion	<λ/8 @ 632 nm
Parallelism	< 1 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 no.	Price, EUR	Catalogue no.	Price, EUR
450-680	467-4205	480	467-4405	480
700-1000	467-4210	480	467-4410	480
950-1300	467-4215	480	467-4415	480
1200-1650	467-4220	480	467-4420	480

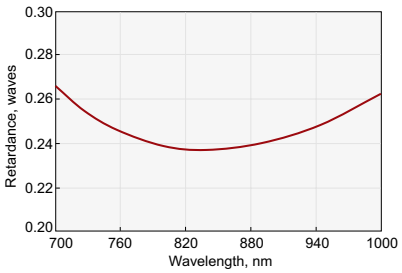
Retardation Curve samples:



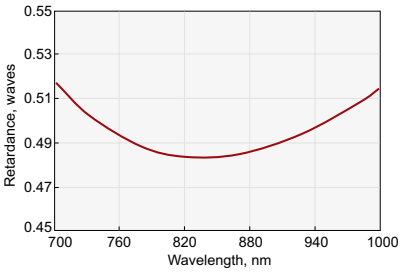
λ/4 @ 450-680 nm



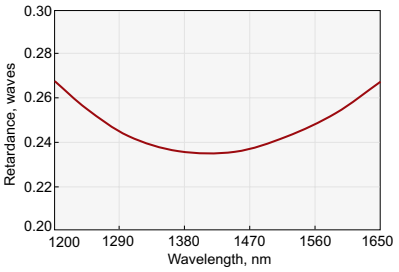
λ/2 @ 450-680 nm



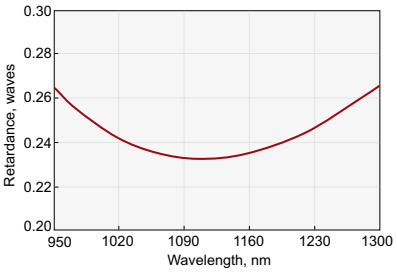
λ/4 @ 700-1000 nm



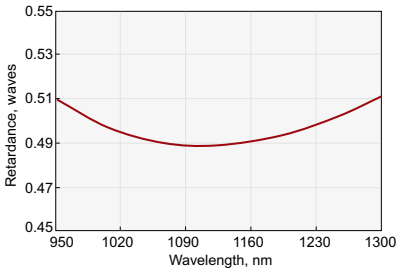
λ/2 @ 700-1000 nm



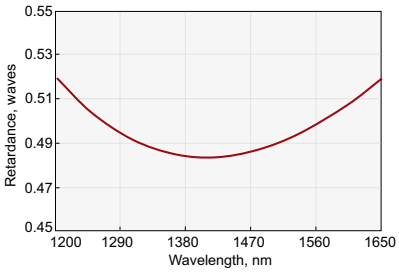
λ/4 @ 1200-1650 nm



λ/4 @ 950-1300 nm



λ/2 @ 950-1300 nm



λ/2 @ 1200-1650 nm

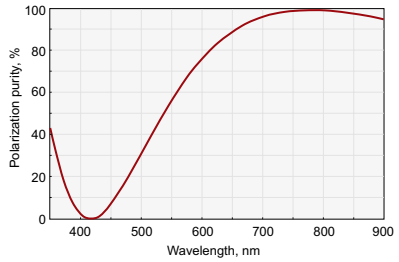
HOUSING ACCESSORIES

High Precision Rotation Polarizer, Waveplate Mount 840-0186

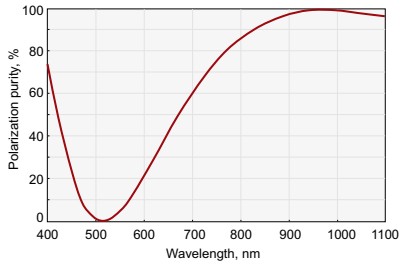
See page 7.49

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)
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

Code	Description	AR coated	Price, EUR
465-4211	optically contacted; λ/2@800 nm + λ@400 nm	800+400 nm	345
465-4212	optically contacted; λ/2@1030 nm + λ@515 nm	1030+515 nm	345
466-4211	air-spaced; λ/2@800 nm + λ@400 nm	800+400 nm	410
466-4212	air-spaced; λ/2@1030 nm + λ@515 nm	1030+515 nm	410

HOUSING ACCESSORIES

Polarizer Holders
840-0180
See page 7.48

LOW ORDER WAVEPLATES

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

Retardation plates are supplied mounted and have a multilayer dielectric anti-reflection coating on both sides maximising transmission.

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)
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	Price, EUR	Catalogue number	Price, EUR
1550	461-4201D12	105	461-4401D12	105
1064	461-4205D12	105	461-4405D12	105
1053	461-4206D12	105	461-4406D12	105
1030	461-4208D12	105	461-4408D12	105
800	461-4215D12	105	461-4415D12	105
780	461-4220D12	105	461-4420D12	105
633	461-4225D12	105	461-4425D12	105
532	461-4230D12	105	461-4430D12	105
515	461-4232D12	105	461-4432D12	105
355	461-4240D12	115	461-4440D12	115

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	Price, EUR	Catalogue number	Price, EUR
1550	461-4201	160	461-4401	160
1064	461-4205	160	461-4405	160
1053	461-4206	160	461-4406	160
1030	461-4208	160	461-4408	160
950	461-4210	160	461-4410	160
852	461-4213	160	461-4413	160
800	461-4215	160	461-4415	160
780	461-4220	160	461-4420	160
770	461-4221	160	461-4421	160
633	461-4225	160	461-4425	160
589	461-4228	160	461-4428	160
532	461-4230	160	461-4430	160
527	461-4231	160	461-4431	160
515	461-4232	160	461-4432	160
488	461-4233	160	461-4433	160
400	461-4235	160	461-4435	160
355	461-4240	192	461-4440	192
343	461-4241	192	461-4441	192

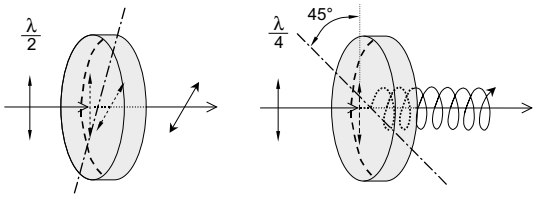
Please contact us for other wavelength, size or precision requirements.

MULTIPLE ORDER WAVEPLATES

- **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.

Retardation plates are supplied mounted and have a multilayer dielectric anti-reflection coating on both sides maximising transmission.



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)
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	Price, EUR	Catalogue number	Price, EUR
1550	462-4201D12	90	462-4401D12	90
1064	462-4205D12	90	462-4405D12	90
1053	462-4206D12	90	462-4406D12	90
1030	462-4208D12	90	462-4408D12	90
800	462-4215D12	90	462-4415D12	90
780	462-4220D12	90	462-4420D12	90
633	462-4225D12	90	462-4425D12	90
532	462-4230D12	90	462-4430D12	90
515	462-4232D12	90	462-4432D12	90
355	462-4240D12	95	462-4440D12	95

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

HOUSING ACCESSORIES

High Precision Rotation Polarizer, Waveplate Mount 840-0186

See page 7.49

Polarizer Holders 840-0180

See page 7.48

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

Wavelength, nm	Retardation λ/2		Retardation λ/4	
	Catalogue number	Price, EUR	Catalogue number	Price, EUR
1550	462-4201	138	462-4401	138
1064	462-4205	138	462-4405	138
1053	462-4206	138	462-4406	138
1030	462-4208	138	462-4408	138
950	462-4210	138	462-4410	138
852	462-4213	138	462-4413	138
800	462-4215	138	462-4415	138
780	462-4220	138	462-4420	138
770	462-4221	138	462-4421	138
633	462-4225	138	462-4425	138
589	462-4228	138	462-4428	138
532	462-4230	138	462-4430	138
527	462-4231	138	462-4431	138
515	462-4232	138	462-4432	138
448	462-4233	138	462-4433	138
400	462-4235	138	462-4435	138
355	462-4240	143	462-4440	143
343	462-4241	143	462-4441	143
266	462-4245	153	462-4445	153
257	462-4246	153	462-4446	153

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

MULTIPLE ORDER DUAL WAVELENGTH WAVEPLATES

- **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)
Parallelism	< 10 arcsec
AR coating	R < 0.5%
Nominal thickness of waveplate	0.2-1.2 mm
Laser damage threshold	5 J/cm^2, 10 nsec pulse, 1064 nm typical

HOUSING ACCESSORIES

High Precision Rotation Polarizer, Waveplate Mount 840-0186

See page 7.49

Polarizer Holders 840-0180

See page 7.48

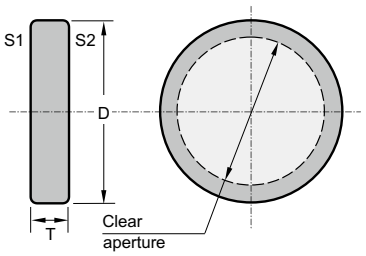
Retardation and Wavelength	Catalogue number	Price, EUR
λ @ 1064nm + λ/2 @ 532 nm	463-4120	215
λ @ 1064nm + λ/4 @ 532 nm	463-4140	215
λ/2 @ 1064nm + λ@ 532 nm	463-4210	215
λ/2 @ 1064nm + λ/2 @ 532 nm	463-4220	215
λ/2 @ 1064nm + λ/4 @ 532 nm	463-4240	215
λ/4 @ 1064nm + λ @ 532 nm	463-4410	215
λ/4 @ 1064nm + λ/2 @ 532 nm	463-4420	215
λ/4 @ 1064nm + λ/4 @ 532 nm	463-4440	215
λ @ 800nm + λ/2 @ 400nm	463-4121	215
λ @ 800nm + λ/4 @ 400nm	463-4141	215
λ/2 @ 800nm + λ @ 400nm	463-4211	215
λ/2 @ 800nm + λ/2 @ 400nm	463-4221	215
λ/2 @ 800nm + λ/4 @ 400nm	463-4241	215
λ/4 @ 800nm + λ @ 400nm	463-4411	215
λ/4 @ 800nm + λ/2 @ 400nm	463-4421	215
λ/4 @ 800nm + λ/4 @ 400nm	463-4441	215

POLARIZATION PLANE ROTATORS

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

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

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.



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

Catalogue number	Center wavelength, nm	Rotation angle of polarization plane, deg	Price, EUR
470-4644	1064	45	215
470-4649	1064	90	215
470-4904	1030	45	215
470-4909	1030	90	215
470-4804	800	45	195
470-4809	800	90	195
470-4784	780	45	195
470-4789	780	90	195
470-4634	633	45	195
470-4639	633	90	195
470-4534	532	45	195
470-4539	532	90	195
470-4514	515	45	195
470-4519	515	90	195
470-4414	413	45	195
470-4419	413	90	195
470-4044	400	45	195
470-4049	400	90	195
470-4354	355	45	195
470-4359	355	90	195
470-4344	343	45	195
470-4349	343	90	195
470-4264	266	45	245
470-4269	266	90	245
470-4254	257	45	245
470-4259	257	90	245
470-4244	244	45	245
470-4249	244	90	245

Please contact us for other size or wavelengths requirements.

RELATED PRODUCTS

Kinematic Mirror and Beamsplitter Mount 840-0020

See page 7.33

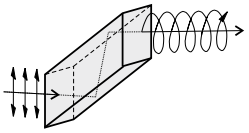
Kinematic Positioning Mount 840-0193

See page 7.51

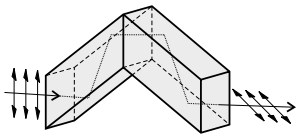
FRESNEL RHOMBS

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

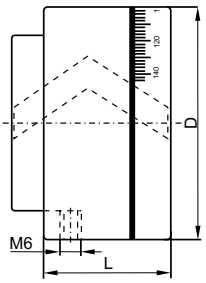
Due to unequal phase shifts arising in orthogonally polarized components of an incident wave at total internal reflection, Fresnel Rhombs are used to alter the polarization type of radiation. They are designed so that two full internal reflections inside a rhomb provide π/2 phase difference between the 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/4 Fresnel rhomb



λ/2 Fresnel rhomb



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	Catalogue number	Wavelength range, nm	Retardation	Clear aperture, mm	Price, EUR
BK7	481-0210	600–900	λ/2	10	368
	481-0410	600–900	λ/4	10	186
	481-0212	400–700	λ/2	10	368
	481-0414	400–700	λ/4	10	186
UV FS	481-1210	210–400	λ/2	10	491
	481-1410	210–400	λ/4	10	296

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

Mounted

Material	Catalogue number	Wavelength range, nm	Retardation	Clear aperture, mm	Holder diameter D, mm	Holder lenght L, mm	Price, EUR
BK7	480-0210	600–900	λ/2	10	73	55	659
	480-0410	600–900	λ/4	10	65	25	336
	480-0212	400–700	λ/2	10	73	55	659
	480-0414	400–700	λ/4	10	65	25	336
UV FS	480-1210	210–400	λ/2	10	73	55	782
	480-1410	210–400	λ/4	10	65	25	446

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

UV & IR Optics

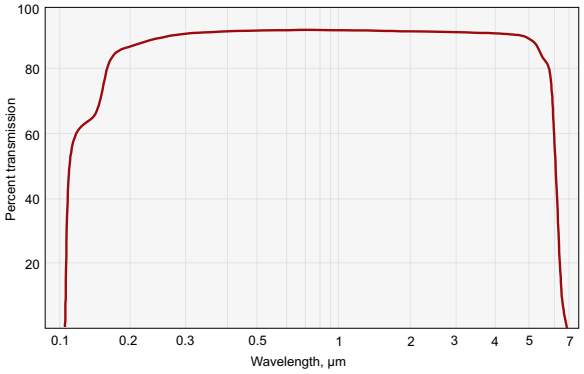
LITHIUM FLUORIDE (LiF) COMPONENTS

- **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

See page 7.29

Catalogue number	Diameter, mm	Thickness, mm	Substrate	Price, EUR
510-5253	25.4	3.0	UV grade LiF	102
510-5384	38.1	4.0	UV grade LiF	215
510-5506	50.8	6.0	UV grade LiF	315

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

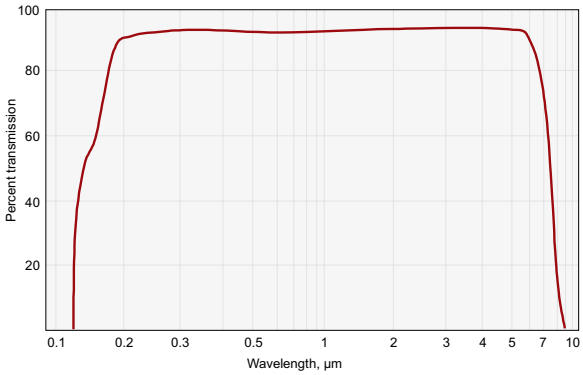
MAGNESIUM FLUORIDE (MgF_2) COMPONENTS

- **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.

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.



External transmission of MgF_2 window of 10 mm thickness.

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

Catalogue number	Diameter, mm	Thickness, mm	Substrate	Price, EUR
520-5253	25.4	3.0	UV grade MgF_2	130
520-5385	38.1	5.0	UV grade MgF_2	230
520-5506	50.8	6.0	UV grade MgF_2	370
520-6253	25.4	3.0	IR grade MgF_2	110
520-6385	38.1	5.0	IR grade MgF_2	215
520-6506	50.8	6.0	IR grade MgF_2	350

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

HOUSING ACCESSORIES

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

See page 7.35

CALCIUM FLUORIDE (CaF_2) COMPONENTS

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

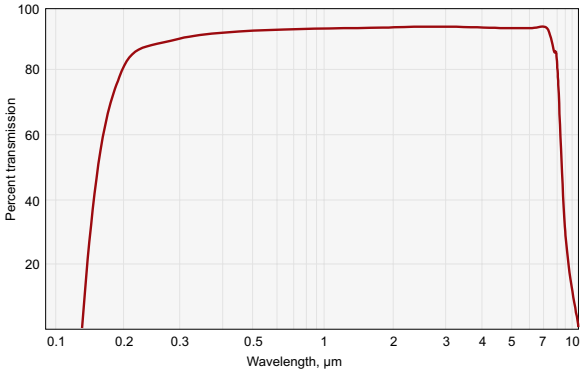
Two grades of materials are available: one for UV and the other for IR applications. Low solubility and a wide transmission range makes it useful for many applications, including:

– 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

Catalogue number	Diameter, mm	Thickness, mm	Substrate	Price, EUR
530-6251	25.4	1.0	UV grade CaF_2	80
530-6252	25.4	2.0	UV grade CaF_2	76
530-5253	25.4	3.0	UV grade CaF_2	70
530-5385	38.1	5.0	UV grade CaF_2	150
530-5506	50.8	6.0	UV grade CaF_2	250
530-6253	25.4	3.0	IR grade CaF_2	60
530-6385	38.1	5.0	IR grade CaF_2	99
530-6506	50.8	6.0	IR grade CaF_2	175
530-6710	70.0	10.0	IR grade CaF_2	230
530-6756	75.0	6.0	IR grade CaF_2	300

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

Catalogue number	Diameter, mm	Thickness, mm	Substrate	Price, EUR
530-6121	12.0	1	IR grade CaF_2	5

HOUSING ACCESSORIES

Flipping Mirror / Beamsplitter Mounts 840-0155

See page 7.45

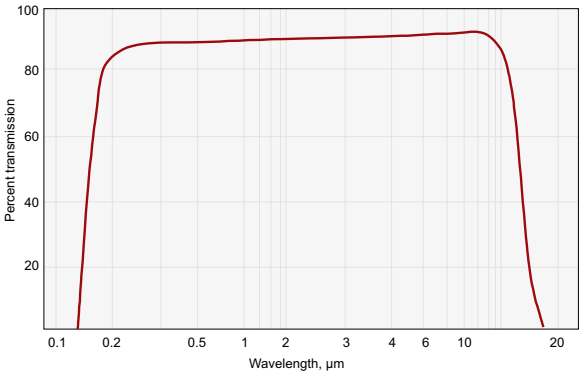
BARIUM FLUORIDE (BaF_2) COMPONENTS

- **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/cm^3	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

Catalogue number	Diameter, mm	Thickness, mm	Price, EUR
540-7252	25.4	2	60
540-7251	25.4	3	60
540-7445	44.6	3.5	100
540-7503	50.8	3	220

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 dia	100 mm

HOUSING ACCESSORIES

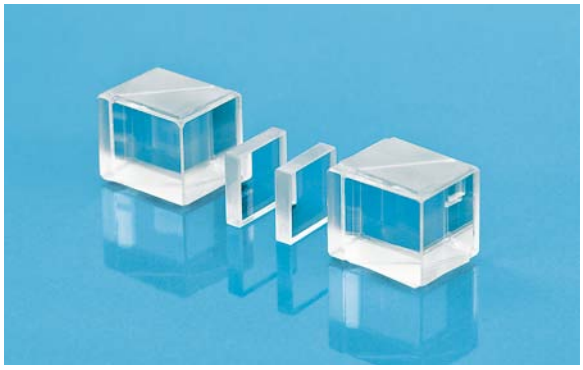
Self-Centring Lens Mounts 830-0010

See page 7.25

Catalogue number	Diameter, mm	Focal length, mm	Type	Price, EUR
541-7105	12.7	25	plano-convex	89
541-7204	25.4	40	plano-convex	145
541-7205	25.4	50	plano-convex	134
541-7207	25.4	75	plano-convex	120
541-7210	25.4	100	plano-convex	109
541-7212	25.4	125	plano-convex	109
541-7213	25.4	150	plano-convex	109
541-7214	25.4	200	plano-convex	109
541-7225	25.4	250	plano-convex	109
541-7230	25.4	300	plano-convex	109
541-7275	25.4	750	plano-convex	109
541-7250	25.4	1000	plano-convex	109
542-7105	12.7	-25	plano-concave	89
542-7205	25.4	-50	plano-concave	134
542-7207	25.4	-75	plano-concave	120
542-7210	25.4	-100	plano-concave	109
542-7225	25.4	-250	plano-concave	109
542-7250	25.4	-1000	plano-concave	109
542-7270	25.4	-2000	plano-concave	109

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

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/cm^3	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} m^2/V^2	1.53	0.94	11
σ	-1.2	-0.6	-1.8
GVD, fs^2/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

Catalogue Number	Size, mm	Thickness, mm	Orientation	Price, EUR
540-7105	10x10	0.5	[011]	180
540-7110	10x10	1.0	[011]	180
540-7115	10x10	1.5	[011]	180
540-7120	10x10	2.0	[011]	180
540-7125	10x10	2.5	[011]	180
540-7130	10x10	3.0	[011]	180

Mounted into Open Ring Holder

Catalogue Number	Size, mm	Thickness, mm	Orientation	Price, EUR
540-7105M	10x10	0.5	[011]	230
540-7110M	10x10	1.0	[011]	230
540-7115M	10x10	1.5	[011]	230
540-7120M	10x10	2.0	[011]	230
540-7125M	10x10	2.5	[011]	230
540-7130M	10x10	3.0	[011]	230

SAPPHIRE (Al_2O_3) COMPONENTS

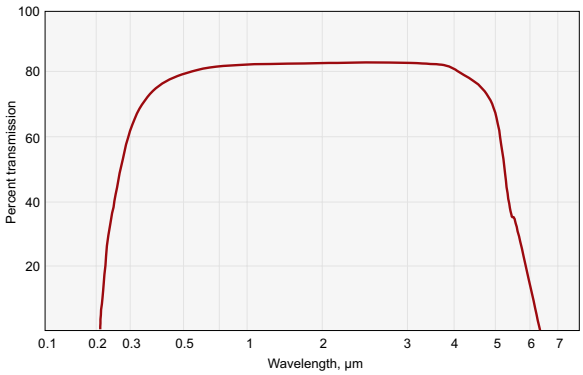
- **The hardest of the oxide crystals**
- **Excellent transparency and thermal properties**
- **Chemically inert and insoluble**
- **Can be safely made much thinner than windows from glass or other crystals**

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

Catalogue number	**Diameter,** mm	**Thickness,** mm	**Price,** EUR
550-7120	12.7	0.5	26
550-7121	12.7	1	25
550-7122	12.7	2	25
550-7123	12.7	3	25
550-7124	12.7	4	27
550-7126	12.7	6	30
550-7200	20.0	0.5	35
550-7201	20.0	1	35
550-7202	20.0	2	35
550-7250	25.4	0.5	45
550-7251	25.4	1	45
550-7252	25.4	2	45
550-7253	25.4	3	45
550-7254	25.4	4	45
550-7255	25.4	5	50
550-7382	38.1	2	109
550-7502	50.0	2	157
550-7503	50.0	3	165

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

HOUSING ACCESSORIES

Mirror / Beamsplitter Mount 840-0036

See page 7.36

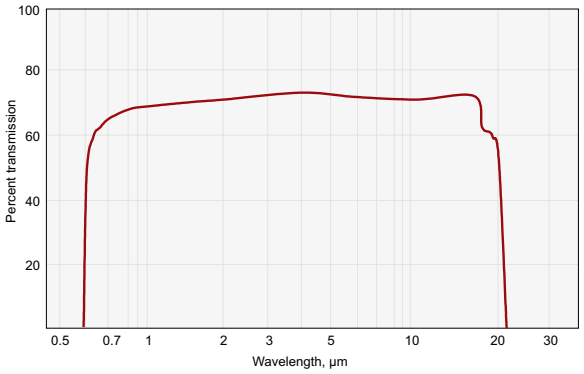
ZINC SELENIDE (ZnSe) COMPONENTS

- **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.

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.



External transmission of ZnSe window of 10 mm thickness.

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
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

Catalogue number	Diameter, mm	Thickness, mm	Price, EUR
560-6120	12.7	2.0	55
560-6121	12.7	3.0	57
560-6250	25.4	2.0	69
560-6251	25.4	3.0	73
560-6381	38.1	3.0	135
560-6501	50.8	3.0	270
560-6503	50.8	5.0	340

Coated AR/AR@10.6 µm, AOI=0°

Catalogue number	Diameter, mm	Thickness, mm	Price, EUR
560-6122	12.7	2.0	85
560-6253	25.4	3.0	130
560-6383	38.1	3.0	205
560-6505	50.8	5.0	410
560-6766	76.2	6.4	995

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

Catalogue number	Diameter, mm	Focal length, mm	Price, EUR
561-6122	12.7	25.4	185
561-6192	19.1	38.1	185
561-6251	25.4	50	195
561-6252	25.4	63.5	195
561-6253	25.4	75	195
561-6254	25.4	100	195
561-6255	25.4	127	190
561-6256	25.4	150	190

Catalogue number	Diameter, mm	Focal length, mm	Price, EUR
561-6257	25.4	200	190
561-6258	25.4	254	190
561-6382	38.1	63.5	315
561-6385	38.1	127	308
561-6388	38.1	190.5	308
561-6502	50.8	127	580
561-6765	76.2	254	1390

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
See page 7.30

Catalogue number	Diameter, mm	Focal length, mm	Price, EUR
565-6122	12.7	38.1	215
565-6251	25.4	25.4	224
565-6252	25.4	38.1	224
565-6253	25.4	50	217
565-6255	25.4	63.5	217
565-6256	25.4	75	217
565-6257	25.4	100	217
565-6258	25.4	127	217
565-6382	38.1	63.5	345
565-6385	38.1	127	345
565-6388	38.1	254	345
565-6502	50.8	127	612
565-6765	76.2	254	1450

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%

Catalogue number	Diameter, mm	Thickness, mm	Price, EUR
575-6250	25.4	3	59
575-6380	38.1	4	94
575-6500	50.8	5	159

Silicon (Si) Windows

SPECIFICATIONS

Coating	uncoated
Parallelism	3 arcmin

Catalogue number	Diameter, mm	Thickness, mm	Price, EUR
575-6250U	25.4	3	95
575-6500U	50.8	3	160

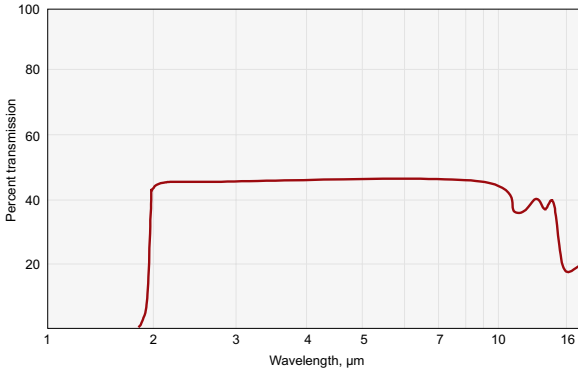
GERMANIUM (Ge) COMPONENTS

- **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/cm^3	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

Catalogue number	Diameter, mm	Thickness, mm	Coating	Price, EUR
580-6023	25.4	3.0	uncoated	99
580-6034	38.1	4.0	uncoated	210
580-6055	50.8	5.0	uncoated	299
580-6123	25.4	3.0	AR/AR @ 10.6 µm	159
580-6134	38.1	4.0	AR/AR @ 10.6 µm	269
580-6155	50.8	5.0	AR/AR @ 10.6 µm	370

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

HOUSING ACCESSORIES

Kinematic Mirror and Beamsplitter Mount 840-0020

See page 7.33

Crystals

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Barium & Strontium Tungstate-Molybdate – $BaWO_4$ 2.23
Passive Q-switching Crystals – $Co^{2+}:MgAl_2O_4$, $Cr^{4+}:YAG$ 2.24

POSITIONERS & HOLDERS

Ring Holders for Nonlinear Crystals 830-0001 ..... 2.25
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CRYSTAL OVENS

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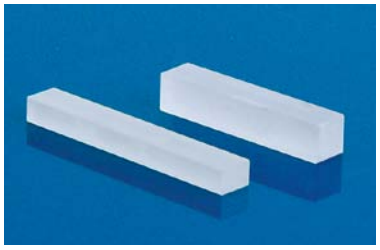
Nonlinear Crystals

LBO — LITHIUM TRIBORATE



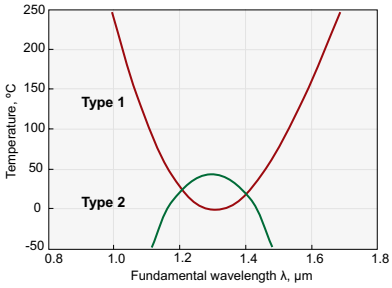
- **Wide transparency region**
- **Broad Type 1 and Type 2**
- **Non-critical phase-matching (NCPM) range**
- **Small walk-off angle**
- **High damage threshold**
- **Wide acceptance angle**
- **High optical homogeneity**

LBO is well suited for various nonlinear optical applications:

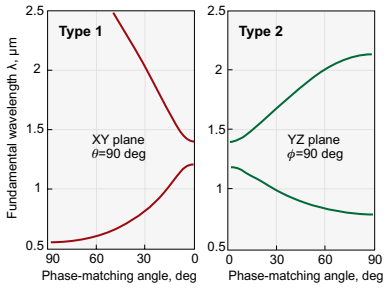
- frequency doubling and tripling of high peak power pulsed Nd doped, Ti:Sapphire and Dye lasers
- optical parametric oscillators (OPO) of both Type 1 and Type 2 phase-matching
- non-critical phase-matching for frequency conversion of CW and quasi-CW radiation.

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



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
- Thin crystals down to 10 μm thickness
- AR, BBAR, P-coatings
- Different mounting and repolishing services

Please contact EKSMA OPTICS for special OEM and large volume pricing.

STANDARD CRYSTALS LIST

Code	Size, mm	θ, deg	φ, deg	Coating	Application	Price, EUR
LBO-401	3x3x10	90	11.6	AR/AR @ 1064+532 nm	SHG @ 1064 nm	245
LBO-402	3x3x15	90	11.6	AR/AR @ 1064+532 nm	SHG @ 1064 nm	325
LBO-301	4x4x10	90	11.6	AR/AR @ 1064+532 nm	SHG @ 1064 nm	510
LBO-302	4x4x15	90	11.6	AR/AR @ 1064+532 nm	SHG @ 1064 nm	630
LBO-303	4x4x20	90	11.6	AR/AR @ 1064+532 nm	SHG @ 1064 nm	745
LBO-501	5x5x10	90	11.6	AR/AR @ 1064+532 nm	SHG @ 1064 nm	655
LBO-503	5x5x15	90	11.6	AR/AR @ 1064+532 nm	SHG @ 1064 nm	765
LBO-502	5x5x20	90	11.6	AR/AR @ 1064+532 nm	SHG @ 1064 nm	940
LBO-404	3x3x15	90	0	AR/AR @ 1064+532 nm	NCPM SHG @ 1064 nm, T = 149 °C	325
LBO-405	3x3x20	90	0	AR/AR @ 1064+532 nm	NCPM SHG @ 1064 nm, T = 149 °C	405
LBO-409	3x3x30	90	0	AR/AR @ 1064+532 nm	NCPM SHG @ 1064 nm, T = 149 °C	710
LBO-410	3x3x50	90	0	AR/AR @ 1064+532 nm	NCPM SHG @ 1064 nm, T = 149 °C	1300
LBO-304	4x4x10	90	0	AR/AR @ 1064+532 nm	NCPM SHG @ 1064 nm, T = 149 °C	510
LBO-305	4x4x15	90	0	AR/AR @ 1064+532 nm	NCPM SHG @ 1064 nm, T = 149 °C	630
LBO-306	4x4x20	90	0	AR/AR @ 1064+532 nm	NCPM SHG @ 1064 nm, T = 149 °C	745
LBO-406	3x3x10	42.2	90	AR/AR @ 1064+532/355 nm	THG @ 1064 nm	245
LBO-407	3x3x15	42.2	90	AR/AR @ 1064+532/355 nm	THG @ 1064 nm	325
LBO-307	4x4x10	42.2	90	AR/AR @ 1064+532/355 nm	THG @ 1064 nm	510
LBO-308	4x4x15	42.2	90	AR/AR @ 1064+532/355 nm	THG @ 1064 nm	630
LBO-507	5x5x10	42.2	90	AR/AR @ 1064+532/355 nm	THG @ 1064 nm	655
LBO-508	5x5x15	42.2	90	AR/AR @ 1064+532/355 nm	THG @ 1064 nm	765

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	$d_{31} = -(0.98 \pm 0.09)$ pm/V; $d_{32} = (1.05 \pm 0.09)$ pm/V; $d_{33} = (0.05 \pm 0.006)$ 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 5.38*

Crystal Oven TC2
See page 2.27

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 (see technical specifications, p. 2.27).

Heatpoint Crystal Oven
See page 2.28

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

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

WE OFFER:

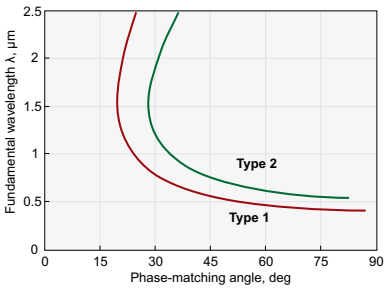
- Crystal aperture up to 22×22 mm
- Crystal length up to 25 mm
- Thin crystals down to 5 μm thickness
- AR, BBAR, P-coating
- BBO with gold electrodes for e/o applications
- Different mounting and repolishing services

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

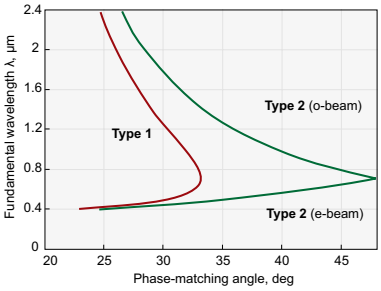
- harmonic generations (up to fifth) of Nd doped lasers
- frequency doubling and tripling of ultrashort pulse Ti:Sapphire and Dye lasers
- optical parametric oscillators (OPO) at both Type 1(ooe) and Type 2 (eoe) phase-matching
- frequency doubling of Argon ion and Copper vapour laser radiation
- electro-optic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

STANDARD CRYSTALS LIST

Catalogue number	Size, mm	θ, deg	φ, deg	Coating	Application	Price, EUR
BBO-601H	6×6×0.1	29.2	90	P/P @ 400-800 nm	SHG @ 800 nm, Type 1	505
BBO-602H	6×6×0.2	29.2	90	P/P @ 400-800 nm	SHG @ 800 nm, Type 1	505
BBO-603H	6×6×0.5	29.2	90	P/P @ 400-800 nm	SHG @ 800 nm, Type 1	440
BBO-604H	6×6×1	29.2	90	P/P @ 400-800 nm	SHG @ 800 nm, Type 1	390
BBO-605H	6×6×2	29.2	90	P/P @ 400-800 nm	SHG @ 800 nm, Type 1	360
BBO-609H	6×6×0.1	44.3	90	P/P @ 400-800/266 nm	THG @ 800 nm, Type 1	505
BBO-610H	6×6×0.2	44.3	90	P/P @ 400-800/266 nm	THG @ 800 nm, Type 1	505
BBO-611H	6×6×0.5	44.3	90	P/P @ 400-800/266 nm	THG @ 800 nm, Type 1	440
BBO-612H	6×6×1	44.3	90	P/P @ 400-800/266 nm	THG @ 800 nm, Type 1	390
BBO-1001H	10×10×0.1	29.2	90	P/P @ 400-800 nm	SHG @ 800 nm, Type 1	800
BBO-1002H	10×10×0.2	29.2	90	P/P @ 400-800 nm	SHG @ 800 nm, Type 1	790
BBO-1003H	10×10×0.5	29.2	90	P/P @ 400-800 nm	SHG @ 800 nm, Type 1	760
BBO-1004H	10×10×1	29.2	90	P/P @ 400-800 nm	SHG @ 800 nm, Type 1	765
BBO-1005H	10×10×2	29.2	90	P/P @ 400-800 nm	SHG @ 800 nm, Type 1	830
BBO-1009H	10×10×0.1	44.3	90	P/P @ 400-800/266 nm	THG @ 800 nm, Type 1	800
BBO-1010H	10×10×0.2	44.3	90	P/P @ 400-800/266 nm	THG @ 800 nm, Type 1	790
BBO-1011H	10×10×0.5	44.3	90	P/P @ 400-800/266 nm	THG @ 800 nm, Type 1	760
BBO-1012H	10×10×1	44.3	90	P/P @ 400-800/266 nm	THG @ 800 nm, Type 1	785

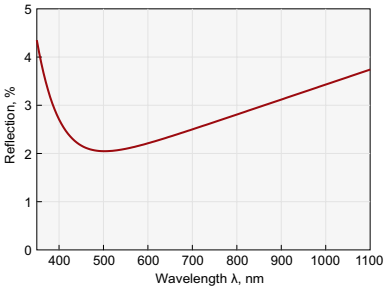
Wide selection of non-standard size and cut angle BBO crystals is available at **www.eksmaoptics.com**

Please contact EKSMA OPTICS for special OEM and large volume pricing.

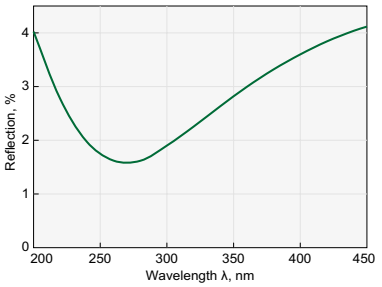
PHYSICAL AND OPTICAL PROPERTIES

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	

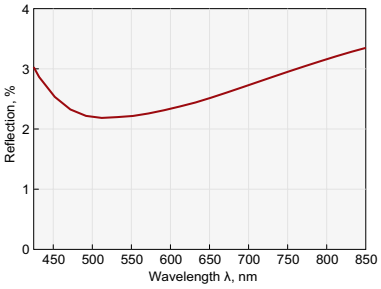
P-protective coating. It's a single or two layers antireflection coating made at specified wavelength range. Typical reflection values are R≈2% in the mid range, R<4% at the edges. P coating is recommended for ultrashort pulses applications and features low dispersion.



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)

RELATED PRODUCTS

Thin BBO crystals for SHG and THG of Ti:Sapphire laser wavelength
See page 5.31

BBO crystals for SHG of Yb:KGW/KYW laser frequency conversion
See page 5.38

HOUSING ACCESSORIES

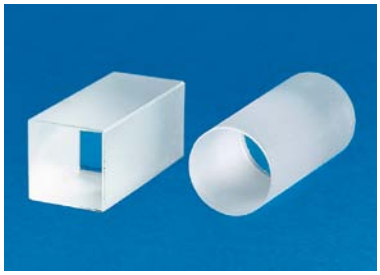
Ring Holders for Nonlinear Crystals
See page 2.25

Positioning Mount 840-0199 for Nonlinear Crystal Housing

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

See page 2.26

KDP • DKDP POTASSIUM DIDEUTERIUM PHOSPHATE



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

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.

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

- 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

Code	Size, mm	θ, deg	φ, deg	Coating	Application	Price, EUR
DKDP-401	15x15x13	36.5	45	AR/AR @ 1064+532 nm	SHG @ 1064 nm, Type 1	485
DKDP-402	15x15x13	53.5	0	AR/AR @ 1064+532 nm	SHG @ 1064 nm, Type 2	485
DKDP-403	12x12x20	59.3	0	AR/AR @ 1064+532 / 355 nm	THG @ 1064 nm, Type 2	475
DKDP-404	12x12x20	53.5	0	AR/AR @ 1064 / 1064+532 nm	SHG @ 1064 nm	475
DKDP-405	15x15x20	53.5	0	AR/AR @ 1064 / 1064+532 nm	SHG @ 1064 nm	579
DKDP-406	15x15x20	59.3	0	AR/AR @ 1064+532 / 355 nm	THG @ 1064 nm	579
KDP-401	12x12x5	76.5	45	AR/AR @ 532/266 nm	SHG @ 532 nm	405
KDP-402	15x15x7	76.5	45	AR/AR @ 532/266 nm	SHG @ 532 nm	480

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

Please contact EKSMA OPTICS for special OEM and large volume pricing.

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}= 1.9×10^{-2}	k_{11}= 1.9×10^{-2} k_{33}= 2.1×10^{-2}
Thermal expansion coefficients, K^{-1}		a_{11}= 2.5×10^{-5} a_{33}= 4.4×10^{-5}	a_{11}= 1.9×10^{-5} a_{33}= 4.4×10^{-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		$d_{ooe} = d_{36} \times \sin\theta \times \sin 2\varphi$ $d_{eoe} = d_{36} \times \sin\theta \times \cos 2\varphi$	
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!

RELATED PRODUCTS

Nonlinear Crystal Oven CH8

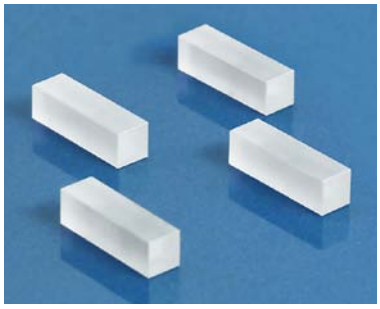
See page 2.29

Nonlinear Crystal Oven CH9

See page 2.30

DKDP and KDP crystals are highly hygroscopic. CH8 and CH9 ovens help to protect hygroscopic crystals from moisture. The raised working temperature (40-60 °C) allows to extend crystal lifetime and to keep it thermostable. This helps to stabilise SHG efficiency.

KTP POTASSIUM TITANYL PHOSPHATE



- **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.

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

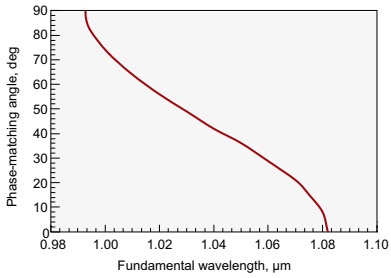


Fig. 1. *Type 2 SHG in x-y plane*

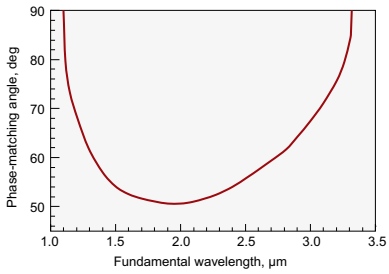


Fig. 2. *Type 2 SHG in x-z plane*

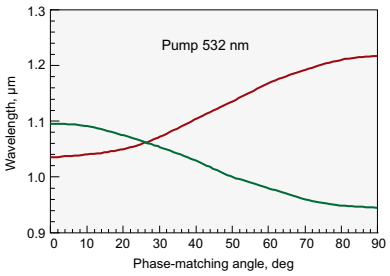


Fig. 3. *OPO tuning curve in x-y plane*

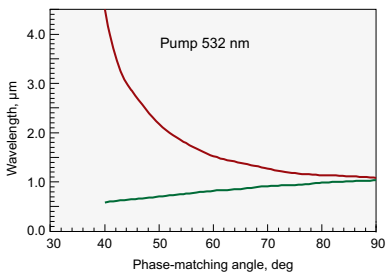


Fig. 4. *OPO tuning curve in x-z plane*

Fig. 1 represents Type 2 SHG tuning curve of KTP in x-y plane. In x-y plane the slope $\partial(\Delta k)/\partial\theta$ 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 $\partial(\Delta k)/\partial\lambda$ 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

Code	Size, mm	θ, deg	φ, deg	Coating	Application	Price, EUR
KTP-401	3x3x5	90	23.5	AR/AR @ 1064+532 nm	SHG @ 1064 nm	76
KTP-402	3x3x10	90	23.5	AR/AR @ 1064+532 nm	SHG @ 1064 nm	109
KTP-403	4x4x6	90	23.5	AR/AR @ 1064+532 nm	SHG @ 1064 nm	118
KTP-404	7x7x9	90	23.5	AR/AR @ 1064+532 nm	SHG @ 1064 nm	529

Please contact EKSMA OPTICS for special OEM and large volume pricing.

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	ΔT = 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 2.27

Ring Holders for Nonlinear Crystals
See page 2.25

Heatpoint Crystal Oven
See page 2.28

Positioning Mount 840-0199 for Nonlinear Crystal Housing
See page 2.26

KTA — POTASSIUM TITANYLE ARSENATE

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

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

WE OFFER:

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

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

STANDARD CRYSTALS LIST

Code	Size, mm	θ, deg	φ, deg	Coating	Application	Price, EUR
KTA-503	5×5×20	45	0	AR/AR @ 1064+(1500-4500) nm	Nanosecond OPO @ 1064 nm	1985
KTA-504	5×5×10	45	0	AR/AR @ 1064+(1500-4500) nm	Picosecond OPG/A @ 1064 nm	1060
KTA-601H	6×6×1	47	0	AR/AR @ 1.2-2.4/2.6-5.0 μm	DFG @ 1.2-2.4 μm	675
KTA-602H	6×6×3	46	0	AR/AR @ 1030+(1700-5000) nm	OPO @ 1030 nm	590

Please contact EKSMA OPTICS for special OEM and large volume pricing.

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/cm³	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/cm² 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

Code	Size, mm	Orientation	Coating	Price, EUR
LNO-602	6×6×25	z-cut	AR/AR @ 1064 nm	550
LNO-901	9×x9×25	z-cut	AR/AR @ 1064 nm	620

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 × 10^{-6} / K at 1.4 μm dn_e/dT = 39.073 × 10^{-6} / K at 1.4 μm

$LiIO_3$ LITHIUM IODATE

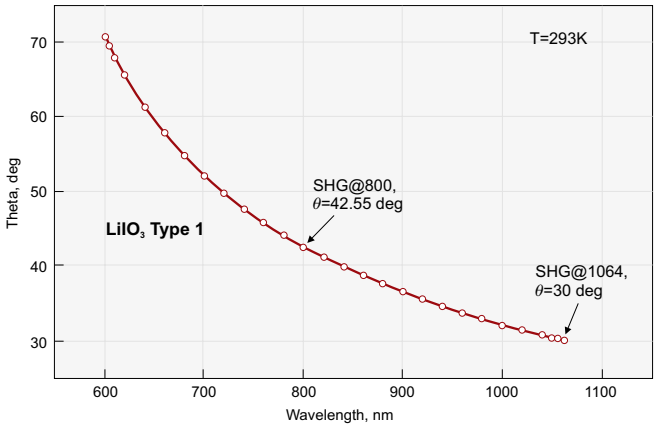
- **High nonlinear optical coefficients**
- **Wide transparency range**
- **Low damage threshold – not recommended for high power applications**

APPLICATIONS

- Harmonic generators
- Thin $LiIO_3$ for autocorrelation measurements

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



$LiIO_3$ Second harmonic generation phasematching

PHYSICAL AND OPTICAL PROPERTIES

Crystal structure		hexagonal
Point group		6
Density, g/cm³		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_{15}, pm/V		2.2 (at 1064 nm)
Effective nonlinearity		$d_{ooe} = d_{15}\sin\theta$
Damage threshold, MW/cm²		> 100 for TEM_{00}, 1064 nm, 10 ns, 10 Hz
Wavelength dispersion of refractive indices (λ – in μm)		
$n_o^2 = 2.083648 + \frac{1.332068\,\lambda^2}{\lambda^2 - 0.035306} - 0.008525\,\lambda^2$		$n_e^2 = 1.673463 + \frac{1.245229\,\lambda^2}{\lambda^2 - 0.028224} - 0.003641\,\lambda^2$

HOUSING ACCESSORIES

Ring Holders for Nonlinear Crystals

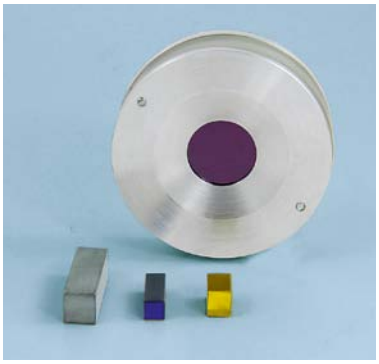
See page 2.25

Positioning Mount 840-0199 for Nonlinear Crystal Housing

See page 2.26

$ZnGeP_2$ • $AgGaSe_2$ $AgGaS_2$ • GaSe

INFRARED NONLINEAR CRYSTALS



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).

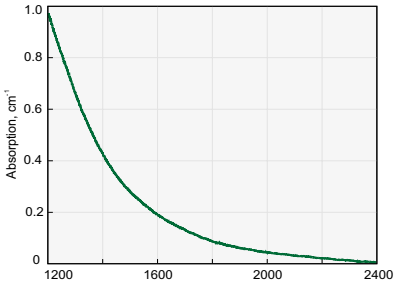
$ZnGeP_2$

$ZnGeP_2$ (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:

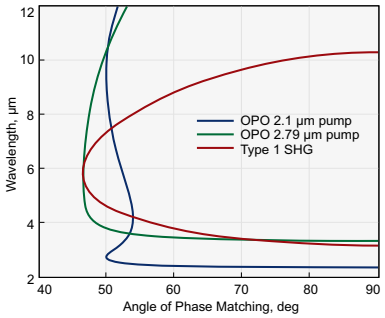
- up-conversion of CO_2 and CO laser radiation to near IR range via harmonics generation and mixing processes;
- efficient SHG of pulsed CO, CO_2 and chemical DF-laser;
- efficient down conversion of Holmium, Thulium and Erbium and laser wavelengths to mid infrared wavelength ranges by OPO process.

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

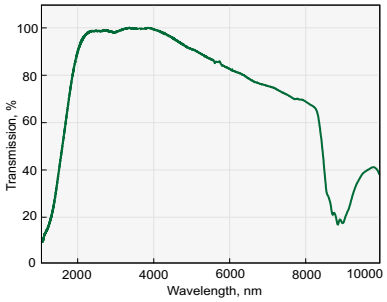
Typical absorption coefficient is <0.03 cm^{-1} at 2.5 - 8.2 μm range.



Absorption spectra of $ZnGeP_2$ crystal near 2 μm



Type 1 OPO and SHG tuning curves in $ZnGeP_2$



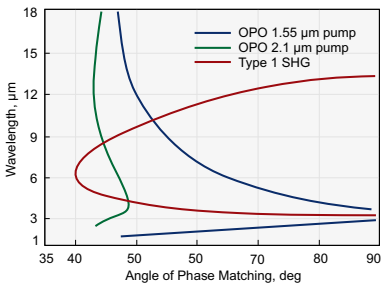
Transmission spectra of 15 mm long AR coated $ZnGeP_2$ crystal for OPO @ 2.1 μm

TYPE 1 $ZnGeP_2$ CRYSTALS for OPO at 3.5-5 μm range pumped at ~2.1 μm

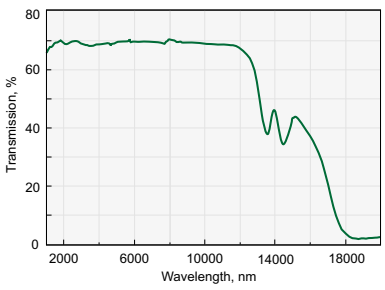
Catalogue number	Size, mm	θ, deg	φ, deg	Coating	Application
ZGP-401	7×5×15	54	0	AR @ 2.1 μm + BBAR @ 3.5-5 μm	OPO@2.1 → 3.5-5 μm
ZGP-402	7×5×20	54	0	AR @ 2.1 μm + BBAR @ 3.5-5 μm	OPO@2.1 → 3.5-5 μm
ZGP-403	7×5×25	54	0	AR @ 2.1 μm + BBAR @ 3.5-5 μm	OPO@2.1 → 3.5-5 μm

$AgGaSe_2$

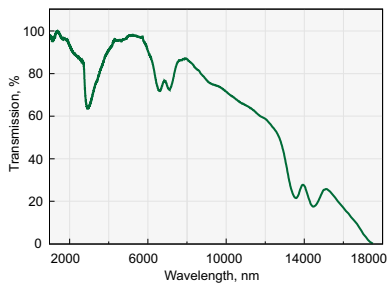
$AgGaSe_2$ has band edges at 0.73 and 18 μm. Its useful transmission range of 0.9–16 μm and wide phase matching capability provide excellent potential for OPO applications when pumped by a variety of currently available lasers. Tuning from 2.5–12 μm has been obtained when pumping by Ho:YLF laser at 2.05 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 $AgGaSe_2$



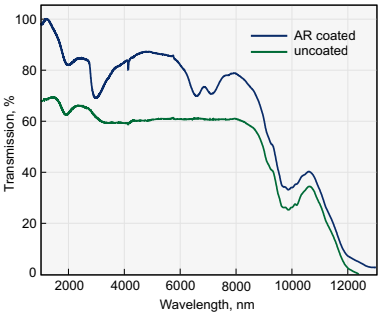
Transmission spectra of 18 mm long uncoated $AgGaSe_2$ crystal



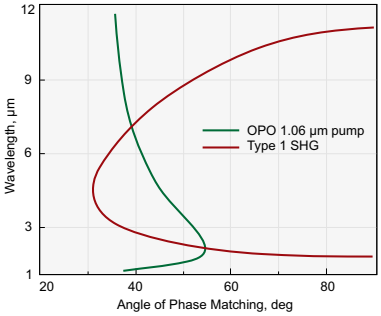
Transmission spectra of 25 mm long AR coated $AgGaSe_2$ crystal

$AgGaS_2$

$AgGaS_2$ 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 counter-measure 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 $AgGaS_2$

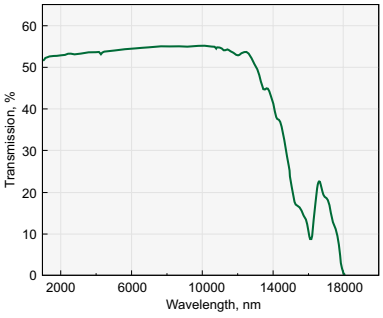
LIST OF STANDARD $AgGaS_2$ CRYSTALS

Code	Size, mm	θ, deg	φ, deg	Coating	Application	Price, EUR
AGS-401H	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	835
AGS-402H	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	1345
AGS-403H	5×5×0.4	34	45	BBAR/BBAR @ 3-6 / 1.5-3 μm	SHG @ 3-6 μm, Type 1	995
AGS-404H	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	995
AGS-801H	8×8×0.4	39	45	BBAR/BBAR @ 1.1-2.6 / 2.6-11 μm	DFG @ 1.2-2.4 μm, Type 1	2340
AGS-802H	8×8×1	39	45	BBAR/BBAR @ 1.1-2.6 / 2.6-11 μm	DFG @ 1.2-2.4 μm, Type 1	2140

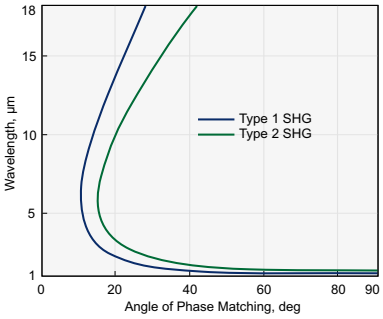
Crystals are mounted into open ring holders (see page 2.25).

GaSe

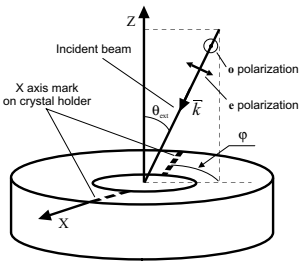
GaSe has band edges at 0.65 and 18 μm. GaSe has been successfully used for efficient SHG of CO_2 laser, for SHG of pulsed CO, CO_2 and chemical DF-laser (λ = 2.36 μm) radiation; up conversion of CO and CO_2 laser radiation into the visible range; infrared pulses generation via difference frequency mixing 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

Catalogue number	Clear aperture, mm	Thickness, μm	Holder, mm	Price, EUR
GaSe-10H1	Ø7	10	Ø25.4	1950
GaSe-30H1	Ø7	30	Ø25.4	1625
GaSe-100H1	Ø7	100	Ø25.4	1475
GaSe-500H1	Ø7	500	Ø25.4	1460
GaSe-1000H1	Ø7	1000	Ø25.4	1635
GaSe-2000H1	Ø7	2000	Ø25.4	1810

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 2.25

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/cm²	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 fsec²/mm	196 fsec²/mm
LBO	47 fsec²/mm	128 fsec²/mm
KDP	27 fsec²/mm	107 fsec²/mm
$LiIO_3$	196 fsec²/mm	589 fsec²/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 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	5×5 mm	20×20 mm	0.1 mm
LBO	5×5 mm	30×30 mm	0.1 mm
KDP	4×4 mm	100×100 mm	0.1 mm*
$LiIO_3$	4×4 mm	50×50 mm	0.1 mm*
$AgGaS_2$	5×5 mm	15×15 mm	0.1 mm
GaSe	Ø5 mm	Ø7 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	10×10 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

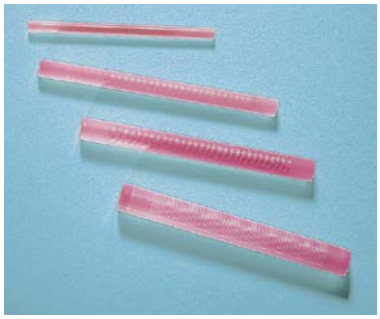
Other Ultrahin BBO crystals available. *See pages 5.31; 5.38*

Ring Holders for Nonlinear Crystals
See page 2.25

Positioning Mount 840-0199 for Nonlinear Crystal Housing
See page 2.26

Laser Crystals

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.

Please contact EKSMA OPTICS for further information or non-standard specifications.

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

Code	Diameter, mm	Length, mm	Doping, %	Wedge of the ends, deg	Price, EUR
E-Y-3-0.9-A/A	3	53	0.9	0/0	215
E-Y-3-0.8-A/A	3	65	0.8	0/0	265
E-Y-3-1.1-A/A	3	65	1.1	0/0	325
E-Y-4-0.8-A/A	4	65	0.8	3/3 parallel	530
E-Y-4-1.1-A/A	4	65	1.1	3/3 parallel	530
E-Y-6.35-1.1-A/A	6.35	85*	1.1	3/3 parallel	890
E-Y-8-1.1-A/A	8	85*	1.1	3/3 parallel	1340
E-Y-10-1.1-A/A	10	85*	1.1	3/3 parallel	2200
E-Y-12-0.8-A/A	12	100*	0.8	3/3 parallel	4740
E-Y-12-1.1-A/A	12	100*	1.1	3/3 parallel	4740

** rods with barrel grooving, except 10 mm at both ends of the rod without grooving.*

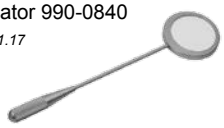
SPECIFICATIONS OF STANDARD Nd:YAG LASER RODS

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

RELATED PRODUCTS

Laser Safety Eyewear
See page 1.17

Visualizator 990-0840
See page 1.17



Yb:KGW • Yb:KYW — Yb-DOPED POTASSIUM GADOLINIUM TUNGSTATE

- **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

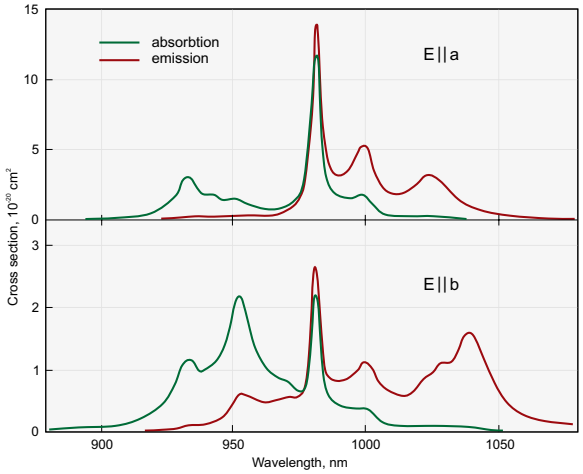
CUSTOM MANUFACTURING CAPABILITIES

- Various shapes (slabs, rods, cubes)
- Different dopant levels
- Diversified coatings

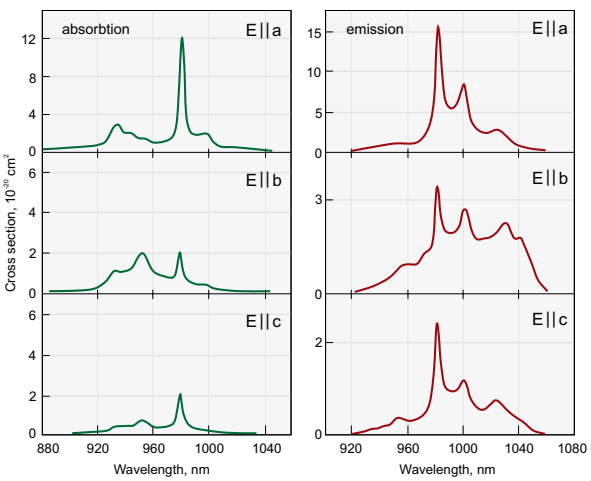
Yb-Doped Potassium Gadolinium Tungstate (**Yb:KGd$(WO_4)_2$**) and Yb-doped Potassium Itrium Tungstate (**Yb:KY$(WO_4)_2$**) single crystals are the laser crystals for diode or laser pumped solid-state laser applications.

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

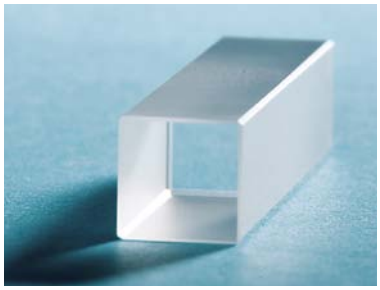


Absorption and emission spectra of Yb(5%):KYW



Absorption and emission spectrae of Yb(5%):KGW

Nd:KGW — Nd-DOPED POTASSIUM GADOLINIUM TUNGSTATE



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.

Nd:KGW crystals are low lasing threshold, highly efficient laser material exceptionally suitable for laser rangefinding applications.

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

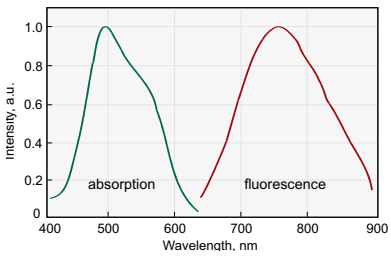
Al_2O_3:Ti^{3+} indefinitely long stability and useful lifetime added to the lasing over entire band of 660 – 1050 nm challenge "dirty" dyes in variety of applications. Medical laser systems, lidars, laser spectroscopy, direct femtosecond pulse generation by Kerr-type mode-locking – there are few of 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.

Al_2O_3:Ti^{3+} – titanium-doped sapphire crystals combine outstanding physical and optical properties with broadest lasing range.

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.*

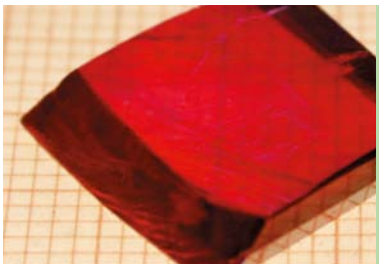


STANDARD SPECIFICATIONS

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



Terahertz Crystals

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

Catalogue number	Size, mm	Thickness, mm	Holder, mm	Price, EUR
ZnTe-100H	10×10	0.1	Ø25.4	890
ZnTe-200H	10×10	0.2	Ø25.4	730
ZnTe-500H	10×10	0.5	Ø25.4	620
ZnTe-1000H	10×10	1.0	Ø25.4	510
ZnTe-2000H	10×10	2.0	Ø25.4	750

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

Catalogue number	Clear aperture, mm	Thickness, μm	Holder, mm	Price, EUR
GaSe-10H1	Ø7	10	Ø25.4	1950
GaSe-30H1	Ø7	30	Ø25.4	1625
GaSe-100H1	Ø7	100	Ø25.4	1475
GaSe-500H1	Ø7	500	Ø25.4	1460
GaSe-1000H1	Ø7	1000	Ø25.4	1635
GaSe-2000H1	Ø7	2000	Ø25.4	1810

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.

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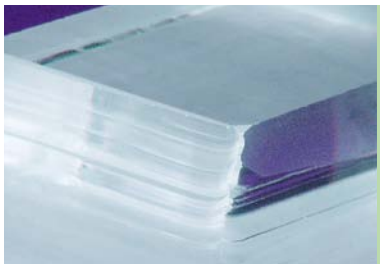
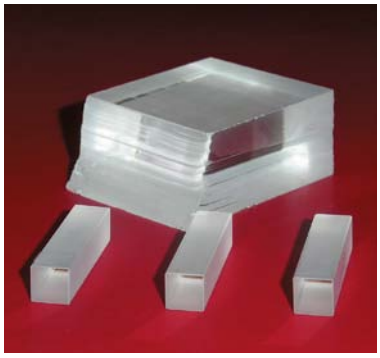


Raman Crystals

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 $\partial n/\partial T$ 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/cm^3
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
$\partial n/\partial T$	-20×10^{-6} K^{-1}
Optical Damage Threshold	~ 0.4 GW/cm^2

KGW PHYSICAL AND OPTICAL PROPERTIES

Crystal symmetry	monoclinic, C2/c
Transmission range	0.35–5.5 μm
Density	7.27 g/cm^3
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
$\partial n/\partial T$	0.4 × 10^{-6} K^{-1}
Optical Damage Threshold	> 10 GW/cm^2

Raman wavelengths in KGW crystal (oscillation coefficient 901.5 cm^{-1}) and $Ba(NO_3)_2$ crystal (oscillation coefficient 1048.6 cm^{-1}) are given in the table below.

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 KGW CRYSTALS, updoped, b-cut

Catalogue number	Dimensions, mm	Coating	Price, EUR
KGW-701	7 × 7 × 30	Uncoated	600
KGW-702	5 × 7.5 × 30	BBAR/BBAR@400-700 nm	785

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

Barium & Strontium tungstate-molybdate

CRYSTALS FOR RAMAN SHIFT

new

- $Ba(MoO_4)_x(WO_4)_{1-x}$, 0<x<0.01
- $Sr(MoO_4)_x(WO_4)_{1-x}$, 0<x<0.01
- $Sr(MoO_4)_x(WO_4)_{1-x}$, 0.99<x<1

New Barium and Strontium tungstate-molybdate single crystals feature higher Raman gain as compared to KGW or $CaCO_3$ and relatively higher thermal conductivity as compared to a $Ba(NO_2)_3$.

Barium and Strontium tungstate-molybdate single crystals are grown and provided with cut along a-direction.

Active elements do not require precise positioning since stimulated Raman scattering (SRS) threshold slightly depends on the crystal orientation relative to pump polarization (within a few percent) and minimum threshold is reached at E||c. In this case, the polarization of the pump and stokes pulses are parallel to the optical axis (c-axis).

The crystals are water-insoluble and durable. Available sizes and shapes of active elements are rectangular up to 10 × 10 × 100 mm or with cylindrical cross-section up to Ø10 × 100 mm.

APPLICATIONS

- Raman converters – new crystals extend the capabilities of the Raman devices in addition to commercially available $Ba(NO_2)_3$, $CaCO_3$, KGW crystals, since new crystals have different values of the Stokes shift and allow to obtain a laser radiation at the other wavelengths
- Raman lasers including self-Raman generation
- Laser pulse compressors based on stimulated Raman scattering effect

RAMAN WAVELENGTHS GENERATION IN BARIUM TUNGSTATE, STRONTIUM TUNGSTATE AND STRONTIUM MOLYBDATE SINGLE CRYSTALS

Crystal	Barium tungstate		Strontium tungstate		Strontium molybdate	
Chemical formula	$Ba(MoO_4)_x(WO_4)_{1-x}$ 0 < x < 0.01		$Sr(MoO_4)_x(WO_4)_{1-x}$ 0 < x < 0.01		$Sr(MoO_4)_x(WO_4)_{1-x}$ 0.99 < x < 1	
Oscillation coeficient	925 cm^{-1}		921.5 cm^{-1}		888 cm^{-1}	
Pump	1064 nm	532 nm	1064 nm	532 nm	1064 nm	532 nm
1 Stoke	1180	560	1180	559	1175	558
2 Stoke	1325	590	1324	590	1312	588
3 Stoke	1510	624	1507	624	1485	620
4 Stoke	1755	662	1751	662	1710	656
1 Antistoke	969	507	969	507	972	508

PHYSICAL AND OPTICAL PROPERTIES

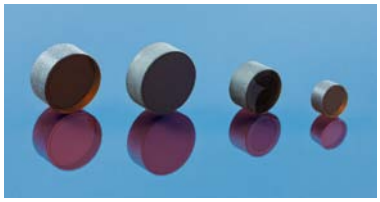
Crystal	Barium tungstate	Strontium tungstate	Strontium molybdate
Chemical formula	$Ba(MoO_4)_x(WO_4)_{1-x}$ 0 < x < 0.01	$Sr(MoO_4)_x(WO_4)_{1-x}$ 0 < x < 0.01	$Sr(MoO_4)_x(WO_4)_{1-x}$ 0.99 < x < 1
Crystal structure	Tetragonal, space group $I4_1/a$	Tetragonal, space group $I4_1/a$	Tetragonal, space group $I4_1/a$
Density	6.35 g/cm³	6.26 g/cm³	4.65 g/cm³
Thermal conductivity	2.3 W/m·K	3 W/m·K	4 W/m·K
Transparency range	0.45 – 5.4 μm	0.25 – 5.4 μm	0.25 – 5.4 μm
Refractive index	n_o =1.806, n_e = 1.804 at 1064 nm n_o =1.848, n_e = 1.846 at 532 nm	n_o =1.84, n_e = 1.85 at 1064 nm n_o =1.87, n_e = 1.88 at 532 nm	n_o =1.878, n_e = 1.88 at 1064 nm n_o =1.919, n_e = 1.924 at 532 nm
Stokes shift	925 cm^{-1}	921.5 cm^{-1}	888 cm^{-1}
Steady-state Raman gain at 1064 nm	8.5 cm/GW	5 cm/GW	5.5 cm/GW
Can be supplied Nd doped: Nd^{3+} concentration in the crystal	0 – 0.15 at. % (on Ba site)	0 – 1.5 at. % (on Sr site)	0 – 1.5 at. % (on Sr site)
Surface optical damage threshold (1064 nm, 4.2 ns)	2 GW/cm²	1.9 GW/cm²	0.8 GW/cm²
Mohs hardness	4	4	4

$BaWO_4$ CRYSTALS FOR RAMAN GENERATION, polished, a-cut

Catalogue number	Dimensions, mm	Coating	Price, EUR
BaWO-501	5 × 5 × 20	Uncoated	1300
BaWO-502	5 × 5 × 30	Uncoated	1700
BaWO-503	5 × 5 × 50	Uncoated	2060

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.

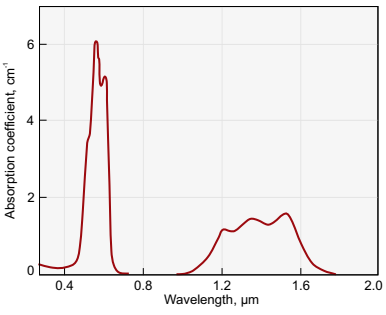


***Fig. 1.** Absorption spectra of the Co:Spinel crystal*

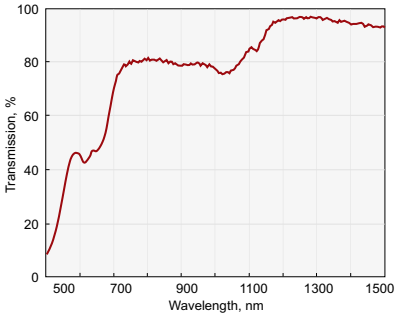


***Fig. 2.** Transmission of AR coated at 1064 nm Cr:YAG Q-switch with initial transmission of 80% at 1064 nm*

SPECIFICATIONS

	Co:Spinel	Cr^{4+}:YAG
Working wavelength range, µm	1.2 – 1.6	0.8 – 1.2
Absorption cross-section, cm^2	3.5×10^{-19} (at 1.54 µm)	5×10^{-18} (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

Catalogue number	Initial Transmission, %	Diameter, mm	Price, EUR
CrYAG-07-20	20	7	130
CrYAG-07-30	30	7	130
CrYAG-07-35	35	7	130
CrYAG-07-40	40	7	130
CrYAG-07-45	45	7	130
CrYAG-07-50	50	7	130
CrYAG-07-65	65	7	130
CrYAG-07-70	70	7	130
CrYAG-07-80	80	7	130
CrYAG-07-85	85	7	130

STANDARD Co:SPINEL CRYSTALS

Catalogue number	Initial Transmission, %	Diameter, mm	Price, EUR
CoMALO-05-30	30	5	725
CoMALO-05-40	40	5	725
CoMALO-05-50	50	5	725
CoMALO-05-60	60	5	725
CoMALO-05-70	70	5	725
CoMALO-05-80	80	5	725
CoMALO-05-90	90	5	725

Positioners & Holders

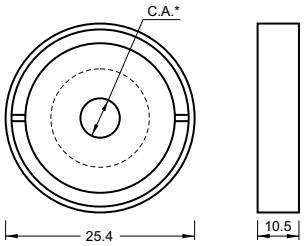
830-0001 RING HOLDERS FOR NONLINEAR CRYSTALS

830-0001-10

830-0001-06

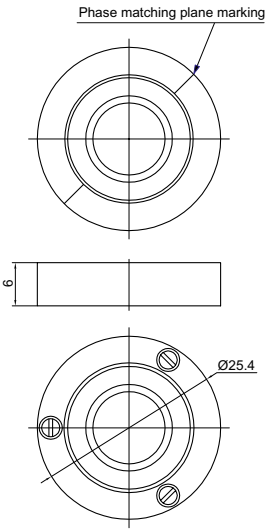
- **Black anodized aluminium body**
- **Teflon or white anodized aluminium adapter for particular crystal size**
- **Easy assembling and disassembling**

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.



** C.A. - depends on crystal aperture*

830-0001-10



830-0001-06

Please indicate the exact crystal size when ordering.

Part No	Diameter, mm	Thickness, mm	Max. acceptable crystal size, mm	Price, EUR
830-0001-06	25.4	6	12×12×0.5	50
830-0001-10	25.4	10.5	12×12×3	50
830-0001-13	25.4	13.5	12×12×6	50
830-0001-17	25.4	17.5	12×12×15	90
830-0002-10	30	10.5	15×15×3	50
830-0002-13	30	13.5	15×15×6	50
830-0002-17	30	17.5	15×15×15	90

HOUSING ACCESSORIES

Positioning Mount 840-0199 for Nonlinear Crystal Housing

See page 2.26

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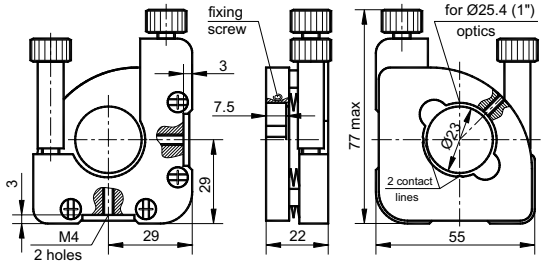
840-0193 KINEMATIC POSITIONING MOUNT

- 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



Code	Weight, kg	Price, EUR
840-0193	0.12	87

840-0199 POSITIONING MOUNT FOR NONLINEAR CRYSTAL HOUSING

840-0199 Positioning Mount with 830-0001 Ring Holder

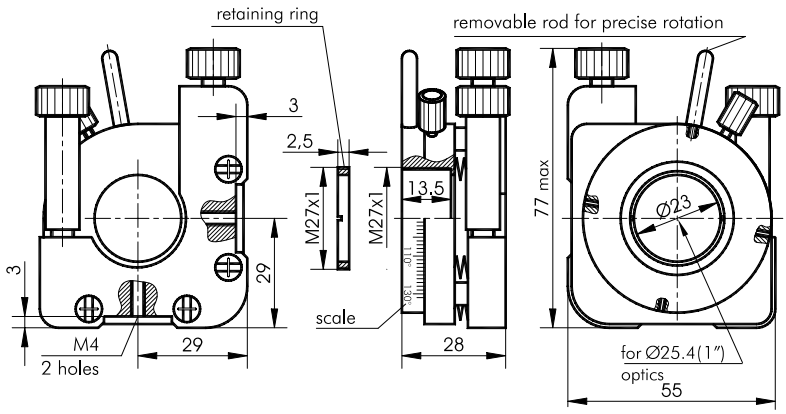
- Accepts Ø25.4 mm and up to 10.5 mm thickness ring housings
- Kinematic design
- Wedge and ball drive mechanism
- Tilt/tip range: ±2°
- Sensitivity: 3 arcsec
- Fine adjustment screws with 0.25 mm pitch
- Hardened seats under adjustment screws
- Rotation range: 360°
- Scale gradation: 2°
- Compact and robust design
- Material: black anodized aluminum

This kinematic mount accepts crystal housings of Ø25.4 mm and thickness up to 10.5 mm.

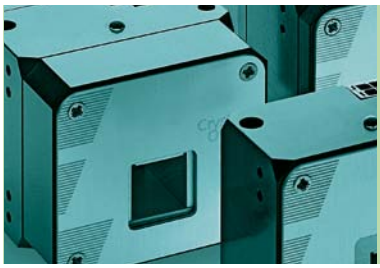
Large knobs on the adjusting screws relieve the strain on operator fingers during adjustment. Both screws protrude from the top allowing convenient adjustment outside the laser beam path and providing easy access for adjustments in densely packed optical set-ups.

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.



Code	Weight, kg	Price, EUR
840-0199	0.12	165

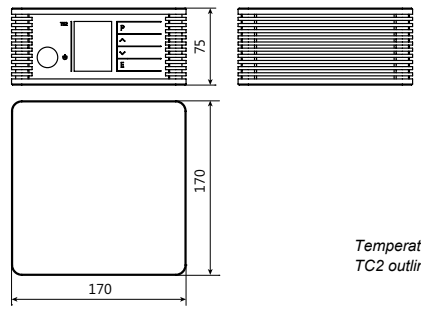


Crystal Ovens

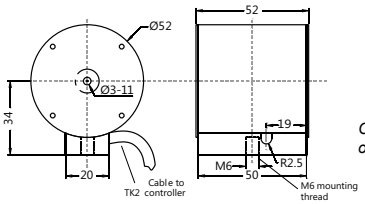
Many of widely used nonlinear crystals are susceptible to ambient humidity, for example KD*P, BBO, LBO. Protective coatings applied to the surface can reduce degradation to some extent only. To improve the protection of surfaces of the crystals from the degradation it is desirable to keep the crystals 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.

TC2 • CO1 TEMPERATURE CONTROLLER TC2 WITH OVEN CO1



Temperature controller TC2 outline drawing



Crystal oven CO1 outline drawing

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 C02-30 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	1
Temperature tuning range	RT – 200 °C	
Maximum crystals dimensions	12×12×30 mm	12×12×50 mm
Sealing (optional)	FS windows	
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.

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Code **	Description, features	Price, EUR
Thermocontroller TC2		
TC2	Thermocontroller, Fuzzy logic, RT-200 ºC, can control two CO1 ovens, long-term stability ±0.05 ºK, worldwide mains	1063
Crystal Ovens for TC2		
For crystal length up to 30 mm		
CO1-30-y/y	Standard crystal sizes *	622
CO1-30-y/z	Custom crystal sizes	672
CO1-30S-y/y	Sealed, standard crystal sizes *	1022
For crystal length up to 50 mm		
CO1-50-y/y	Standard crystal sizes *	766
CO1-50-y/z	Custom crystal size	828
CO1-50S-y/y	Sealed, standard crystal sizes *	1166
Mounting accessories		
MS-4	Adapter for CO1 oven mounting on tilt stage. Tilt stage should be ordered separately	150

** Sizes 3×3, 4×4, 5×5, 6×6,12×12 are standard.* *** y/y, y/z – crystal size.*

Heatpoint — ROUND OVEN FOR NONLINEAR CRYSTALS

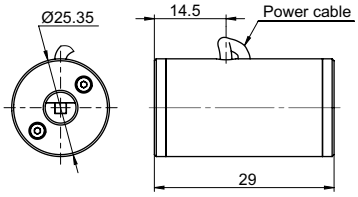
Heatpoint Crystal oven

Heatpoint is a compact round oven designed for heating of humidity sensitive nonlinear crystals. It is used to prevent moisture condensation on the crystal faces or for thermo-stabilization of the crystals.

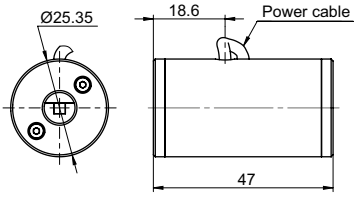
The oven features precise long term stability and compact design. Heatpoint is designed to be used with common one-inch optics positioning mounts or with our special positioning mount PM1. A small thermocontroller is attached to the oven on a wiring.

Required temperature of the oven is preset in the factory and it can be chosen by the customer in the range between 30 °C and 80 °C. Preset temperature can be adjusted in ±5 °C range.

Heatpoint oven has special crystal adapter and fits crystals of size up to 6×6×30 mm. The adapter is made exactly for particular crystal size and it cannot be used for a crystal of a different size.



HP1 dimensions



HP2 dimensions

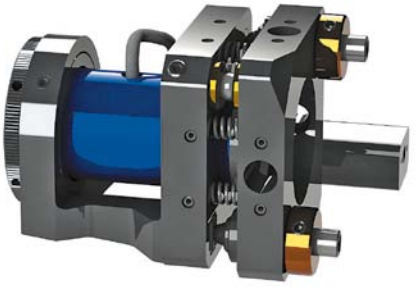
SPECIFICATIONS

Model	HP1	HP2
Maximum crystals dimensions	6 × 6 × 15 mm	6 × 6 × 30 mm
Preset temperature	30 – 80 °C	
Temperature tuning range near preset	± 5 °C	
Long-term stability	± 0.15 at 30-50 °C ± 0.2 at 50-80 °C	
Powering requirements	12 – 16 V	
Power consumption (PMAX)	5.5 W	
Sensor type	PTC thermo resistor	
Output connector	2.5 mm mono plug	
Thermocontroller size	18 × 12 × 42.5 mm	
Distance (wiring length) from oven to thermocontroller	180 mm	
Oven dimension, dia × L	Ø25.4 × 29 mm	Ø25.4 × 47 mm

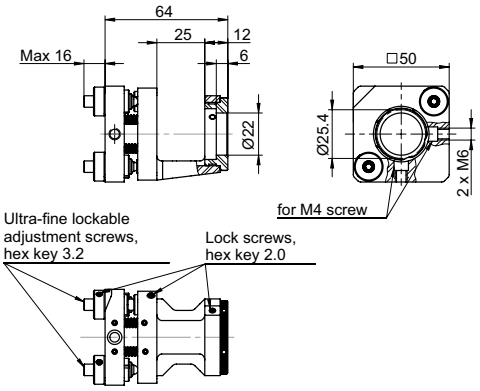
MOUNT SPECIFICATIONS

Model	PM1
Adjusting angles, tilt and tip	± 3.5°
Rotation along Z-axis	180°

Code	Description	Price, EUR
HP1	Heatpoint oven (Ø25.4 × 29 mm) with attached thermocontroller	200
HP2	Heatpoint oven (Ø25.4 × 47 mm) with attached thermocontroller	200
PM1	Positioning mount for Heatpoint ovens	250



Heatpoint Crystal oven with PM1 holder



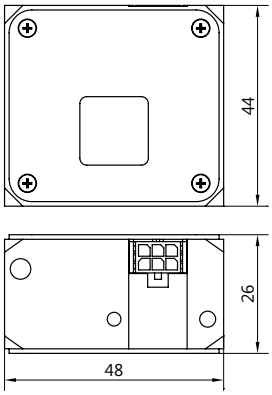
CH8 OVEN FOR NONLINEAR CRYSTALS

CH8 is compact oven with built-in thermo-controller for nonlinears crystals to keep them at stabilized temperature in range 30…60 °C. It is ideal for larger aperture crystals like KD*P. The crystals with up to 15 × 15 mm dimensions can be mounted. Each oven is made exactly for specific crystal aperture size, so it cannot be used for different size crystals.

SPECIFICATIONS

Model	CH8-20	CH8-30	CH8-50
Temperature range		30 – 60 °C	
Maximum crystals dimensions	15×15×20 mm	15×15×30 mm	15×15×50 mm
Temperature stability		± 0.2 °C	
Power consumption	<6 W	<6 W	<9 W
Control interface		CAN	
Crystal center position above pad		16 mm	
Dimensions, W×H×D	48×44×26 mm	48×44×36 mm	48×44×56 mm

Specifications are subject to changes without advance notice.



CH8 dimensions

Code **	Description, features	Price, EUR
CH8-20 – crystal length up to 20 mm		
CH8-20-y/y-x	Standard crystal sizes *	452
CH8-20-y/z-x	Non-standard crystal size	508
CH8-30 – crystal length up to 30 mm		
CH8-30-y/y-x	Standard crystal sizes *	509
CH8-30-y/z-x	Non-standard crystal size	572
CH8-50 – crystal length up to 50 mm		
CH8-50-y/y-x	Standard crystal sizes *	580
CH8-50-y/z-x	Non-standard crystal size	733
Mounting accessories		
MS-1	Two axis tilt adjustment 5 degrees range, suitable for all types of CH8 or CH9 crystal ovens	214
MS-2	Two axis tilt stage, adjustment in 5 degree range, fits two pc. of CH8 or CH9 ovens	358
MS-3	Adapter for CH8 or CH9 mounting on rotary stage, 15 degrees fine tuning, angle read-out. Rotary stage should be ordered separately	119
Power supply PS-12		
PS-12	Power supply for CH8 or CH9 crystal oven, 100 – 240 VAC mains, +12 VDC output	61

** Sizes 3×3, 4×4, ...,15×15 are standard.*
*** y/y, y/z – crystal size, x – preset temperature in degrees of Celsius (30-60 °C range).*

CH9 OVEN FOR NONLINEAR CRYSTALS

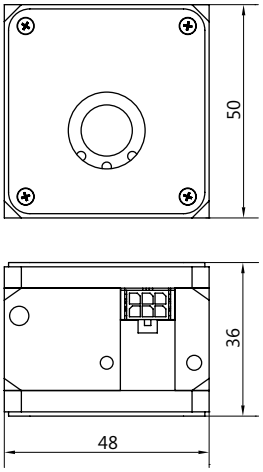
CH9 is compact oven with built-in thermo-controller for nonlinears crystals to keep them at stabilized temperature in range 30…80 °C. The crystals with aperture up to 12×12 mm and length up to 15 mm can be mounted. CH9-30 oven is designed for crystal length up to 30 mm.

Crystal oven is equipped with crystal adapters (holders), similar design as CO1, that can be easy replacable for different crystal size. Crystal adapters can be ordered separately.

SPECIFICATIONS

Model	CH9-15	CH9-30
Temperature range	30 – 60 °C	
Maximum crystals dimensions	12×12×15 mm	12×12×30 mm
Temperature stability	± 0.2 °C	
Power consumption	<6 W	<9 W
Control interface	CAN	
Crystal center position above pad	23 mm	
Dimensions, W×H×D	48×50×36 mm	48×50×56 mm

Specifications are subject to changes without advance notice.



CH9 dimensions

Code **	Description, features	Price, EUR
CH9-15 – crystal length up to 15 mm		
CH9-15-y/y-x	Standard crystal sizes *	588
CH9-15-y/z-x	Non-standard crystal sizes	642
CH9-30 – crystal length up to 30 mm		
CH9-30-y/y-x	Standard crystal sizes *	659
CH9-30-y/z-x	Non-standard crystal sizes	733
Mounting accessories		
MS-1	Two axis tilt adjustment 5 degrees range, suitable for all types of CH8 or CH9 crystal ovens	214
MS-2	Two axis tilt stage, adjustment in 5 degrees range, fits two pc. of CH8 or CH9 ovens	358
MS-3	Adapter for CH8 or CH9 mounting on rotary stage, 15 degrees fine tuning, angle read-out. Rotary stage should be ordered separately	119
Power supply PS-12		
PS-12	Power supply for CH8 or CH9 crystal oven, 100-240 VAC mains, +12 VDC output	61

** Sizes 3×3, 4×4, ...,15×15 are standard.*
*** y/y, y/z – crystal size, x – preset temperature in degrees of Celsius (30-60 °C range).*

RELATED PRODUCTS

Mount MS-1
for fine tuning
of CH8 or CH9 angle
is available.
The tuning
range is ± 2.5°.

Pockels Cells
Selection Guide

KTP Pockels Cells
page 3.2

KD*P Pockels Cells
page 3.3

BBO Pockels Cells
page 3.4

Mounting Stages
for Pockels Cells of Ø25.4 mm
page 3.5

Mounting Stage
for Pockels Cells of Ø25.4 mm
page 3.5

Mounting Stage
for Pockels Cells of Ø35 mm
page 3.5

DPS/DPD Pockels Cell Drivers
Cavity Dumping & Pulse Picking
page 3.6

DPB High Voltage Pockels Cell Driver
page 3.12

DQ High Repetition Rate Pockels Cell Driver
for Q-Switching
page 3.13

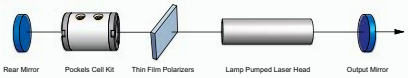
DP Cavity Dumper Driver
page 3.13

DQF Pockels Cell Driver
for Q-Switching for Flashlamp Pumped Lasers
page 3.14

PS Series High Voltage Power Supply
page 3.14

High Voltage Power Supplies
page 3.15

Pulse Picking Solutions
page 3.16



Q-Switching Kits
page 3.23

EKSMA OPTICS • Tel.: +370 5 272 99 00 • Fax: +370 5 272 92 99 • info@eksmaoptics.com • www.eksmaoptics.com

Pockels Cells

PCK KTP POCKELS CELLS

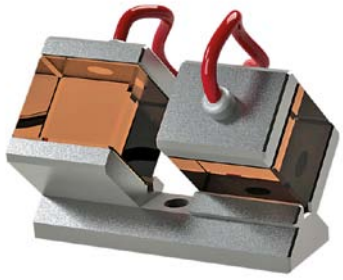
PCK4

New PCK series KTP Pockels developed at EKSMA OPTICS are based on specially grown high resistivity KTP crystals. KTP crystals have better optical homogeneity and higher damage threshold comparing to RTP crystals. The outstanding feature is possibility to operate KTP Pockels cells at high duty cycles or even to keep at high voltage for the longer time.

APPLICATIONS

- **Q-switching for high repetition rate lasers 1 kHz – 1 MHz**
- **Pulse picking of high repetition rate lasers**

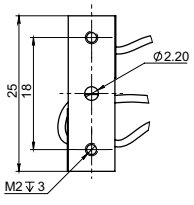
- **More than twice smaller HV requirement comparing to double BBO Pockels cells**
- **Operates at high duty cycles**
- **Very low piezo-electric resonances**
- **Standard available apertures: 4×4, 6×6 and 8×8 mm**



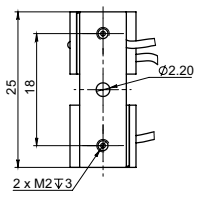
For drawings of other standard KTP Pockels Cells please visit ***www.eksmaoptics.com***

SPECIFICATIONS

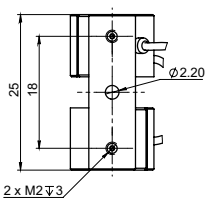
Model	PCK4	PCK4-O	PCK6	PCK6-O	PCK8-O
Clear aperture diameter, mm	3.5		5.5		7.5
Crystal size (W×H×L), mm	4×4×10		6×6×10		8×8×10
Quantity of crystals	2				
Half-wave voltage (@ 1064 nm), kV DC	<1.8		<2.5		<3.6
Capacitance, pF	4		<6		<8
Optical transmission, %	> 98				
Contrast ratio	>1:500				
Cell size, mm	Ø25.4×42.2	25×11.1×7.5	Ø25.4×42.2	25×13.8×10.6	25×16.6×13.4



PCK4-O



PCK6-O



PCK8-O

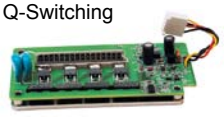
RELATED PRODUCTS

Mounting Stages for Pockels Cells of Ø25.4 mm

See page 3.5

DQ High Repetition Rate Pockels Cell Driver for Q-Switching

See page 3.13



DPD Cavity Dumping & Pulse Picking Pockels Cell Drivers

See page 3.6

PC • D-compact KD*P POCKELS CELLS

D-compact/12

D-compact/9

PC12SR

PC10S

- **Economically priced**
- **Compact size**
- **Low absorption**
- **Transmission from 400 nm to 1100 nm**

APPLICATIONS

- **Q-switching of the laser cavity**
- **Cavity Dumping**

Pockels cells are used to change the polarization state of light passing through it when a voltage is applied to the electrodes of electro-optic crystals such as KD*P. When used in conjunction with polarizer, Pockels cells can be used as fast optical switches.

Typical applications include Q-switching of the laser cavity, laser cavity dumping and coupling light into and from regenerative amplifiers. KD*P based Pockels cells are routinely used for Q-switching applications from the 400 nm to about 1.1 µm. Most of commercial flashlamp pumped Nd:YAG lasers and low repetition rate DPSS Nd:YAG lasers are equipped with KD*P based Pockels cell for laser cavity Q-switching.

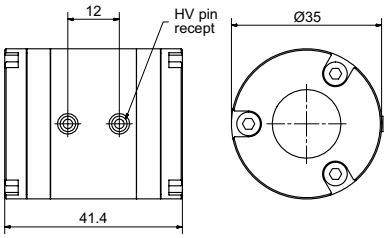
Electro-optical KD*P crystals have high laser power resistant dielectric AR coatings. Additionally PC12SR and D-compact series Pockels cells have AR coated windows for improved lifetime and protection in less user friendly environment.

Model	PC5S	PC5D	PC10S	PC12SR	D-compact/9	D-compact/12	D-mini/8	D-mini/9
Clear aperture, mm	4.5×4.5	4.5×4.5	9.5×9.5	Ø11	Ø8	Ø11	Ø7	Ø8
Crystal size, (W×H×L) mm	5×5×16	5×5×16	10×10×25	Ø12×24	Ø9×20	Ø12×24	Ø8×12	Ø9×20
Quantity of crystals	1	2	1	1	1	1	1	1
λ/2 voltage, kV DC	<6.5 [1]	<3.4 [1]	<6.8 [1]	<6.8 [1]	<6.8 [1]	<6.8 [1]	<5 [2]	<6.8 [1]
Capacitance, pF	1.5	3	4	6	6	6	3	6
Optical transmision, %	>97							
Contrast ratio [3]	> 1:2000	>1:1000	>1:2000	>1:2000	>1:2000	>1:2000	>1:2000	> 1:2000
Cell size, mm	18×14×25	23×16×52	22×18×33	Ø35×41.4	Ø25.4×35	Ø25.4×39	Ø19×19	Ø19×25.4

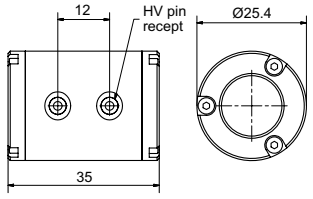
[1] At 1064 nm. [2] At 800 nm.
[3] Measured by crossed polarizers method.

Specifications are subject to change without advance notice.

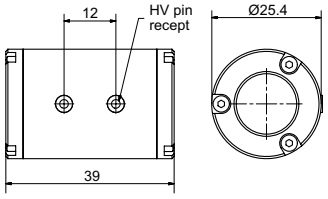
All crystals are antireflection coated. Damage threshold >5 J/cm² for 10 ns pulses at 1064 nm.



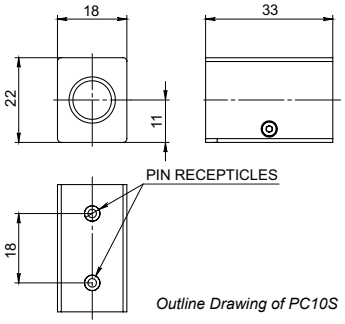
Outline drawing of PC12SR



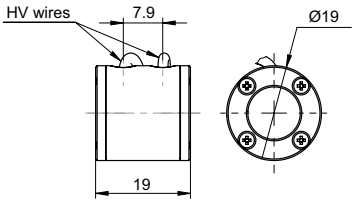
Outline drawing of D-compact/9



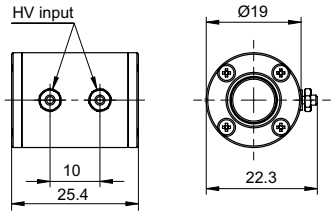
Outline drawing of D-compact/12



Outline Drawing of PC10S



Outline drawing of D-mini/8

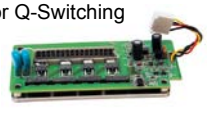


Outline drawing of D-mini/9

RELATED PRODUCTS

DQ High Repetition Rate Pockels Cell Driver for Q-Switching

See page 3.13



DQF Pockels Cell Driver for Q-Switching for Flashlamp Pumped Lasers

See page 3.14

PCB BBO POCKELS CELLS

PCB3D PCB3D-C

- **Minimal piezoelectric ringing**
- **Low absorption**
- **Broad trasmission range from 200 nm to 2000 nm**
- **Compact size**

APPLICATIONS

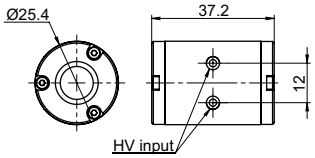
- **High repetition rate DPSS Q-switch**
- **High repetition rate regenerative amplifier control**
- **Cavity dumping**
- **Beam chopper**

Pockels cell are used to change the polarization state of light passing through it when a voltage is applied to the electrodes of electro-optic crystals such as BBO. When used in conjunction with polarizer, Pockels cells can be used as fast optical switches. Typical applications include Q-switching of the laser cavity, laser cavity dumping and coupling light into and from regenerative amplifiers.

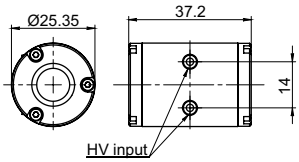
BBO based Pockels cells can be useful at wavelengths from the UV to more than 2 µm. Low piezoelectric ringing makes these Pockels cells attractive for the control of high-power and high pulse repetition rate lasers. Fast switching electronic drivers properly matched to the cell are available for Q-switching, cavity dumping and other applications.

Pockels cells of PCB series are transverse field devices. Low electro-optical coefficient of BBO results in high operating voltages. The quarter-wave voltage is proportional to the ratio of electrode spacing and crystal length. As a result, smaller aperture devices have lower quarter-wave, however even for 2.5 mm aperture devices the quarter-wave voltage is as high as 4 kV @ 1064 nm.

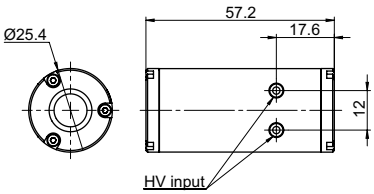
Double crystal design is employed to reduce required voltages and to allow operation in half-wave mode with fast switching times.



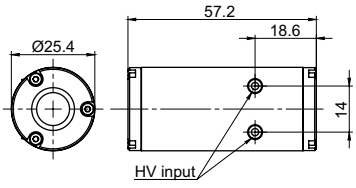
PCB3S, PCB4S outline drawing



PCB6.3S outline drawing



PCB3D, PCB4D outline drawing



PCB6.3D outline drawing

SPECIFICATIONS

Model	PCB3S	PCB3D	PCB4S	PCB4D	PCB6.3S	PCB6.3D	PCB8D
Clear aperture diameter, mm	2.5		3.5		5.8		7
Crystal size (W×H×L), mm	3×3×20		4×4×20		6.3×6.3×20		8×8×20
Quantity of crystals	1	2	1	2	1	2	2
λ/4 voltage (@ 1064 nm), kV DC	<3.5	<1.8	<4.6	<2.3	<7.5	<3.8	<4.6
Capacitance, pF	4	6	3	6	6	<8	<8
Optical transmission, %	> 98	>98	>98	>97	>98	>98	>98
Contrast ratio [1]	>1:1000	>1:500	>1:1000	>1:500	>1:1000	>1:500	>1:500
Dimensions, mm	Ø25.4×37.2	Ø25.4×57.2	Ø25.4×37.2	Ø25.4×57.2	Ø25.4×42.2	Ø25.4×57.2	Ø35×64

[1] *Measured by crossed polarizers method.*

Specifications are subject to changes without advance notice.

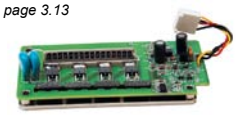
All crystals are coated AR/AR@1064 nm.
Other antireflection coatings are available on request.
Damage threshold >5 J/cm² for 10 ns pulses at 1064 nm.

RELATED PRODUCTS

Mounting Stage for Pockels Cells of Ø25.4 mm
See page 3.5

Mounting Stages for Pockels Cells of Ø25.4 mm
See page 3.5

DQ High Repetition Rate Pockels Cell Driver for Q-Switching
See page 3.13



DPD Cavity Dumping & Pulse Picking Pockels Cell Drivers
See page 3.6

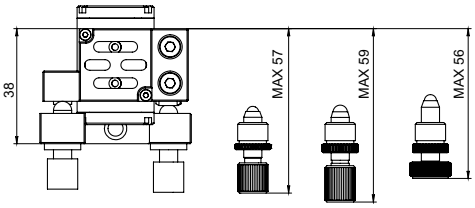
PCH1 MOUNTING STAGES FOR POCKELS CELLS OF Ø25.4 mm

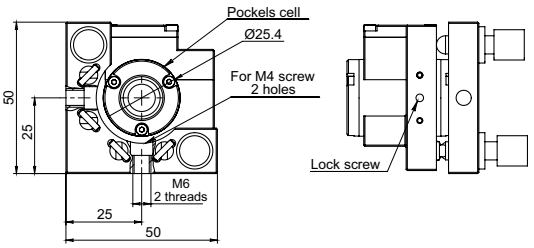
PCH1 series mounting stage for Pockels cells of 25.4 mm of diameter.

SPECIFICATIONS

Adjusting angle allong X and Y axis	8°
Rotation angle along Z-axis for D-Compact series Pockels cells	22°
Rotating angle along Z-axis for BBO Pockels cells	12°

Catalogue Number	Amount of Adjustment Screws	Adjustment Screw Thread	Screw Sensitivity, µm	Price, EUR
PCH1-2-0.5	2	M6x0.5	1.5	230
PCH1-2-0.35	2	M6x0.35	1.3	265
PCH1-2-0.25	2	M6x0.25	0.5	292
PCH1-3-0.5	3	M6x0.5	1.5	250
PCH1-3-0.35	3	M6x0.35	1.3	306
PCH1-3-0.25	3	M6x0.25	0.5	349



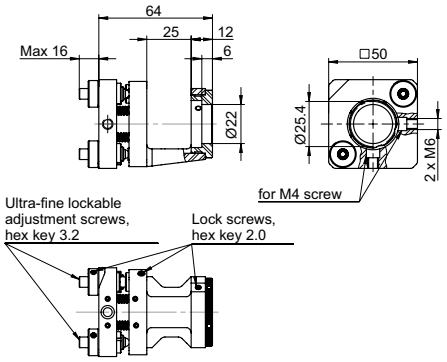


PM1 MOUNTING STAGE FOR POCKELS CELLS OF Ø25.4 mm

SPECIFICATIONS

Model	PM1
Adjusting angles, tilt and tip	±3.5°
Rotation along Z-axis	180°
Adjustment screw thread	M6×0.25
Screw sensitivity	0.5 µm

Catalogue Number	Price, EUR
PM1	250

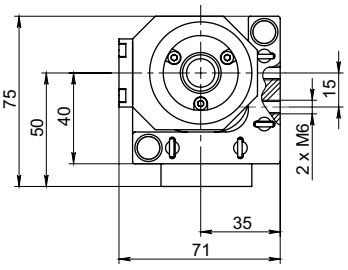


HPR MOUNTING STAGE FOR POCKELS CELLS OF Ø35 mm

Other side

HPR series mounting stage for pockels cell is used for housing of Pockells cells in diameter of 35 mm.

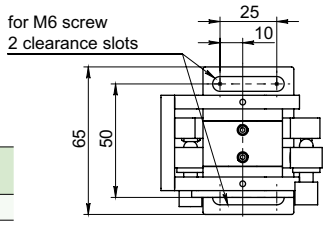
Stages with fine and ultrafine screws are available upon request.



SPECIFICATIONS

Model	HPR-35
Suitable for pockels cells housing diameters, mm	Ø35
Adjusting angle along X and Y axis, deg	9
Rotating angle along Z-axis, deg	20
Beam high above breadboard, mm	50
Adjustment screw thread	M6×0.5
Screw sensitivity	1.5 µm

Catalogue Number	Price, EUR
HPR-35	250



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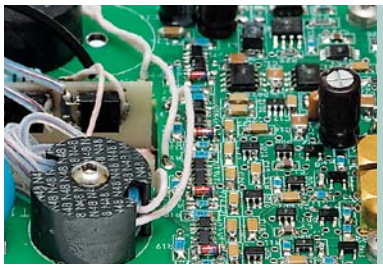


Pockels Cells Drivers

DPS/DPD Series
DP-SP Series

CAVITY DUMPING & PULSE PICKING POCKELS CELL DRIVERS

OEM version of DPS/DPD series Pockels cell driver

Encased version of DPS/DPD series Pockels cell driver

- **Fast HV rise/fall time <4 – 8 ns**
- **HV pulse amplitude up to 3.6 kV**
- **Pulse repetition rate up to 3.5 MHz**
- **Output pulse jitter <50 ps if trigger pulse rise time <0.5 ns**

DPD series Pockels cell drivers are designed for wide range of applications and operating modes. Repetition rate can be up to 500 kHz for standard range of drivers, up to 1 MHz enhanced and up to 3.5 MHz high rate. Standard range of possible pulse durations is from 100 ns to 5 µs. It can be extended to infinity using pulse regeneration technique.

Different versions of the drivers are built as variations of voltage, repetition rate and rise/fall time. These three parameters are mutually dependent: higher voltage means longer rise/fall time, and higher repetition rate is limited by voltage.

Connection diagram can be PUSH-PULL configuration using stand-alone driver, as well as FULL BRIDGE using two drivers for one Pockels cell. FULL BRIDGE configuration gives such advantages as repetition rate doubling to reach up to 7 MHz rate, pulse duration shortening down to zero or voltage doubling on pockels cell.

Most of the DPS/DPD series units are available in two versions: “open frame” which is ideal for OEM manufacturers incorporating drivers in their own systems or encased in aluminum housings. Encasing of Pockels cell driver in aluminum housing solves two problems: shields both humans and electronics from high voltage impact from operating Pockels cell driver, and protects driver itself from potentially harmful external contact – ensuring safe operation and driver longevity. The housed option is especially handy for researchers and custom product manufacturers who use these drivers during their own systems build-up.

DP-SP modification has possibility to shorten output pulse duration down to 15 ns. Following they can be used for single pulse selection in pulse picker applications for higher repetition rate lasers.

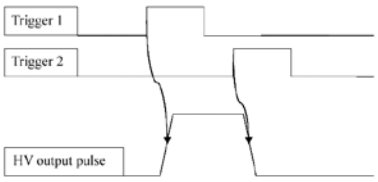


Fig. 1. Control timing charts for two-pulses controlled drivers

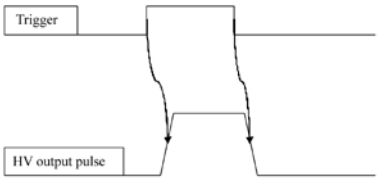
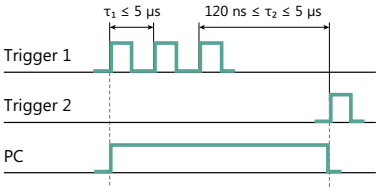


Fig. 2. Control timing charts for single pulse controlled drivers

PULSE REGENERATION TECHNIQUE

Gives possibility to operate push-pull drivers very long output pulse, and full bridge drivers get very low repetition rate. Pulse regeneration does not work with bipolar and short-pulse driver.



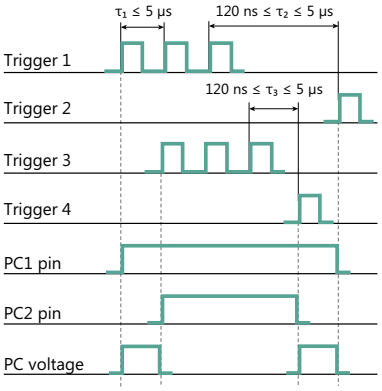


Fig 3. Principle and requirements for long output pulse forming – control way using pulse regeneration. Top diagram is related to DPS/DPD series, bottom for 2DPS/2DPD series (Full-Bridge) drivers.

Pockels cell driver selection chart

This chart represents a summary of the DPD/DPS series of Pockel cells drivers. Horizontal axis depicts repetition rate and vertical axis – operating voltage.

DPS/DPD & DP-SP SERIES DRIVER'S SELECTION CHART

kHz	50	250	300	350	400	500	600	1000	2000	kV
DPS- DPD-					400-1.5 400-1.5					1.5
DP-SP-									2000-1.6-AI	1.6
2DPS- 2DPD-							600-1.8	1000-1.8 1000-1.8-AI		1.8
DPS- DPD-								1000-2.4-AI		2.4
		250-2.5 250-2.5-AI 250-2.5 250-2.5-AI					600-2.5 600-2.5-AI			2.5
						500-2.6 500-2.6-AI				2.6
								1000-2.9-AI		2.9
Regural drivers	50-3.6	250-3.6								3.6
	50-3.6	250-3.6-AI								
Bipolar drivers		250-3.6 250-3.6-AI								
Short-pulse drivers				350-4-AI						4.0
			300-4.6-AI							4.6
Full-bridge drivers		250-5.2-AI								5.2

GENERAL SPECIFICATIONS FOR DPS/DPD AND DP-SP SERIES DRIVERS [1)]

Driver model	DPS/DPD series	DP-SP series
Maximal HV rated voltage (for testing only)	3.8 kV	
Maximal HV operating voltage	<90 % from rated voltage	
HV pulse rise time	< 4 – 8 ns *(Fig. 7)*	
HV pulse fall time	< 4 – 8 ns *(Fig. 8)*	
HV pulse duration for single driver	100 – 5000 ns	15 – 5000 ns
Max HV pulse duration for full-bridge configuration	0 - 5000 ns	N/A
Maximal HV pulse repetition rate	3.5 MHz	600 kHz
External triggering pulse duration requirement	>100 ns	>10 ns
External triggering pulse amplitude requirement	3.5 – 5 V (50 Ω load)	
External triggering pulse rise & fall time	< 20 ns	< 5 ns
Maximal length of leads to Pockels cell	10 cm	
Control diagram options:		
– single triggering pulse control	*Fig. 2*	
– two trigger pulses control	*Fig. 1*	
HV pulse delay	45 ns	30 ns
External powering requirements: [2)]		
– high voltage supply	depends on modification	
– low voltage DC supply	24^{+1}_{-10}, <150 mA 12±0.5 V, <150 mA on request	24±1 V, <150 mA

[1)] Specifications are given for Pockels cell with capacity <6 pF. Not all combinations of parameters can be possible at the same time. Specifications are subject to changes without advance notice.

[2)] Driver needs to be mounted on the heatsink (excluding water cooled versions). Heat sink temperature needs to be lower than 35 °C (95 °F) in all regimes of operation.

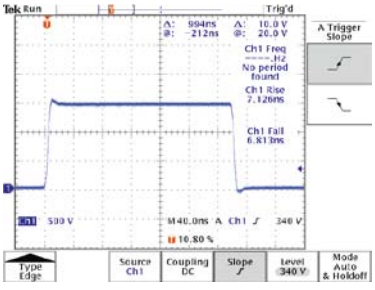


Fig. 4. Typical output pulse shape

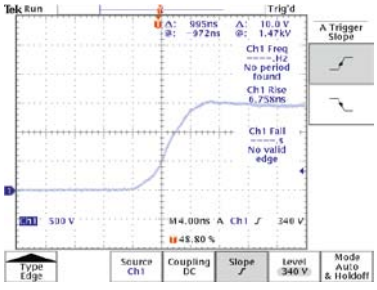


Fig. 5. Typical rising front of output pulse in detail

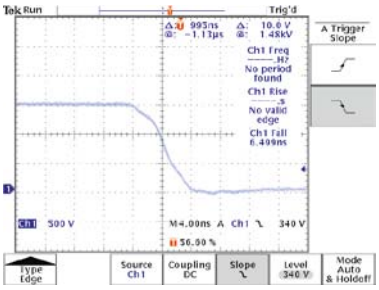


Fig. 6. Typical falling front of output pulse in detail

OEM version

CONFIGURATION SAMPLES OF OEM VERSION OF DPS/DPD SERIES DRIVERS

Catalogue Number of Driver	DPS-50-3.6 DPD-50-3.6	DPS-400-1.5 DPD-400-1.5	DPS-250-3.6 DPD-250-3.6	DPS-250-2.5 DPD-250-2.5	DPS-500-2.6 DPD-500-2.6	DPS-1000-1.8 DPD-1000-1.8
Maximal HV rated voltage	3.8 kV	1.6 kV	3.7 kV	2.6 kV	2.7 kV	2 kV
Maximal HV operating voltage	3.6 kV	1.5 kV	3.6 kV	2.5 kV	2.6 kV	1.8 kV
Maximal HV repetition rate	50 kHz	400 kHz	250 kHz	250 kHz	500 kHz	1000 kHz
Pulse duration	100 – 5000 ns					
HV pulse rise time, typical	<7 ns	<5.5 ns	<7 ns	<6 ns	<6.5 ns	<6 ns
HV pulse fall time, typical	<7 ns	<5.5 ns	<7 ns	<6 ns	<6.5 ns	<6 ns
Output polarity	positive					
HV power consumption	<20 W	<20 W	<75 W	<40 W	<90 W	<80 W
12V/24V power consumption	1 W	5.5 W	4 W	4.5 W	6 W	9 W
Dimensions	see Fig. 8		see Fig. 7			
Cooling	conductive	conductive or water				

DPS in code indicates that driver is controlled by 1 sync pulse, DPD in code indicates that driver is controlled by 2 sync pulses.
HV output voltage to Pockels cell is equal to HV power supply voltage.
Heat sink temperature needs to be lower than 35 °C (95 °F) in all regimes of operation.

OEM version of DPS/DPD series driver with general purpose pad

OEM version of DPS/DPD series driver with conductive pad. Suitable for repetition rate up to 50 kHz

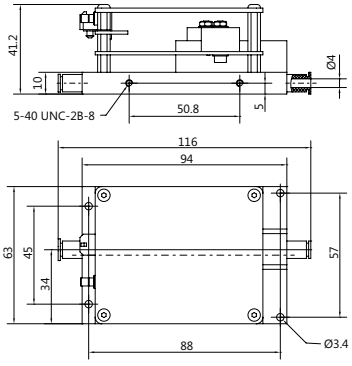


Fig. 7. Outline drawing of DPS series driver with general purpose pad

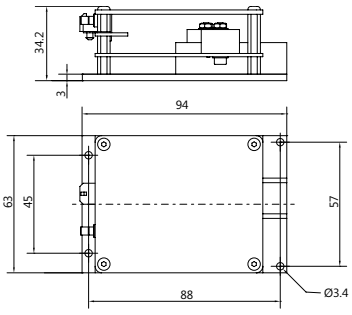


Fig. 8. Outline drawing of DPS series drivers with conductive pad

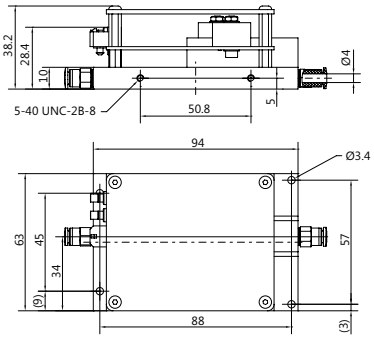


Fig. 7a. Outline drawing of DPD series driver with general purpose pad

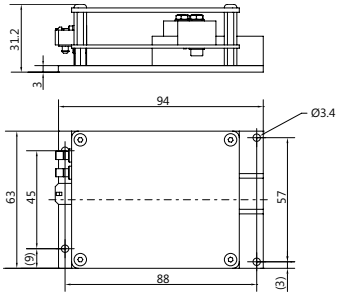


Fig. 8a. Outline drawing of DPD series drivers with conductive pad

ENCASED Short-pulse version

Specific features of DP-SP drivers

- **Short circuit protection at driver output**
- **Driver pad overheat sensor stops operation when overheated**
- **Overheat optocoupled output signal**
- **Switchable single pulse and two pulses control operation modes**
- **LED for error indication (overheat and short circuit)**

CONFIGURATION EXAMPLES OF ENCASED VERSION OF DP-SP SERIES SHORT-PULSE DRIVERS

Catalogue Number of Driver	DP-SP-250-3.6-AI	DP-SP-250-2.5-AI	DP-SP-600-2.5-AI
Maximal HV rated voltage	3.7 kV	2.6 kV	2.6 kV
Max / min HV operating voltage	3.6 kV / 1.8 kV	2.5 kV / 1.25 kV	2.5 kV / 1.25 kV
Maximal HV repetition rate	250 kHz	250 kHz	600 kHz
Pulse duration	15–1250 ns	15–1000 ns	15-400 ns
HV pulse rise time, typical	<7 ns	<6 ns	<6.5 ns
HV pulse fall time, typical	<7 ns	<6 ns	<6.5 ns
Output polarity		positive	
HV power consumption	<75 W	<40 W	<100 W
12V/24V power consumption	4 W	4.5 W	7 W
Dimensions		see Fig. 9	
Cooling		water	

Heat sink temperature needs to be lower than 35 °C (95 °F) in all regimes of operation.
Please specify working voltage and required tuning range by ordering.
HV output voltage to Pockels cell is equal to HV power supply voltage.

Encased version of driver DP-SP

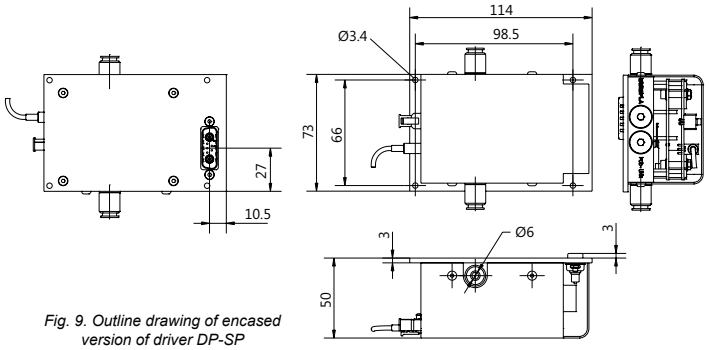


Fig. 9. Outline drawing of encased version of driver DP-SP

OEM Short-pulse version

CONFIGURATION EXAMPLES OF OEM VERSION OF DP-SP SERIES SHORT-PULSE DRIVERS

Catalogue Number of Driver	DP-SP-50-3.6	DP-SP-400-1.5	DP-SP-250-3.6	DP-SP-250-2.5	DP-SP-600-2.5	DP-SP-600-1.8
Maximal HV rated voltage	3.8 kV	1.6 kV	3.7 kV	2.6 kV	2.6 kV	2 kV
Max / min HV operating voltage	3.6 kV / 1.8 kV	1.5 kV / 0.75 kV	3.6 kV / 1.8 kV	2.5 kV / 1.25 kV	2.5 kV / 1.25 kV	1.8 kV / 0.9 kV
Maximal HV repetition rate	50 kHz	400 kHz	250 kHz	250 kHz	600 kHz	600 kHz
Pulse duration	15–5000 ns	15–620 ns	15–1250 ns	15–1000 ns	15-400 ns	15-400 ns
HV pulse rise time, typical	<7 ns	<5.5 ns	<7 ns	<6 ns	<6.5 ns	<6 ns
HV pulse fall time, typical	<7 ns	<5.5 ns	<7 ns	<6 ns	<6.5 ns	<6 ns
Output polarity				positive		
HV power consumption	<20 W	<20 W	<75 W	<40 W	<100 W	<35 W
12V / 24V power consumption	1 W	5.5 W	4 W	4.5 W	7 W	7 W
Dimensions	see Fig. 10			see Fig. 11		
Cooling	conductive			conductive or water		

Driver needs to be mounted on the heatsink (excluding water cooled versions).
Heat sink temperature needs to be lower than 35 °C (95 °F) in all regimes of operation.
Please specify working voltage and required tuning range by ordering.
HV output voltage to Pockels cell is equal to HV power supply voltage.

OEM version of DP-SP series driver with general purpose pad

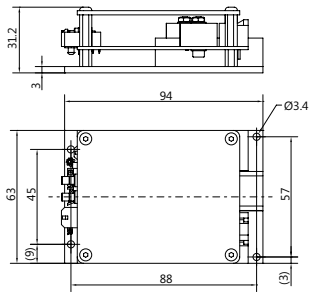


Fig. 10. Outline drawing of DP-SP series drivers with conductive pad

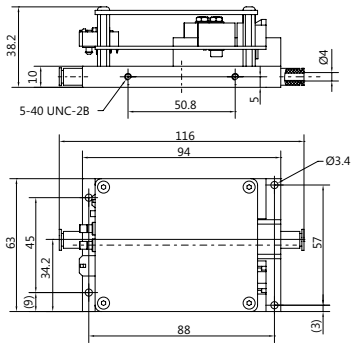


Fig. 11. Outline drawing of DP-SP series driver with general purpose pad

ENCASED version (unipolar drivers)

CONFIGURATION SAMPLES OF ENCASED VERSION OF DPS/DPD SERIES UNIPOLAR DRIVERS

Catalogue Number of Driver	DPS-250-3.6-AI DPD-250-3.6-AI	DPS-250-2.5-AI DPD-250-2.5-AI	DPS-500-2.6-AI DPD-500-2.6-AI	DPS-1000-1.8-AI DPD-1000-1.8-AI
Maximal HV rated voltage	3.7 kV	2.6 kV	2.7 kV	2 kV
Maximal HV operating voltage	3.6 kV	2.5 kV	2.6 kV	1.8 kV
Maximal HV repetition rate	250 kHz	250 kHz	500 kHz	1000 kHz
Pulse duration	100 – 5000 ns			
HV pulse rise time, typical	<7 ns	<6 ns	<6.5 ns	<6 ns
HV pulse fall time, typical	<7 ns	<6 ns	<6.5 ns	<6 ns
Output polarity	positive			
HV power consumption	<75 W	<40 W	<90 W	<80 W
12V/24V power consumption	4 W	4.5 W	6 W	9 W
Dimensions	see Fig. 12			
Cooling	water			

Encased version of driver DPS/DPD models DPS/DPD-200-xx, DPS/DPD-250-xx, DPS/DPD-500-xx, DPS/DPD-1000-1.8

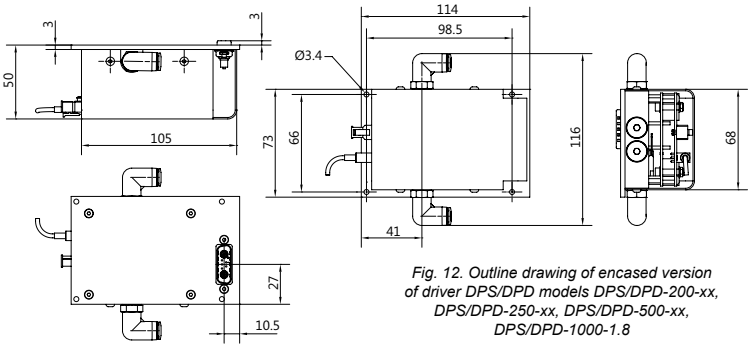


Fig. 12. Outline drawing of encased version of driver DPS/DPD models DPS/DPD-200-xx, DPS/DPD-250-xx, DPS/DPD-500-xx, DPS/DPD-1000-1.8

ENCASED version (bipolar drivers)

CONFIGURATION SAMPLES OF ENCASED VERSION OF DPS/DPD SERIES BIPOLAR DRIVERS

Catalogue Number of Driver	DPS-250-5.2-AI DPD-250-5.2-AI	DPS-300-4.6-AI DPD-300-4.6-AI	DPS-350-4-AI DPD-350-4-AI	DPS-1000-2.9-AI DPD-1000-2.9-AI
Maximal HV rated voltage	5.3 kV	4.8 kV	4.2 kV	3.0 kV
Maximal HV operating voltage	5.2 kV	4.6 kV	4.0 kV	2.9 kV
Maximal HV repetition rate	250 kHz	300 kHz	350 kHz	1000 kHz
Pulse duration	100 – 5000 ns			
HV pulse rise time, typical	<8.5 ns	<8 ns	<7.5 ns	<7.5 ns
HV pulse fall time, typical	<8.5 ns	<8 ns	<7.5 ns	<7.5 ns
Output polarity	bipolar			
HV power consumption	<100 W	<100 W	<100 W	<120 W
12V/24V power consumption	9 W			
Dimensions	see Fig. 13			
Cooling	conductive or water			

Driver needs to be mounted on the heatsink (excluding water cooled versions). Heat sink temperature needs to be lower than 35 °C (95 °F) in all regimes of operation.
HV output voltage to Pockels cell is equal to HV power supply voltage i.e. sum of positive and negative HV values. Please specify working voltage and required tuning range by ordering.

** Bipolar HV power supply HV2x60Wm is specifically designed for these drivers.*

Encased version of driver DPS/DPD models. Water cooled version

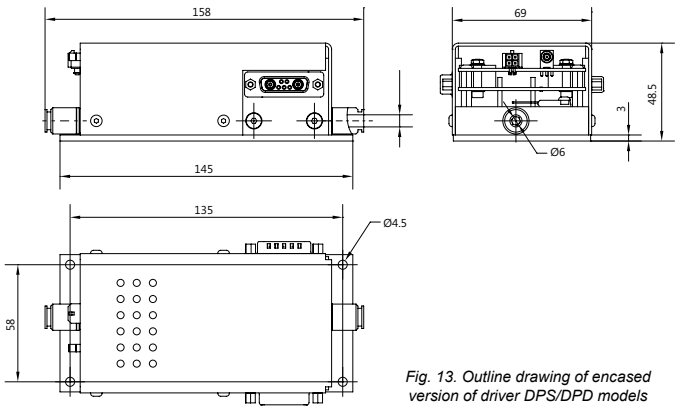


Fig. 13. Outline drawing of encased version of driver DPS/DPD models

FULL-BRIDGE version

CONFIGURATION EXAMPLES OF FULL-BRIDGE CONFIGURATION DRIVERS

Catalogue Number of Full-Bridge Driver	2DPS-1000-2.4-AI 2DPD-1000-2.4-AI	2DPS-2000-1.6-AI 2DPD-2000-1.6-AI
Base driver	DPS-500-2.5 DPD-500-2.5	DPS-1000-1.8 DPD-1000-1.8
Maximal HV operating voltage	2.4 kV	1.6 kV
Maximal HV repetition rate with frequency doubling [1]	1000 kHz	2000 kHz
HV pulse duration range for OUT1	100 – 5000 ns	
HV pulse duration range for OUT2	100 – 5000 ns	
HV pulse duration range to Pockel's cell	0 – 5000 ns	
HV pulse rise time	<6.5 ns	<6 ns
HV pulse fall time	<6.5 ns	<6 ns
Maximal capacitance of Pockels cell	<6 pF	
HV power consumption	<160 W [2]	
Case	see Fig. 16	
Cooling	water	

[1] *Full-bridge drivers are generally designed for operation at high repetition rate. However, low repetition rate pulsing can be achieved using pulse regeneration technique.*

[2] *Two HV power supplies PS-80 are suggested.*

Heat sink temperature needs to be lower than 35 °C (95 °F) in all regimes of operation. HV output voltage pulse to Pockels cell appears as difference of pulses OUT1 and OUT2 and is lower as HV power supply voltage.

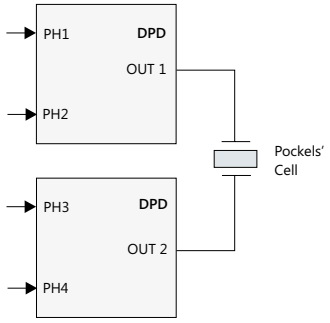


Fig. 14. Diagram of Pockels cell full-bridge connection to driver

External view of full-bridge driver

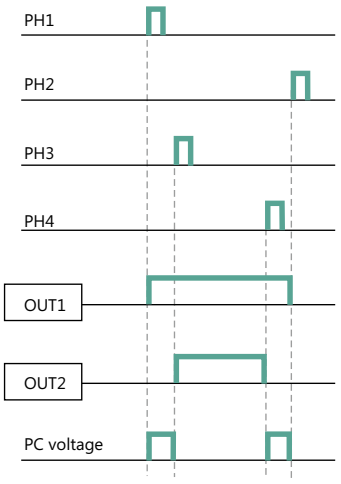


Fig. 15. Principle of 4-phase control of full-bridge driver configuration

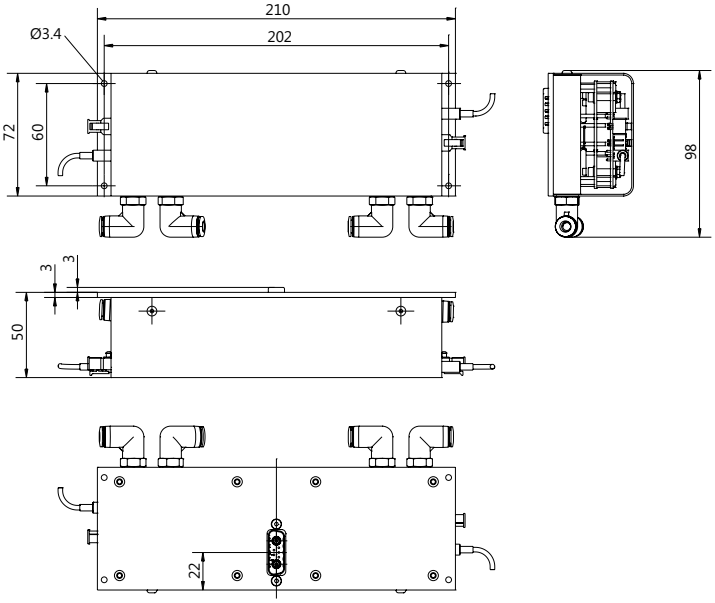


Fig. 16. Outline drawing of case for full-bridge drivers

DPB HIGH VOLTAGE POCKELS CELL DRIVER

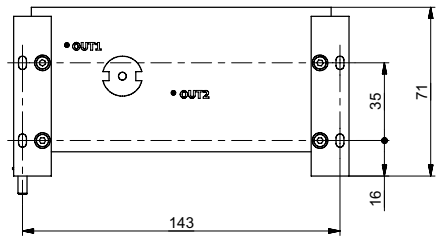
DPB series driver mounted with HV power supply PS-5

- **HV pulse amplitude up to 5.6 kV**
- **HV pulse duration down to 15 ns**
- **HV pulse amplitude doubling layout**
- **Repetition rate up to 10 kHz**
- **Easy integration with HV power supply**
- **Switchable one/two trigger pulses control model**

SPECIFICATIONS

Catalogue Number	DPB-10-4.2	DPB-5-5.6
Maximum high voltage (HV) pulse amplitude to cell	4.2 kV	5.6 kV
Output polarity	bipolar	
HV pulse rise time, typical	7 ns	8 ns
HV pulse fall time, typical	7 ns	8 ns
HV pulse duration	30 – 3000 ns	
Maximal HV pulse repetition rate	10 kHz	5 kHz
External triggering pulse amplitude requirement	3.5 – 5 V (50 Ω load)	
External triggering pulse rise & fall time	< 5 ns	
HV pulse delay	30 ns	
External powering requirements:		
HV power supply*	≤ 2.1 kV, 5W	≤ 2.8 kV, 5 W
low voltage DC supply	15 – 25 V, 150 mA or 12 V, 220 mA (0.5 A inrush current)	
Dimensions (L × W × H):		
driver board	135 × 65 × 25 mm	
driver board mounted with PS-5 power supply	135 × 65 × 55 mm	

** Typical voltage control limits for PS-5 are 1.8 to 2.8 kV. We accept other limits on your request.*



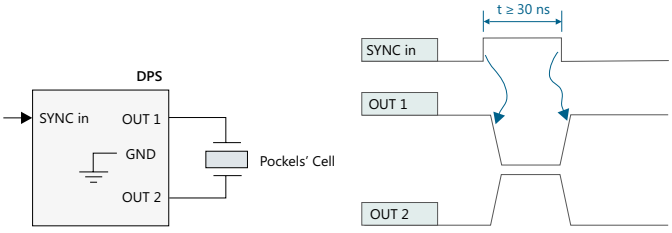
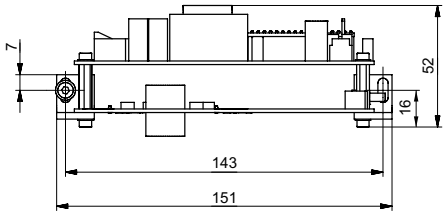


Diagram of pockels cell connection to driver and timing charts of driver controlled by 1 sync pulse DPB-10-4.2S or DPB-5-5.6S



Outline drawing

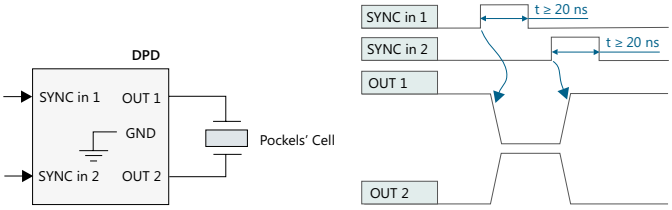
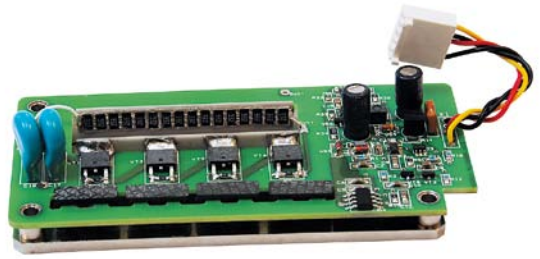


Diagram of pockels cell connection to driver and timing charts of driver controlled by 2 sync pulses DPB-10-4.2D or DPB-5-5.6D

ORDERING INFORMATION

Catalogue Number	Description
DPB-5-5.6S	Controlled by 1 sync pulse; Maximal HV pulse amplitude to cell 5.6 kV; Maximal HV pulse repetition rate 5 kHz
DPB-5-5.6D	Controlled by 2 sync pulses; Maximal HV pulse amplitude to cell 5.6 kV; Maximal HV pulse repetition rate 5 kHz
DPB-10-4.2S	Controlled by 1 sync pulse; Maximal HV pulse amplitude to cell 4.2 kV; Maximal HV pulse repetition rate 10 kHz
DPB-10-4.2D	Controlled by 2 sync pulses; Maximal HV pulse amplitude to cell 4.2 kV; Maximal HV pulse repetition rate 10 kHz

DQ — HIGH REPETITION RATE POCKELS CELLS DRIVER FOR Q-SWITCHING



- **Pulse repetition rate up to 100 kHz**
- **Fast HV rise time <7 ns for 4 kV pulse**
- **HV pulse amplitude up to 4 kV**

DQ series high repetition rate Pockels cell driver has been designed for use in mode-locked lasers for cavity dumping or for cavity Q-switching of solid-state nanosecond lasers. Fast HV (less than 7 ns) edge ensures excellent pre- and post-pulse contrast.

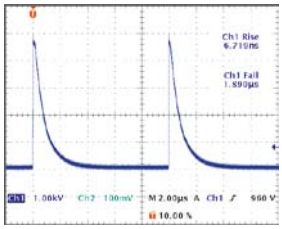
Ability to operate at high pulse repetition rates makes this driver perfect fit for most of diode-pumped nanosecond lasers. For pulse repetition rates up to 10 kHz heatsink is not required. For high repetition rates the driver should be attached to the heatsink with thermal resistance of at least 0.4 °C/W for room temperature (25 °C) operation.

The driver should be mounted into dielectric box (not provided) providing electrical insulation. Low voltage power supply is required to internal triggering circuit, while tuning of HV power supply voltage.

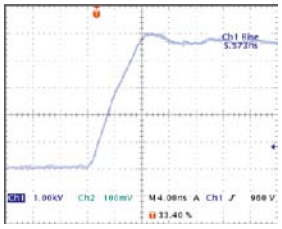
SPECIFICATIONS

Catalogue Number	DQ-100-4
Maximum high voltage (HV) pulse amplitude	4.0 kV
Polarity	Positive
HV pulse rise time	< 7 ns
HV pulse fall time	~2 μs [1]
HV pulse duration	180 ns [1]
Maximum HV pulse repetition rate	100 kHz
HV pulse jitter	< 0.5 ns
External triggering pulse duration requirement	100-1000 ns
External triggering pulse amplitude requirement	3-5 V (50 Ω)
External triggering pulse rise & fall time	< 10 ns
HV pulse delay	35-40 ns
External powering requirements:	
high voltage supply	0 - 4.0 kV, 9 mA max [2]
low voltage DC supply	9 - 24 V, 500 mA max [2]
Operating temperature	0-35 °C [3]
Size	104×52×25 mm

[1] Typical value.
[2] Test conditions :PRR = 100 kHz, C = 6 pF, U = 4 kV.
[3] Heatsink temperature should be bellow 35 °C at 100 kHz pulse repetition rate.



Oscillogram of DQ-100-4 driver operation



Fast edge of HV pulse in detail

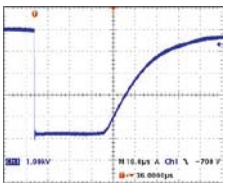
DP — CAVITY DUMPER DRIVER

DP has been designed for use in mode-locked lasers for cavity dumping or for cavity Q-switching of solid-state nanosecond lasers. Fast HV (less than 7 ns) edge ensures excellent pre- and post-pulse contrast.

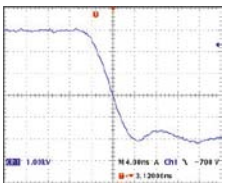
SPECIFICATIONS

Catalogue Number	DP-3-4.2
Maximum high voltage (HV) pulse amplitude	4.2 kV
HV pulse fall time	< 7 ns
HV pulse rise time	~ 0.1 ms
HV pulse duration	from 5 to 100 μs [1]
Maximum HV repetition rate	3 kHz
Jitter	< 0.5 ns
External triggering pulse duration requirement	100 – 1000 ns
External triggering pulse amplitude requirement	3 – 5 V (50 Ω)
External triggering pulse rise & fall time	< 20 ns
HV pulse delay	35 – 40 ns
External powering requirements:	
high voltage supply	4.4 kV, 0.2 mA max
low voltage DC supply	24 – 28 V, 50 mA max
Size	100 × 50 × 40 mm

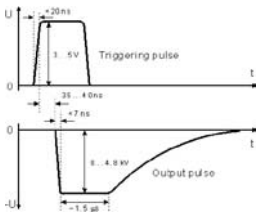
[1] According to customers request.



Oscillogram of DP driver operation: whole HV pulse



Oscillogram of DP driver operation: HV pulse fall



Time diagram of DP cavity dumping driver

DQF — POCKELS CELLS DRIVER FOR Q-SWITCHING FOR FLASHLAMP PUMPED LASERS

External view of DQF-0.2-5 driver

External view of DQF-0.1-8 driver

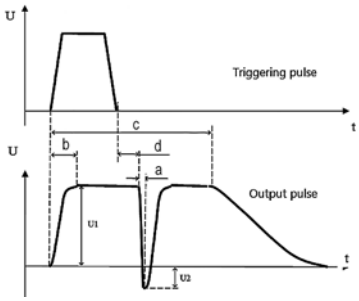


Fig. 1. Time diagram of DQF driver

DQF drivers are designed for Q-switching of nanosecond lasers without use of phase retardation plate. High voltage is applied to Pockels cell in order to inhibit oscillation. Pockels cell is opened by negative polarity pulse allowing laser to radiate.

Drivers DQF-0.1-8D and DQF-0.1-8B are integrated with ±4 kV HV power supply. Voltage control is done using CAN interface. We suggest CAN-USB converter with CAN browser software for Windows® operating system. CAN browser can be kept disconnected after proper voltage value was set.

Drivers DQF-0.2-5D and DQF-0.1-8D are designed for operation with DKDP crystals, drivers DQF-0.2-5B and DQF-0.1-8B – for BBO.

SPECIFICATIONS

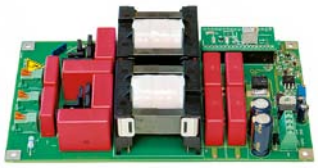
Catalogue Number	DQF-0.2-5D	DQF-0.2-5B	DQF-0.1-8D	DQF-0.1-8B
Maximum high voltage to cell (HV) pulse amplitude (U1 + U2)	5 kV	4 kV	8 kV	7.6 kV
U1 value *(Fig. 1)*	equal to HV powering voltage			
U2 value *(Fig. 1)*	equal to 0.25×U1	0 V	equal to 0.25×U1	0 V
HV pulse fall time *(a)*	< 15 ns		< 12 ns	
HV pulse rise time, typical *(b)*	60 µs		120 µs	
HV pulse duration, typical *(c)*	300 µs (1200 µs optionally)		650 µs	
HV pulse repetition rate	≤ 250 Hz		≤ 100 Hz	
HV pulse delay *(d)*	40 ns		25 ns	
External triggering pulse duration	100 – 1200 µs		120 – 650 µs	
External triggering pulse amplitude	3 – 5 V (50 Ω)		3.5 – 5 V (50 Ω)	
External triggering pulse rise & fall time	< 20 ns		< 20 ns	
Board dimensions	92 × 70 × 22 mm [1]		92 × 70 × 27 mm [1]	
Mounting holes location for M3 studs	84 × 62 mm		84 × 62 mm	
External powering requirements:				
DC supply	12 – 24 V, max 200 mA		12 V, max 15 mA	
HV supply	4 kV, 1 mA		n/a	

[1] Keep safety distance at least 5 mm from any side of board or any component to surrounding conductive parts.

PS — HIGH VOLTAGE POWER SUPPLY

PS-40 power supply

PS-80 power supply



PS-120, PS2-60 power supply

Output ripple is 0.5% typically at maximal power for all models of HV power supplies. External filter can be used to reduce that value if certain application requires smoother output. All Pockels cell drivers have integrated ripple filter and usually do not require additional one. Contact us for suggestions if your specific application needs lower ripple voltage.

Power supply PS series is designed for powering pockels cell driver with appropriate power and voltage requirement. Due to its performance and reliable design, PS is good choice for OEM customers.

Table below shows general specifications of HV power supplies. Particularly "Maximal output high voltage" row gives reference of maximal achievable voltage for particular model limited by design. For specific driver this limitation is different. E.g. for the driver DPS-1000-1.8 voltage control limits are made from 0.8 kV to 1.8 kV typically.

SPECIFICATIONS

Catalogue Number	PS-5	PS-40	PS-80	PS-120	PS2-60
Maximal high voltage output options [1]	1.8 kV 2.8 kV 4.0 kV	1.3 kV 1.8 kV 2.5 kV 3.6 kV 4.0 kV	1.8 kV 2.6 kV 3.1 kV 3.6 kV 4.0 kV 4.4 kV	1.8 kV 2.6 kV 3.1 kV 3.6 kV	±1.4 kV ±2.6 kV
Voltage control limits	-1 kV from maximal value				
Maximal output power at maximal output voltage [2]	5 W	40 W	80 W	120 W	2×60 W
Output voltage control options [3]	CAN interface [4], internal trimmer				
External powering	24 V DC, <15 W [5]	24 V DC, <50 W	24 V DC, <90 W	24 V DC, <150 W	24 V DC, <150 W
Dimensions (L × W × H)	135×70×30 mm	160×70×40 mm	175×70×45 mm	175×110×45 mm	175×110×45 mm
Mounting holes Ø3.4 mm location	125×35 mm	150×60 mm	165×60 mm	165×100 mm	165×100 mm

[1] Matching to Pockels cell driver voltage requirement is necessary by ordering.
[2] Maximal power is proportionally lower by tuning to lower HV output.
[3] Needs to be indicated by ordering.
[4] Requires USB-CAN converter for computer control that is sold separately.
[5] Optionally 12 V DC, <15 W.

PS4012

HIGH VOLTAGE POWER SUPPLY FOR POCKELS CELL DRIVERS

new

- **HV power supply and low voltage 24 V DC power supply in one box**
- **Tailored for use in laboratories**
- **HV tuning by multi-turn knob**
- **3½ LCD display for voltage monitoring**
- **Various versions for different power requirement**

Desktop HV power supply PS4012 is designed for powering Pockels cell drivers. It features internal HV power supply as well as low voltage 24 V DC power supply in one case.

SPECIFICATIONS

Model	PS4012-05	PS4012-40	PS4012-80	PS4012-120	PS4012-150	PS4012-2×60
Maximal high voltage output options	1.8 kV 2.8 kV 4.0 kV	1.3 kV 1.8 kV 2.5 kV 3.6 kV	1.8 kV 2.6 kV 3.1 kV 3.6 kV 4.0 kV 4.4 kV	1.8 kV 2.6 kV 3.1 kV 3.6 kV	1.8 kV 2.6 kV 3.1 kV 3.6 kV 4.0 kV 4.4 kV	±1.4 kV ±2.6 kV
Maximal output power at maximal output voltage [1)]	5 W	40 W	80 W	120 W	150 W	2×60 W
Voltage control limits	40% U_{max} to U_{max}					
24 V DC remaining power for external needs (including PCD)	190 W	150 W	100 W	60 W	20 W	60 W
Mains voltage	90 to 264 V AC, 47–63 Hz					
Dimensions (W×L×H)	260 × 280 × 100 mm					
Weight	2.7 kg					

[1)] Maximal power is proportionally lower by tuning to lower HV output.

Output ripple is 0.5% typically at maximal power for all models of HV power supplies. External filter can be used to reduce that value if certain application requires smoother output.

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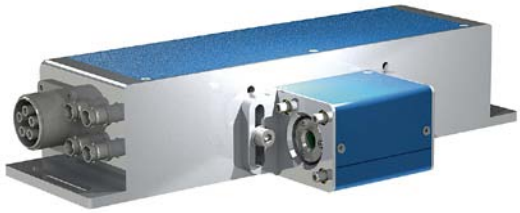
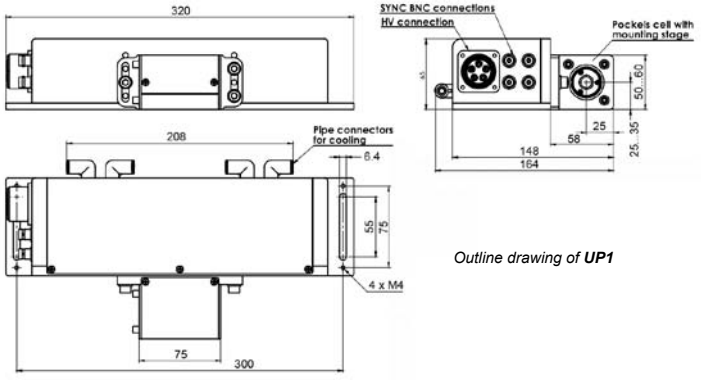
Pulse Picking & Q-Switching

UP1 ULTRAFAST PULSE PICKER

pMaster 4.0H *– Digital synchronization and delay pulse generator with built-in HV power supply*



UP1 *– Ultrafast pulse picker*



Outline drawing of ***UP1***

UP1 Pulse picker consists of built-in drivers in full bridge configuration and a Pockels cell attahed to the unit. In setup with pMaster 4.0H generator, UP1 pulse picker is able to select pulses at up to 1 MHz rate from max 100 MHz repetition rate pulse train.

UP1 comes with a BBO Pockels cell (set for quarter wave voltage) or a KTP Pockels cell (for half wave operation). KTP Pockels cell usage is limited by the average power of the laser beam – up to 2 W and contrast ratio is typically >1:500. While BBO Pockels cells operate at much higher power levels and feature higher contrast ratio – typically >1:1000.

We recommend to use UP1 in a set with digital synchronization and delay pulse generator pMaster 4.0H for synchronization of your laser with Pockels cell driver and triggering of Pockels cell driver used for pulse picking from the train of picosecond or femtosecond pulses. **pMaster 4.0H** has a built-in high voltage power supply and can be used with UP1 pulse picker for pulse picking at up to 1 MHz rate.

Suggested configuration

Ultrafast pulse picking
at up to 1 MHz rate

pMaster 4.0H → Pulse picker **UP1**

Pulse Picker's Control Software and Operation Scheme

See page 3.22.

SPECIFICATIONS OF DIGITAL SYNCHRONIZATION AND DELAY PULSE GENERATOR pMASTER 4.0H

Model	pMaster 4.0H
PROGRAMMABLE TIMING GENERATOR	
Channel modes	Single shot, burst, normal, duty cycle
Control modes	Internally triggered, externally triggered and external gate
Delay range	0 to 1000 s
Delay accuracy	1.5 ns + 0.0001 delay
Delay resolution	250 ps
Delay Jitter	<400 ps RMS
Pulse inhibit delay / output inhibit delay	120 ns / 50 ns
TRIGGER INPUT MODULE	
Trigger input rate	DC – 5 MHz
Trigger insertion delay	<180 ns
Trigger jitter	<800 ps RMS
Minimal pulse width	2 ns
Trigger threshold	0.2 – 15 V DC
Maximum input voltage	60 V Peak
Input impedance	1.5 k ohms + 40 pF
Resolution	10 mV
EXTERNAL CLOCK INPUT MODULE	
External clock input rate	10 MHz – 100 MHz
Minimal pulse width	100 ps
Pulse amplitude	1 V rms (min) – 5 V rms (max)
Input impedance	102 ohms
PHYSICAL SPECIFICATIONS	
High voltage power supply for PC driver	Built-in
Dimensions W × D × H	482 × 387 × 88 mm

SPECIFICATIONS OF PULSE PICKER UNIT

Pulse picker	UP1 - BBO	UP1 - KTP
Built-in driver	operates at up to 1 MHz rep. rate	
Max laser repetition rate for single pulse picking	100 MHz	
HV power supply	requires [1]	
Operation	quarter wave, λ/4	half-wave, λ/2
HV pulse duration	0 – 5000 ns	
HV pulse rise and fall time	<6.5 ns	
Pockels cell contrast ratio, VCR [2]	>1:500	
Pockels cell transmission [3]	>98 % at 1030 nm	>98 % at 1064 nm
Clear aperture	Ø3.5 mm	Ø5 mm [4]
Cooling	water	
Dimensions L × W × H	320 × 164 × 65 mm	

[1] *Requires two HV power supplies with max 4 kV output and maximal output power 120 W each. Optimal HV power supplies are provided in generator pMaster 4.0H.*

[2] *VCR – contrast ratio when voltage is applied to the cell.*

[3] *Other particular laser wavelengths or wavelength ranges are available on request.*

[4] *Max clear aperture for KTP Pockels cell can be up to Ø9 mm.*

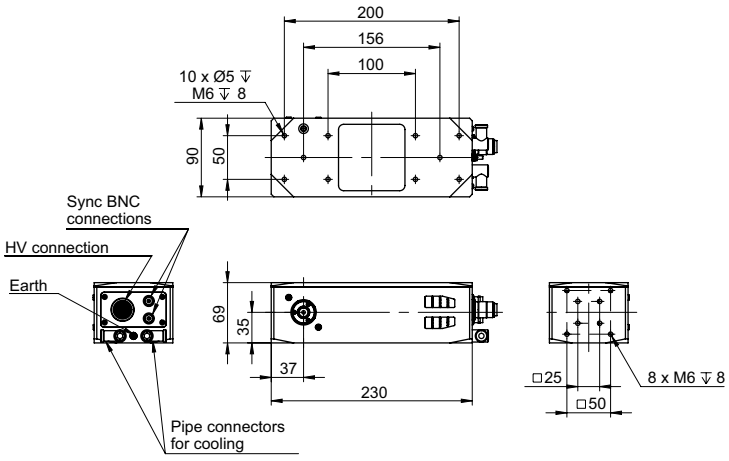
ORDERING INFORMATION

Code	Description
pMaster 4.0H	Pulse synchronization and delay generator, 4 output channels for trigger pulses with built-in High Voltage supply
UP1-BBO-2.5	Ultrafast pulse picker for up to 1 MHz operating rate, BBO clear aperture 2.5 mm, λ/4 operation at 1030-1064 nm
UP1-BBO-3.5	Ultrafast pulse picker for up to 1 MHz operating rate, BBO clear aperture 3.5 mm, λ/4 operation at 1030-1064 nm
UP1-KTP-5.5	Ultrafast pulse picker for up to 1 MHz operating rate, KTP clear aperture 5.5 mm, λ/2 operation at 1030-1064 nm

MP1 FAST PULSE PICKER

pMaster 4.0H *– Digital synchronization and delay pulse generator with built-in HV power supply*

MP1 *– Fast pulse picker*



Outline drawing of ***MP1***

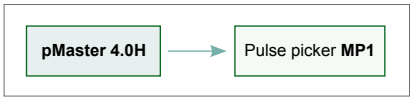
MP1 pulse picker consists of built-in fast driver and a Pockels cell.

This unit is able to select pulses at up to 600 kHz rate. MP1 requires sync pulses from the laser for the driver control or can be used with **pMaster 4.0H** generator. In setup with pMaster 4.0H generator can be synchronized for single pulse picking from max 30 MHz repetition rate pulse train.

MP1 pulse picker has BBO Pockels cell and is set for quarter wave voltage operation. On special requests BBO cell can be changed to KTP Pockels cell for half wave voltage operation.

Suggested configuration

Ultrafast pulse picking
at up to 600 kHz rate



Pulse Picker's Control Software and Operation Scheme

See page 3.22.

SPECIFICATIONS OF DIGITAL SYNCHRONIZATION AND DELAY PULSE GENERATOR pMASTER 4.0H

Model	pMaster 4.0H
PROGRAMMABLE TIMING GENERATOR	
Channel modes	Single shot, burst, normal, duty cycle
Control modes	Internally triggered, externally triggered and external gate
Delay range	0 to 1000 s
Delay accuracy	1.5 ns + 0.0001 delay
Delay resolution	250 ps
Delay Jitter	<400 ps RMS
Pulse inhibit delay / output inhibit delay	120 ns / 50 ns
TRIGGER INPUT MODULE	
Trigger input rate	DC – 5 MHz
Trigger insertion delay	<180 ns
Trigger jitter	<800 ps RMS
Minimal pulse width	2 ns
Trigger threshold	0.2 – 15 V DC
Maximum input voltage	60 V Peak
Input impedance	1.5 k ohms + 40 pF
Resolution	10 mV
EXTERNAL CLOCK INPUT MODULE	
External clock input rate	10 MHz – 100 MHz
Minimal pulse width	100 ps
Pulse amplitude	1 V rms (min) – 5 V rms (max)
Input impedance	102 ohms
PHYSICAL SPECIFICATIONS	
High voltage power supply for PC driver	Built-in
Dimensions W × D × H	482 × 387 × 88 mm

SPECIFICATIONS OF PULSE PICKER UNIT

Pulse picker	MP1 - BBO
Built-in driver	operates at up to 600 kHz rep. rate
Max laser repetition rate for single pulse picking	30 MHz
HV power supply	requires [1]
Operation	quarter wave, λ/4
HV pulse duration	15 – 5000 ns
HV pulse rise and fall time	<7 ns
Pockels cell contrast ratio, VCR [2]	>1:500
Pockels cell transmission [3]	>98 % at 1030 nm
Clear aperture	Ø3.5 mm
Cooling	water
Dimensions L × W × H	230 × 90 × 69 mm

[1] Requires one HV power supply with max 4 kV output and maximal output power 120 W each. Optimal HV power supplies are provided in generator pMaster 4.0H.

[2] VCR – contrast ratio when voltage is applied to the cell.

[3] Other particular laser wavelengths or wavelength ranges are available on request.

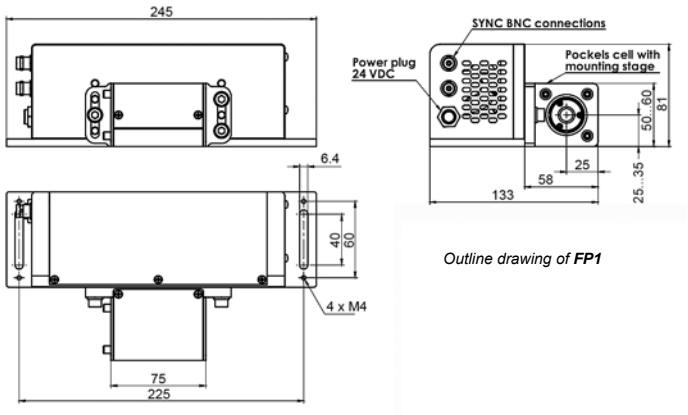
ORDERING INFORMATION

Code	Description
pMaster 4.0H	Pulse synchronization and delay generator, 4 output channels for trigger pulses with built-in High Voltage supply
MP1-BBO-3.5	Pulse picker for up to 600 kHz operating rate, BBO clear aperture 3.5 mm, λ/4 operation at 1030-1064 nm
Minichiller 300-H	Chiller for water cooling of HV drivers (optional)

FP1 PULSE PICKER

pMaster 4.0 *– Digital synchronization and delay pulse generator*

FP1 *pulse picker*



Outline drawing of ***FP1***

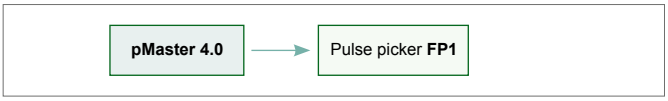
Pulse picker FP1 consists of a built-in driver with a high voltage power supply and a Pockels cell attached to the unit. FP1 pulse picker is able to select pulses at up to 1 kHz rate.

FP1 requires sync pulses from the laser for driver control or it can be used with pMaster 4.0 pulse synchronization and delay generator. In setup with pMaster 4.0 generator FP1 can be synnchronized for single pulse picking from max 20 MHz repetition rate pulse train. Standard FP1 pulse picker has a DKDP Pockels cell and is set for quarter wave voltage operation. On special requests DKDP cell can be changed to BBO or KTP Pockels cell for half wave voltage operation.

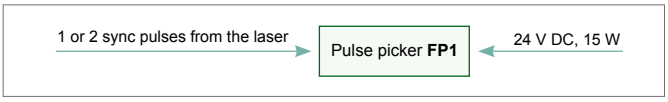
For synchronization of your laser with Pockels cell driver and triggering of Pockels cell driver used for pulse picking from the train of picosecond or femtosecond pulses we recommend to use **FP1 Pulse picker in setup with pMaster 4.0** digital synchronization and delay pulse generator.

Suggested configurations

Pulse picking at up to 1 kHz rate



Pulse picking at up to 1 kHz rate



Pulse Picker's Control Software and Operation Scheme

See page 3.22.

SPECIFICATIONS OF DIGITAL SYNCHRONIZATION AND DELAY PULSE GENERATOR pMASTER 4.0

Model	pMaster 4.0
PROGRAMMABLE TIMING GENERATOR	
Channel modes	Single shot, burst, normal, duty cycle
Control modes	Internally triggered, externally triggered and external gate
Delay range	0 to 1000 s
Delay accuracy	1.5 ns + 0.0001 delay
Delay resolution	250 ps
Delay Jitter	<400 ps RMS
Pulse inhibit delay / output inhibit delay	120 ns / 50 ns
TRIGGER INPUT MODULE	
Trigger input rate	DC – 5 MHz
Trigger insertion delay	<180 ns
Trigger jitter	<800 ps RMS
Minimal pulse width	2 ns
Trigger threshold	0.2 – 15 V DC
Maximum input voltage	60 V Peak
Input impedance	1.5 k ohms + 40 pF
Resolution	10 mV
EXTERNAL CLOCK INPUT MODULE	
External clock input rate	10 MHz – 100 MHz
Minimal pulse width	100 ps
Pulse amplitude	1 V rms (min) – 5 V rms (max)
Input impedance	102 ohms
PHYSICAL SPECIFICATIONS	
High voltage power supply for PC driver	–
Dimensions W × D × H	482 × 283 × 44 mm

SPECIFICATIONS OF PULSE PICKER UNIT

Pulse picker	FP1 - DKDP
Built-in driver	operates at up to 1 kHz rep. rate
Max laser repetition rate for single pulse picking	20 MHz
HV power supply	built-in [1]
Operation	quarter wave, λ/4
HV pulse duration	15 – 3000 ns
HV pulse rise and fall time	<6.5 ns
Pockels cell contrast ratio, VCR [2]	>1:2000
Pockels cell transmission [3]	>97% at 1064 nm
Clear aperture	Ø11 mm
Cooling	conductive heat sink
Dimensions L × W × H	245 × 133 × 81 mm

[1] *Requires only 24 V, 15 W external power supply.*

[2] *VCR – contrast ratio when voltage is applied to the cell.*

[3] *Other particular laser wavelengths or wavelength ranges are available on request.*

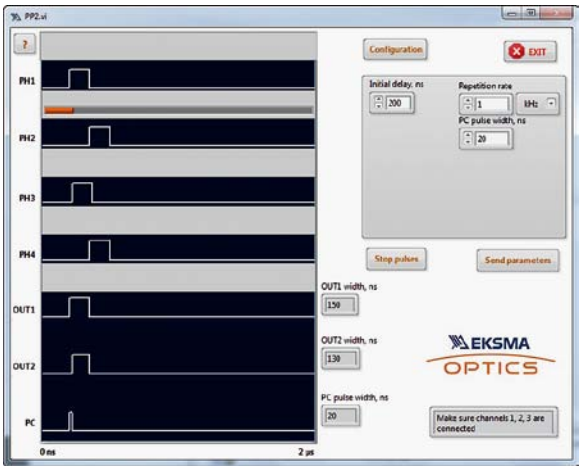
ORDERING INFORMATION

Code	Description
pMaster 4.0	Pulse synchronization and delay generator, 4 output channels for trigger pulses
FP1-DKDP-11	Pulse picker with built in HV supply for up to 10 kHz operating rate, DKDP clear aperture 11 mm, λ/4 operation at 1064 nm

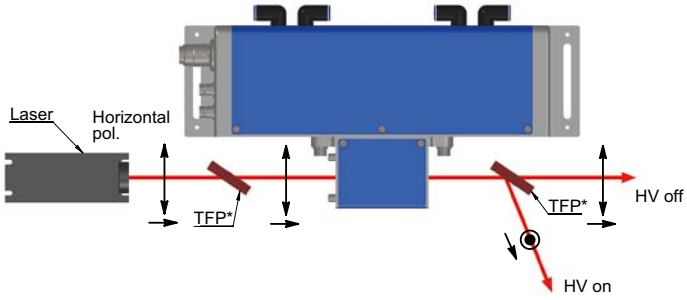
PULSE PICKER'S CONTROL SOFTWARE AND OPERATION SCHEMES

Control software

pMaster features 4 independent programmable channel outputs and communication via USB port with LabView compatible drivers for full control over all parameters.

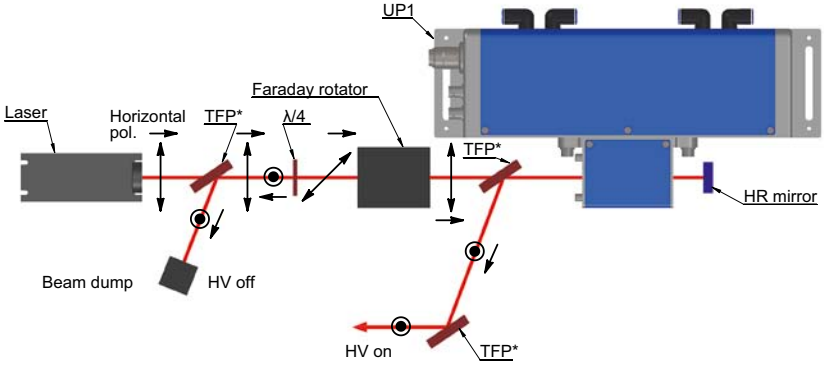


Suggested Half-wave voltage operation scheme



** TFP – Thin film polarizer, for instance our standard products: 420-1258UHT, 420-1256UHT or 420-1248UHT.*

Suggested Quater-wave voltage operation scheme



** TFP – Thin film polarizer, for instance our standard products: 420-1258UHT, 420-1256UHT or 420-1248UHT.*

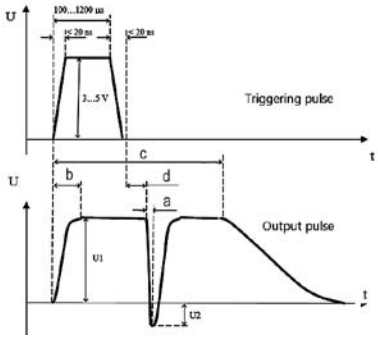
OEM DKDP POCKELS CELLS KIT FOR Q-SWITCHING OF FLASH LAMP PUMPED LASERS

- **Pulse repetition rate up to 200 Hz**
- **Q-switching without retardation plate**

EKSMA OPTICS offers Pockels cells kit for lamp pumped nanosecond lasers. High voltage through Pockels cell driver DQF is applied to Pockels cell in order to inhibit oscillation. Pockels cell is opened by negative polarity pulse allowing laser to radiate.

DKDP POCKELS CELLS Q-SWITCHING KIT INCLUDES:

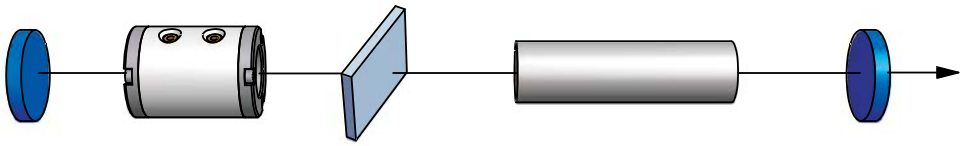
- Low repetition rate Pockels Cell driver *see page 3.13*
- High voltage power supply for Pockels Cell driver *see page 3.14*
- DKDP Pockels cells *see page 3.3*



Time diagram of DQF Pockels cell driver

OEM DKDP POCKELS CELL KITS

Code	Description
QKD-01	for 1064 nm, λ/4 operation; clear aperture 4.5×4.5 mm; repetition rate up to 200 Hz
QKD-02	for 1064 nm, λ/4 operation; clear aperture 9.5×9.5 mm; repetition rate up to 200 Hz
QKD-03	for 1064 nm, λ/4 operation; clear aperture Ø11 mm; repetition rate up to 200 Hz
QKD-04	for 1064 nm, λ/4 operation; clear aperture Ø8 mm; repetition rate up to 200 Hz
QKD-05	for 1064 nm, λ/4 operation; clear aperture Ø11 mm; repetition rate up to 200 Hz



OEM BBO POCKELS CELL KIT FOR Q-SWITCHING OF DPSS LASERS

- **Pulse repetition rate up to 100 kHz**
- **Up to 10 kHz no external cooling is required**
- **Fast HV rise time <7 ns**

EKSMA OPTICS offers BBO Pockels cell kit for Q-Switching of high repetition rate nanosecond lasers and mode locked lasers.

BBO POCKELS CELLS Q-SWITCHING KIT INCLUDES:

- High repetition rate Pockels Cell driver *see page 3.13*
- High voltage power supply for Pockels Cell driver *see page 3.14*
- BBO Pockels cell *see page 3.4*

OEM BBO POCKELS CELLS KITS

Code	Description
QKB-01	for 1064 nm, λ/4 operation; clear aperture 2.5 mm; repetition rate up to 100 kHz
QKB-02	for 1064 nm, λ/4 operation; clear aperture 3.5 mm; repetition rate up to 100 kHz

EKSMA OPTICS • Tel.: +370 5 272 99 00 • Fax: +370 5 272 92 99 • info@eksmaoptics.com • www.eksmaoptics.com

Pockels cells and Drivers

EKSMA OPTICS

BBO Pockels Cells
for 1064 nm and 1020 – 1040 nm

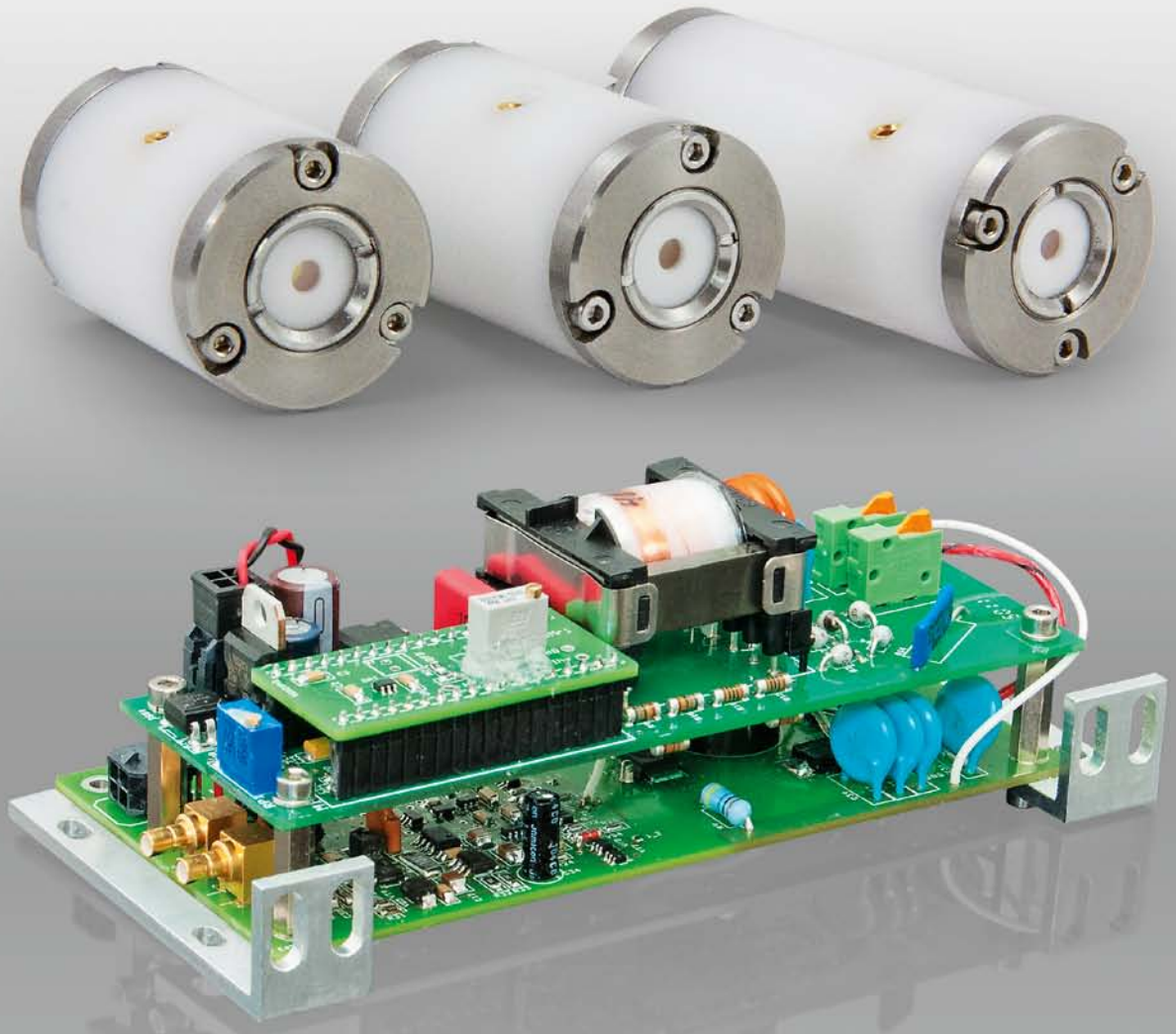
KD*P Pockels Cells
for 694 nm, 1064 nm and broadband 740 – 840 nm

KTP Pockels Cells for 1064 nm

Drivers and HV Power Supplies

Pulse Picking Solutions

Q-Switching Kits



Nd:YAG LaserLine Components

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OPTICAL COMPONENTS CLEANING INSTRUCTIONS

See page A.4

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

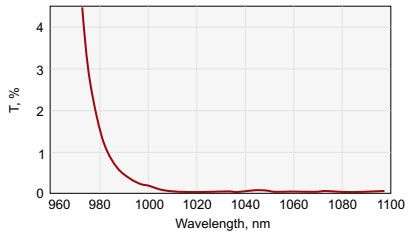
Material	UV grade Fused Silica or BK7 glass
S1 Surface Flatness	λ/10 at 633 nm
S1 Surface Quality	20-10 scratch & dig (MIL-PRF-13830B)
S2 Surface Quality	Commercial polish
Diameter Tolerance	+0.00 mm -0.12 mm
Thickness Tolerance	±0.25 mm
Wedge	< 3 min
Chamfer	0.3 mm at 45° typical

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°

Size – **Ø12.7 × 3 mm**

Wavelength, nm	**R,** % (s+p)/2 AOI=0° / AOI=45°	**Catalogue number** AOI=0°	AOI=45°	**Price,** EUR AOI=0° / AOI=45°
351–361	99.7 / 99.5	031-0350-i0	031-0350	59 / 59
527–532	99.7 / 99.5	031-0530-i0	031-0530	56 / 56
1047–1064	99.7 / 99.5	031-1060-i0	031-1060	57 / 57

Size – **Ø12.7 × 6 mm**

Wavelength, nm	**R,** % (s+p)/2 AOI=0° / AOI=45°	**Catalogue number** AOI=0°	AOI=45°	**Price,** EUR AOI=0° / AOI=45°
351–361	99.7 / 99.5	031-0350T6-i0	031-0350T6	59 / 59
527–532	99.7 / 99.5	031-0530T6-i0	031-0530T6	56 / 56
1047–1064	99.7 / 99.5	031-1060T6-i0	031-1060T6	57 / 57

Size – **Ø25.4 × 6 mm**

Wavelength, nm	**R,** % (s+p)/2 AOI=0° / AOI=45°	**Catalogue number** AOI=0°	AOI=45°	**Price,** EUR AOI=0° / AOI=45°
351–361	99.7 / 99.5	032-0350-i0	032-0350	90 / 90
527–532	99.7 / 99.5	032-0530-i0	032-0530	74 / 74
1047–1064	99.7 / 99.5	032-1060-i0	032-1060	75 / 75

Size – **Ø50.8 × 8 mm**

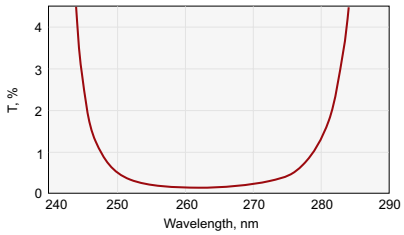
Wavelength, nm	**R,** % (s+p)/2 AOI=0° / AOI=45°	**Catalogue number** AOI=0°	AOI=45°	**Price,** EUR AOI=0° / AOI=45°
351–361	99.7 / 99.5	035-0350-i0	035-0350	128 / 128
527–532	99.7 / 99.5	035-0530-i0	035-0530	110 / 110
1047–1064	99.7 / 99.5	035-1060-i0	035-1060	110 / 110

Size – **Ø76.2 × 12.7 mm**

Wavelength, nm	**R,** % (s+p)/2 AOI=0° / AOI=45°	**Catalogue number** AOI=0°	AOI=45°	**Price,** EUR AOI=0° / AOI=45°
527–532	99.7 / 99.5	037-0530-i0	037-0530	185 / 185
1047–1064	99.7 / 99.5	037-1060-i0	037-1060	185 / 185

Laser Line Mirrors

Substrate material: **UV grade Fused Silica**



HR 266 nm, AOI = 45°

Size – **Ø12.7 × 3 mm**

Wavelength, nm	R, % (s+p)/2 AOI=0° / AOI=45°	Catalogue number AOI=0°	Catalogue number AOI=45°	Price, EUR AOI=0° / AOI=45°
262–266	99 / 99	041-0260-i0	041-0260	71 / 71
351–361	99.7 / 99.5	041-0350-i0	041-0350	67 / 67
527–532	99.7 / 99.5	041-0530-i0	041-0530	62 / 62
1047–1064	99.7 / 99.5	041-1060-i0	041-1060	62 / 62

Size – **Ø12.7 × 6 mm**

Wavelength, nm	R, % (s+p)/2 AOI=0° / AOI=45°	Catalogue number AOI=0°	Catalogue number AOI=45°	Price, EUR AOI=0° / AOI=45°
262–266	99 / 99	041-0260T6-i0	041-0260T6	71 / 71
351–361	99.7 / 99.5	041-0350T6-i0	041-0350T6	67 / 67
	– / 99.9	–	041-0350HHRT6	– / 110
527–532	99.7 / 99.5	041-0530T6-i0	041-0530T6	62 / 62
	99.9 / 99.9	041-0530HHRT6-i0	041-0530HHRT6	75 / 75
1047–1064	99.7 / 99.5	041-1060T6-i0	041-1060T6	62 / 62
	99.9 / 99.9	041-1060HHRT6-i0	041-1060HHRT6	75 / 75

Size – **Ø25.4 × 6 mm**

Wavelength, nm	R, % (s+p)/2 AOI=0° / AOI=45°	Catalogue number AOI=0°	Catalogue number AOI=45°	Price, EUR AOI=0° / AOI=45°
262–266	99 / 99	042-0260-i0	042-0260	99 / 99
351–361	99.7 / 99.5	042-0350-i0	042-0350	95 / 95
	– / 99.9	–	042-0350HHR	– / 130
527–532	99.7 / 99.5	042-0530-i0	042-0530	90 / 90
	99.9 / 99.9	042-0530HHR-i0	042-0530HHR	105 / 105
1047–1064	99.7 / 99.5	042-1060-i0	042-1060	90 / 90
	99.9 / 99.9	042-1060HHR-i0	042-1060HHR	105 / 105

Size – **Ø50.8 × 8 mm**

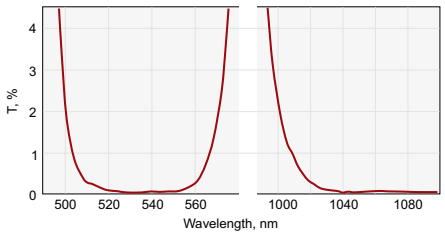
Wavelength, nm	R, % (s+p)/2 AOI=0° / AOI=45°	Catalogue number AOI=0°	Catalogue number AOI=45°	Price, EUR AOI=0° / AOI=45°
262–266	99 / 99	045-0260-i0	045-0260	207 / 207
351–361	99.7 / 99.5	045-0350-i0	045-0350	187 / 187
527–532	99.7 / 99.5	045-0530-i0	045-0530	169 / 169
1047–1064	99.7 / 99.5	045-1060-i0	045-1060	169 / 169

Size – **Ø76.2 × 12.7 mm**

Wavelength, nm	R, % (s+p)/2 AOI=0° / AOI=45°	Catalogue number AOI=0°	Catalogue number AOI=45°	Price, EUR AOI=0° / AOI=45°
351–361	99.7 / 99.5	047-0350-i0	047-0350	281 / 281
527–532	99.7 / 99.5	047-0530-i0	047-0530	258 / 258
1047–1064	99.7 / 99.5	047-1060-i0	047-1060	258 / 258

Dual Band Mirrors

Substrate material: **BK7 grade A**



HR 532+1064 nm, AOI = 45°

Size – **Ø12.7 × 3 mm**

Wavelength, nm	R, % (s+p)/2 AOI=0° / AOI=45°	Catalogue number AOI=0°	Catalogue number AOI=45°	Price, EUR AOI=0° / AOI=45°
532+1064	99.7 / 99.5	051-5306-i0	051-5306	85 / 85
633+1064	99.7 / 99.5	051-6306-i0	051-6306	85 / 85

Size – **Ø12.7 × 6 mm**

Wavelength, nm	R, % (s+p)/2 AOI=0° / AOI=45°	Catalogue number AOI=0°	Catalogue number AOI=45°	Price, EUR AOI=0° / AOI=45°
532+1064	99.7 / 99.5	051-5306T6-i0	051-5306T6	85 / 85
633+1064	99.7 / 99.5	051-6306T6-i0	051-6306T6	85 / 85

Size – **Ø25.4 × 6 mm**

Wavelength, nm	R, % (s+p)/2 AOI=0° / AOI=45°	Catalogue number AOI=0°	Catalogue number AOI=45°	Price, EUR AOI=0° / AOI=45°
532+1064	99.7 / 99.5	052-5306-i0	052-5306	103 / 103
633+1064	99.7 / 99.5	052-6306-i0	052-6306	103 / 103

Size – **Ø50.8 × 8 mm**

Wavelength, nm	R, % (s+p)/2 AOI=0° / AOI=45°	Catalogue number AOI=0°	Catalogue number AOI=45°	Price, EUR AOI=0° / AOI=45°
532+1064	99.7 / 99.5	055-5306-i0	055-5306	151 / 151
633+1064	99.7 / 99.5	055-6306-i0	055-6306	151 / 151

Size – **Ø76.2 × 12.7 mm**

Wavelength, nm	R, % (s+p)/2 AOI=0° / AOI=45°	Catalogue number AOI=0°	Catalogue number AOI=45°	Price, EUR AOI=0° / AOI=45°
532+1064	99.7 / 99.5	057-5306-i0	057-5306	227 / 227
633+1064	99.7 / 99.5	057-6306-i0	057-6306	227 / 227

RELATED PRODUCTS

Prisms

See page 1.49

Kinematic Mirror/Beamsplitter Mounts 840-0056

See page 7.38

Dual Band Mirrors

Substrate material: **UV grade Fused Silica**

Size – **Ø12.7 × 3 mm**

Wavelength, nm	R, % (s+p)/2 AOI=0° / AOI=45°	Catalogue number AOI=0°	Catalogue number AOI=45°	Price, EUR AOI=0° / AOI=45°
532+1064	99.7 / 99.5	061-5306-i0	061-5306	109 / 109
633+1064	99.7 / 99.5	061-6306-i0	061-6306	109 / 109
355+532	99.7 / 99.5	061-3553-i0	061-3553	115 / 115

Size – **Ø12.7 × 6 mm**

Wavelength, nm	R, % (s+p)/2 AOI=0° / AOI=45°	Catalogue number AOI=0°	Catalogue number AOI=45°	Price, EUR AOI=0° / AOI=45°
532+1064	99.7 / 99.5	061-5306T6-i0	061-5306T6	109 / 109
633+1064	99.7 / 99.5	061-6306T6-i0	061-6306T6	109 / 109
355+532	99.7 / 99.5	061-3553T6-i0	061-3553T6	115 / 115

Size – **Ø25.4 × 6 mm**

Wavelength, nm	R, % (s+p)/2 AOI=0° / AOI=45°	Catalogue number AOI=0°	Catalogue number AOI=45°	Price, EUR AOI=0° / AOI=45°
532+1064	99.7 / 99.5	062-5306-i0	062-5306	134 / 134
	99.9 / 99.9	062-5306HHR-i0	062-5306HHR	180 / 180
633+1064	99.7 / 99.5	062-6306-i0	062-6306	134 / 134
355+532	99.7 / 99.5	062-3553-i0	062-3553	139 / 139

Size – **Ø50.8 × 8 mm**

Wavelength, nm	R, % (s+p)/2 AOI=0° / AOI=45°	Catalogue number AOI=0°	Catalogue number AOI=45°	Price, EUR AOI=0° / AOI=45°
532+1064	99.7 / 99.5	065-5306-i0	065-5306	209 / 209
633+1064	99.7 / 99.5	065-6306-i0	065-6306	209 / 209
355+532	99.7 / 99.5	065-3553-i0	065-3553	215 / 215

Size – **Ø76.2 × 12.7 mm**

Wavelength, nm	R, % (s+p)/2 AOI=0° / AOI=45°	Catalogue number AOI=0°	Catalogue number AOI=45°	Price, EUR AOI=0° / AOI=45°
532+1064	99.7 / 99.5	067-5306-i0	067-5306	318 / 318
633+1064	99.7 / 99.5	067-6306-i0	067-6306	318 / 318
355+532	99.7 / 99.5	067-3553-i0	067-3553	323 / 323

RELATED PRODUCTS

Laser Line and Dual Laser Line Mirrors of other wavelengths

See page 1.19

Metal Coated Mirrors

See page 1.24

LASER HARMONIC SEPARATORS

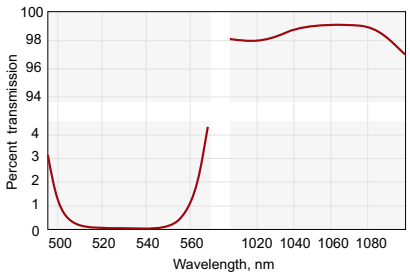
- **Offered on Ø 0.5 or 1 inch substrates of BK7 or UV FS with surface flatness λ/10**

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



041-5105HT.
HR > 99.9% @ 532 nm,
HT > 99% @ 1064 nm, AOI = 45°

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<0.25% AOI 0°, R<0.2%

Reflected wave-length, nm, R > 99.9%	Trans-mitted wave-length, nm	Trans-mission, %	AOI, deg	Sub-strate material	Code Ø12.7x3 mm	Code Ø25.4x6 mm	Price, EUR Ø12.7 / Ø25.4
532	1064	>99	0	UVFS	041-5100HT	042-5100HT	160 / 205
532	1064	>99	45	UVFS	041-5105HT	042-5105HT	160 / 205
1064	532	>99	0	UVFS	041-6500HT	042-6500HT	165 / 210
1064	532	>99	45	UVFS	041-6505HT	042-6505HT	165 / 210

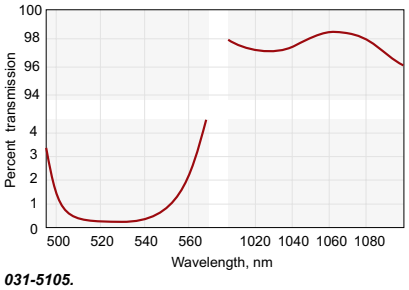
Standard Laser Harmonic Separators

COATING

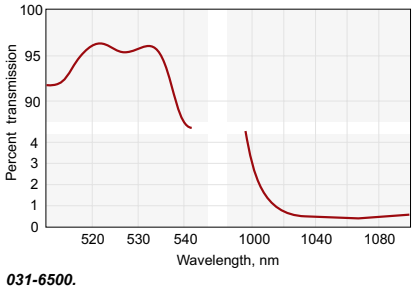
Technology	Electron beam multilayer dielectric
Adhesion and Durability	Per MIL-C-675A. Insoluble in lab solvents
Clear Aperture	Exceeds central 85% of diameter
Damage Threshold:	
BK7	>2 J/cm², 8 nsec pulse, 1064 nm typical
UV FS	>5 J/cm², 8 nsec pulse, 1064 nm typical
Coated Surface Flatness	λ/10 at 633 nm over clear aperture
Back side antireflection coated	AOI 45°, R<0.5% AOI 0°, R<0.1%

RELATED PRODUCTS

Pellin-Broca Prisms
See page 1.51



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°

Reflected wavelength, nm, R > 99.5%	Transmitted wavelength, nm	Transmission, %	AOI, deg	Substrate material	Code Ø12.7x3 mm	Code Ø25.4x6 mm	Price, EUR Ø12.7 / Ø25.4
266	355+532+1064	>90	0	UVFS	041-2310	042-2310	155 / 185
266	355+532+1064	>90	45	UVFS	041-2315	042-2315	155 / 185
266	532	>95	0	UVFS	041-2500	042-2500	135 / 165
266	532	>95	45	UVFS	041-2505	042-2505	135 / 165
355	1064	>95	0	UVFS	041-3100	042-3100	115 / 145
355	1064	>95	45	UVFS	041-3105	042-3105	115 / 145
355	532	>95	0	UVFS	041-3500	042-3500	115 / 145
355	532	>95	45	UVFS	041-3505	042-3505	115 / 145
355	532+1064	>95	0	UVFS	041-3510	042-3510	125 / 155
355	532+1064	>95	45	UVFS	041-3515	042-3515	125 / 155
532	1064	>95	0	BK7	031-5100	032-5100	90 / 115
532	1064	>95	45	BK7	031-5105	032-5105	90 / 115
532	1064	>95	0	UVFS	041-5100	042-5100	115 / 145
532	1064	>95	45	UVFS	041-5105	042-5105	115 / 145
532+1064	355	>85	0	UVFS	041-5140	042-5140	205 / 230
532+1064	355	>85	45	UVFS	041-5145	042-5145	205 / 230
1064	532	>93	0	BK7	031-6500	032-6500	95 / 120
1064	532	>93	45	BK7	031-6505	032-6505	95 / 120
1064	532	>93	0	UVFS	041-6500	042-6500	120 / 150
1064	532	>93	45	UVFS	041-6505	042-6505	120 / 150

HOUSING ACCESSORIES

Adapter for Beamsplitter at 45º 840-0116
See page 7.41

Kinematic Mirror and Beamsplitter Mount 840-0020
See page 7.33

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).

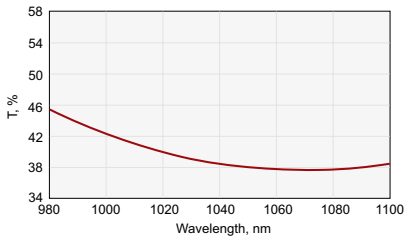
SUBSTRATE

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

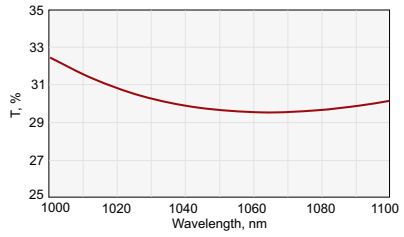
COATING

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



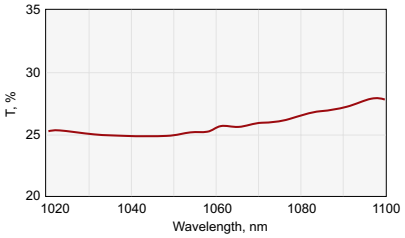
R = 60±2% @ 1064 nm, AOI=0°



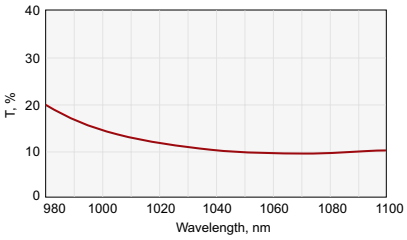
R = 70±2% @ 1064 nm, AOI=0°

Size – **Ø12.7 × 3 mm**

Wavelength, nm	Reflection, %	Transmission, %	Substrate material	Code	Price, EUR
1064	15±3	85±3	BK7	031-0015	75
1064	20±3	80±3	BK7	031-0020	75
1064	25±3	75±3	BK7	031-0025	75
1064	30±3	70±3	BK7	031-0030	75
1064	40±3	60±3	BK7	031-0040	75
1064	50±3	50±3	BK7	031-0050	75
1064	60±3	40±3	BK7	031-0060	75
1064	65±3	35±3	BK7	031-0065	75
1064	70±3	30±3	BK7	031-0070	75
1064	75±3	25±3	BK7	031-0075	75
1064	80±3	20±3	BK7	031-0080	75
1064	85±3	15±3	BK7	031-0085	75
1064	90±2	10±2	BK7	031-0090	82
1064	95±2	5±2	BK7	031-0095	82
1064	97±1	3±1	BK7	031-0097	89
1064	98±1	2±1	BK7	031-0098	89
1064	99.0±0.5	1.0±0.5	BK7	031-0099	96
1064	20±3	80±3	UV FS	041-0020	95
1064	30±3	70±3	UV FS	041-0030	95
1064	40±3	60±3	UV FS	041-0040	95
1064	50±3	50±3	UV FS	041-0050	95
1064	60±3	40±3	UV FS	041-0060	95
1064	65±3	35±3	UV FS	041-0065	95
1064	70±3	30±3	UV FS	041-0070	95
1064	75±3	25±3	UV FS	041-0075	95
1064	80±3	20±3	UV FS	041-0080	95
1064	85±3	15±3	UV FS	041-0085	95
1064	90±2	10±2	UV FS	041-0090	102
1064	95±2	5±2	UV FS	041-0095	102
1064	97±1	3±1	UV FS	041-0097	109
1064	98±1	2±1	UV FS	041-0098	109
1064	99.0±0.5	1.0±0.5	UV FS	041-0099	116



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	Code	Price, EUR
1064	15±3	85±3	BK7	032-0015	95
1064	20±3	80±3	BK7	032-0020	95
1064	25±3	75±3	BK7	032-0025	95
1064	30±3	70±3	BK7	032-0030	95
1064	40±3	60±3	BK7	032-0040	95
1064	50±3	50±3	BK7	032-0050	95
1064	60±3	40±3	BK7	032-0060	95
1064	65±3	35±3	BK7	032-0065	95
1064	70±3	30±3	BK7	032-0070	95
1064	75±3	25±3	BK7	032-0075	95
1064	80±3	20±3	BK7	032-0080	95
1064	85±3	15±3	BK7	032-0085	95
1064	90±2	10±2	BK7	032-0090	102
1064	95±2	5±2	BK7	032-0095	102
1064	97±1	3±1	BK7	032-0097	109
1064	98±1	2±1	BK7	032-0098	109
1064	99.0±0.5	1.0±0.5	BK7	032-0099	116
1064	15±3	85±3	UV FS	042-0015	115
1064	20±3	80±3	UV FS	042-0020	115
1064	25±3	75±3	UV FS	042-0025	115
1064	30±3	70±3	UV FS	042-0030	115
1064	40±3	60±3	UV FS	042-0040	115
1064	50±3	50±3	UV FS	042-0050	115
1064	60±3	40±3	UV FS	042-0060	115
1064	65±3	35±3	UV FS	042-0065	115
1064	70±3	30±3	UV FS	042-0070	115
1064	75±3	25±3	UV FS	042-0075	115
1064	80±3	20±3	UV FS	042-0080	115
1064	85±3	15±3	UV FS	042-0085	115
1064	90±2	10±2	UV FS	042-0090	122
1064	95±2	5±2	UV FS	042-0095	122
1064	97±1	3±1	UV FS	042-0097	129
1064	98±1	2±1	UV FS	042-0098	129
1064	99.0±0.5	1.0±0.5	UV FS	042-0099	136

RELATED PRODUCTS

Uncoated Flat Windows

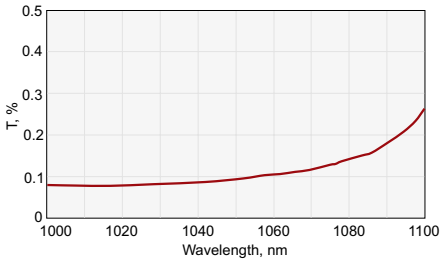
See page 1.10

Kinematic Mirror and Beamsplitter Mount 840-0020

See page 7.33

LASER REAR MIRRORS

High reflectivity (R>99.8%) coatings are applied on laser rear mirrors. The UV FS substrates are suggested for pulsed and CW high power fundamental Nd:YAG laser application.



R > 99.8% @ 1064 nm

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%

Wavelength, nm	Substrate type	Radius, mm	Substrate material	Code Ø25.4×6 mm	Price, EUR
1047–1064	Plano	∞	BK7	032-1060-i0	75
1064	Plano-concave	-50	BK7	032-8005	89
1064	Plano-concave	-100	BK7	032-8010	89
1064	Plano-concave	-150	BK7	032-8015	89
1064	Plano-concave	-200	BK7	032-8020	89
1064	Plano-concave	-250	BK7	032-8025	89
1064	Plano-concave	-500	BK7	032-8050	89
1064	Plano-concave	-1000	BK7	032-8100	89
1064	Plano-concave	-2000	BK7	032-8200	89
1064	Plano-concave	-2500	BK7	032-8250	89
1064	Plano-concave	-4000	BK7	032-8400	89
1064	Plano-concave	-5000	BK7	032-8500	89
1047–1064	Plano	∞	UV FS	042-1060-i0	90
1064	Plano-concave	-50	UV FS	042-8005	109
1064	Plano-concave	-100	UV FS	042-8010	109
1064	Plano-concave	-150	UV FS	042-8015	109
1064	Plano-concave	-200	UV FS	042-8020	109
1064	Plano-concave	-250	UV FS	042-8025	109
1064	Plano-concave	-500	UV FS	042-8050	109
1064	Plano-concave	-1000	UV FS	042-8100	109
1064	Plano-concave	-2000	UV FS	042-8200	109
1064	Plano-concave	-2500	UV FS	042-8250	109
1064	Plano-concave	-4000	UV FS	042-8400	109
1064	Plano-concave	-5000	UV FS	042-8500	109
1064	Plano-convex	+100	BK7	032-9010	93
1064	Plano-convex	+200	BK7	032-9020	93
1064	Plano-convex	+300	BK7	032-9030	93
1064	Plano-convex	+500	BK7	032-9050	93
1064	Plano-convex	+1000	BK7	032-9100	93
1064	Plano-convex	+2000	BK7	032-9200	93
1064	Plano-convex	+3000	BK7	032-9300	93
1064	Plano-convex	+4000	BK7	032-9400	93
1064	Plano-convex	+100	UV FS	042-9010	113
1064	Plano-convex	+200	UV FS	042-9020	113
1064	Plano-convex	+300	UV FS	042-9030	113
1064	Plano-convex	+500	UV FS	042-9050	113
1064	Plano-convex	+1000	UV FS	042-9100	113
1064	Plano-convex	+2000	UV FS	042-9200	113
1064	Plano-convex	+3000	UV FS	042-9300	113
1064	Plano-convex	+4000	UV FS	042-9400	113

RELATED PRODUCTS

Uncoated Curved Windows
See page 1.8

Kinematic Mirror Mount 840-0010
See page 7.33

LASER BEAMSPLITTERS

- **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.

SUBSTRATE

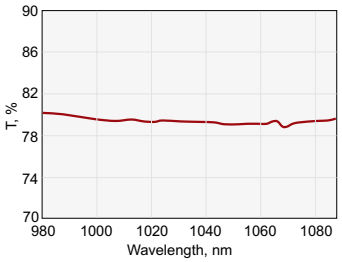
Material	UV FS, BK7
S1 Surface Flatness	λ/10 at 633 nm
S1 Surface Quality	20-10 scratch & dig (MIL-PRF-13830B)
S2 Surface Flatness	λ/10 at 633 nm
S2 Surface Quality	20-10 scratch & dig (MIL-PRF-13830B)
Diameter Tolerance	+0.00 mm-0.12 mm
Thickness Tolerance	±0.25
Parallelism	30 arcsec
Chamfer	0.3 mm 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
UV FS	8 J/cm², 8 nsec pulse, 1064 nm
Angle of Incidence	45±3 degrees
Backside antireflection coated	R<0.5%

RELATED PRODUCTS

Uncoated Flat Windows
See page 1.10



042-7120A.
R = 20±3%, T = 80±3% @ 1064 nm

Designed for average polarization: $R=(R_s+R_p)/2$ and $T=(T_s+T_p)/2$

Wavelength, nm	Reflection, %	Transmission, %	Substrate material	Size Ø12.7x3 mm	Size Ø25.4x6 mm	Price, EUR Ø12.7 / Ø25.4
1064	20±3	80±3	BK7	031-7120A	032-7120A	75 / 95
1064	30±3	70±3	BK7	031-7130A	032-7130A	75 / 95
1064	50±3	50±3	BK7	031-7150A	032-7150A	75 / 95
1064	70±3	30±3	BK7	031-7170A	032-7170A	75 / 95
1064	75±3	25±3	BK7	031-7175A	032-7175A	75 / 95
1064	80±3	20±3	BK7	031-7180A	032-7180A	75 / 95
1064	90±3	10±3	BK7	031-7190A	032-7190A	75 / 95
532	20±3	80±3	BK7	031-7220A	032-7220A	73 / 93
532	30±3	70±3	BK7	031-7230A	032-7230A	73 / 93
532	50±3	50±3	BK7	031-7250A	032-7250A	73 / 93
532	70±3	30±3	BK7	031-7270A	032-7270A	73 / 93
532	80±3	20±3	BK7	031-7280A	032-7280A	73 / 93
1064	20±3	80±3	UV FS	041-7120A	042-7120A	95 / 115
1064	30±3	70±3	UV FS	041-7130A	042-7130A	95 / 115
1064	50±3	50±3	UV FS	041-7150A	042-7150A	95 / 115
1064	70±3	30±3	UV FS	041-7170A	042-7170A	95 / 115
1064	75±3	25±3	UV FS	041-7175A	042-7175A	95 / 115
1064	80±3	20±3	UV FS	041-7180A	042-7180A	95 / 115
1064	90±3	10±3	UV FS	041-7190A	042-7190A	95 / 115
532	20±3	80±3	UV FS	041-7220A	042-7220A	93 / 113
532	30±3	70±3	UV FS	041-7230A	042-7230A	93 / 113
532	50±3	50±3	UV FS	041-7250A	042-7250A	93 / 113
532	70±3	30±3	UV FS	041-7270A	042-7270A	93 / 113
532	80±3	20±3	UV FS	041-7280A	042-7280A	93 / 113
355	20±3	80±3	UV FS	041-7320A	042-7320A	105 / 135
355	30±3	70±3	UV FS	041-7330A	042-7330A	105 / 135
355	50±3	50±3	UV FS	041-7350A	042-7350A	105 / 135
355	70±3	30±3	UV FS	041-7370A	042-7370A	105 / 135
355	80±3	20±3	UV FS	041-7380A	042-7380A	105 / 135
266	20±3	80±3	UV FS	041-7920A	042-7920A	115 / 145
266	30±3	70±3	UV FS	041-7930A	042-7930A	115 / 145
266	50±3	50±3	UV FS	041-7950A	042-7950A	115 / 145
266	70±3	30±3	UV FS	041-7970A	042-7970A	115 / 145
266	80±3	20±3	UV FS	041-7980A	042-7980A	115 / 145

Designed for S- polarization

Wavelength, nm	Reflection, %	Transmission, %	Substrate material	Size Ø12.7x3 mm	Size Ø25.4x6 mm	Price, EUR Ø12.7 / Ø25.4
1064	20±3	80±3	BK7	031-7120S	032-7120S	75 / 95
1064	30±3	70±3	BK7	031-7130S	032-7130S	75 / 95
1064	50±3	50±3	BK7	031-7150S	032-7150S	75 / 95
1064	70±3	30±3	BK7	031-7170S	032-7170S	75 / 95
1064	80±3	20±3	BK7	031-7180S	032-7180S	75 / 95
532	20±3	80±3	BK7	031-7220S	032-7220S	73 / 93
532	30±3	70±3	BK7	031-7230S	032-7230S	73 / 93
532	50±3	50±3	BK7	031-7250S	032-7250S	73 / 93
532	70±3	30±3	BK7	031-7270S	032-7270S	73 / 93
532	80±3	20±3	BK7	031-7280S	032-7280S	73 / 93
1064	20±3	80±3	UV FS	041-7120S	042-7120S	95 / 115
1064	30±3	70±3	UV FS	041-7130S	042-7130S	95 / 115
1064	50±3	50±3	UV FS	041-7150S	042-7150S	95 / 115
1064	70±3	30±3	UV FS	041-7170S	042-7170S	95 / 115
1064	80±3	20±3	UV FS	041-7180S	042-7180S	95 / 115
532	20±3	80±3	UV FS	041-7220S	042-7220S	93 / 113
532	30±3	70±3	UV FS	041-7230S	042-7230S	93 / 113
532	50±3	50±3	UV FS	041-7250S	042-7250S	93 / 113
532	70±3	30±3	UV FS	041-7270S	042-7270S	93 / 113
532	80±3	20±3	UV FS	041-7280S	042-7280S	93 / 113
355	20±3	80±3	UV FS	041-7320S	042-7320S	105 / 135
355	30±3	70±3	UV FS	041-7330S	042-7330S	105 / 135
355	50±3	50±3	UV FS	041-7350S	042-7350S	105 / 135
355	70±3	30±3	UV FS	041-7370S	042-7370S	105 / 135
355	80±3	20±3	UV FS	041-7380S	042-7380S	105 / 135
266	20±3	80±3	UV FS	041-7920S	042-7920S	115 / 145
266	30±3	70±3	UV FS	041-7930S	042-7930S	115 / 145
266	50±3	50±3	UV FS	041-7950S	042-7950S	115 / 145
266	70±3	30±3	UV FS	041-7970S	042-7970S	115 / 145
266	80±3	20±3	UV FS	041-7980S	042-7980S	115 / 145

Designed for P- polarization

Wavelength, nm	Reflection, %	Transmission, %	Substrate material	Size Ø12.7x3 mm	Size Ø25.4x6 mm	Price, EUR Ø12.7 / Ø25.4
1064	20±3	80±3	BK7	031-7120P	032-7120P	75 / 95
1064	30±3	70±3	BK7	031-7130P	032-7130P	75 / 95
1064	50±3	50±3	BK7	031-7150P	032-7150P	75 / 95
1064	70±3	30±3	BK7	031-7170P	032-7170P	75 / 95
1064	80±3	20±3	BK7	031-7180P	032-7180P	75 / 95
532	20±3	80±3	BK7	031-7220P	032-7220P	73 / 93
532	30±3	70±3	BK7	031-7230P	032-7230P	73 / 93
532	50±3	50±3	BK7	031-7250P	032-7250P	73 / 93
532	70±3	30±3	BK7	031-7270P	032-7270P	73 / 93
532	80±3	20±3	BK7	031-7280P	032-7280P	73 / 93
1064	20±3	80±3	UV FS	041-7120P	042-7120P	95 / 115
1064	30±3	70±3	UV FS	041-7130P	042-7130P	95 / 115
1064	50±3	50±3	UV FS	041-7150P	042-7150P	95 / 115
1064	70±3	30±3	UV FS	041-7170P	042-7170P	95 / 115
1064	80±3	20±3	UV FS	041-7180P	042-7180P	95 / 115
532	20±3	80±3	UV FS	041-7220P	042-7220P	93 / 113
532	30±3	70±3	UV FS	041-7230P	042-7230P	93 / 113
532	50±3	50±3	UV FS	041-7250P	042-7250P	93 / 113
532	70±3	30±3	UV FS	041-7270P	042-7270P	93 / 113
532	80±3	20±3	UV FS	041-7280P	042-7280P	93 / 113
355	20±3	80±3	UV FS	041-7320P	042-7320P	105 / 135
355	30±3	70±3	UV FS	041-7330P	042-7330P	105 / 135
355	50±3	50±3	UV FS	041-7350P	042-7350P	105 / 135
355	70±3	30±3	UV FS	041-7370P	042-7370P	105 / 135
355	80±3	20±3	UV FS	041-7380P	042-7380P	105 / 135
266	20±3	80±3	UV FS	041-7920P	042-7920P	115 / 145
266	30±3	70±3	UV FS	041-7930P	042-7930P	115 / 145
266	50±3	50±3	UV FS	041-7950P	042-7950P	115 / 145
266	70±3	30±3	UV FS	041-7970P	042-7970P	115 / 145
266	80±3	20±3	UV FS	041-7980P	042-7980P	115 / 145

HOUSING ACCESSORIES

Kinematic Mirror and Beamsplitter Mount 840-0030-02

See page 7.33

Adapter for Beamsplitter at 45° 840-0116

See page 7.41

Flipping Mirror/Beamsplitter Mount 840-0155

See page 7.45

LASER LINE ANTI-REFLECTION COATED PRECISION WINDOWS

- **Made of premium quality UV FS and BK7**
- **AR coated at 266 nm, 355 nm, 532 nm, 1064 nm**

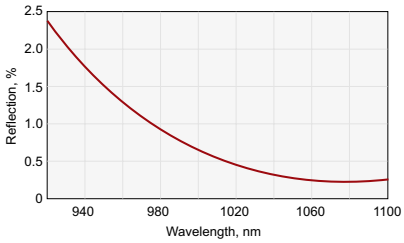
Precision windows are mostly used in laser systems. High quality AR multilayer coatings are applied on windows for fundamental Nd:YAG laser 1064 nm, frequency-doubled 532 nm, frequency-tripled 355nm and frequency-quadrupled 266nm applications. Featuring high optical transmission with little distortion of the transmitted signal, precision windows are a good solution for applications that require protective windows.

SPECIFICATIONS

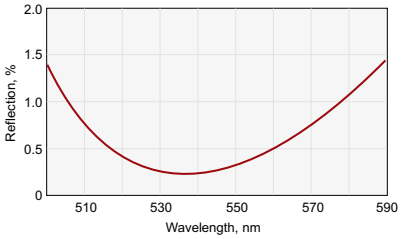
Material	BK7, UV FS
Surface quality	20-10 scratch & dig (MIL-PRF-13830B)
Clear aperture	90% of the diameter
Diameter tolerance	+0.00-0.12 mm
Thickness tolerance	±0.2 mm
Surface flatness	λ/10@633 nm
Parallelism	30 arcsec or 3 arcsec

COATING

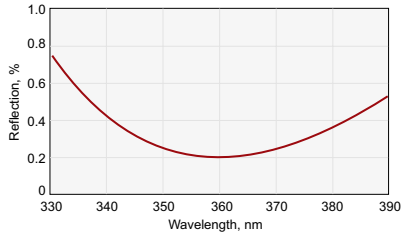
Technology	Electron beam multilayer dielectric
Adhesion and Durability	Per MIL-C-675A. Insoluble in lab solvents
Clear Aperture	Exceeds central 85% of diameter
Damage Threshold:	
BK7	>5 J/cm², 8 nsec pulse, 1064 nm
UV FS	>10 J/cm², 8 nsec pulse, 1064 nm
Angle of Incidence	0 degrees
Coated Surface Flatness	λ/10 at 633 nm over clear aperture



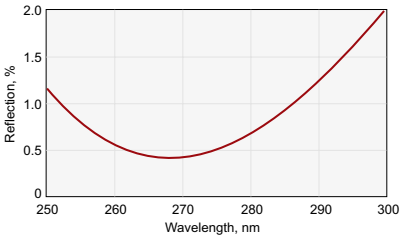
R<0.25%@1064 nm AOI=0°



R<0.25%@532 nm AOI=0°



R<0.25%@355 nm, AOI=0°



R<0.4%@266 nm, AOI=0°

Parallelism 30 arcsec

Catalogue number BK7	Catalogue number UV FS	Wavelength, nm	Diameter D, mm	Thickness T, mm	Price, EUR BK7 / UV FS
–	224-1101E	266	12.7	3.0	– / 79
–	223-1101E	355	12.7	3.0	– / 65
222-0101E	222-1101E	532	12.7	3.0	51 / 65
221-0101E	221-1101E	1064	12.7	3.0	51 / 65
–	224-1201E	266	25.4	6.0	– / 85
–	223-1201E	355	25.4	6.0	– / 70
222-0201E	222-1201E	532	25.4	6.0	61 / 70
221-0201E	221-1201E	1064	25.4	6.0	61 / 70
–	224-1402E	266	38.1	8.0	– / 131
–	223-1402E	355	38.1	8.0	– / 126
222-0402E	222-1402E	532	38.1	8.0	86 / 126
221-0402E	221-1402E	1064	38.1	8.0	86 / 126
–	224-1502E	266	50.8	10.0	– / 181
–	223-1502E	355	50.8	10.0	– / 176
222-0502E	222-1502E	532	50.8	10.0	99 / 176
221-0502E	221-1502E	1064	50.8	10.0	99 / 176

Parallelism 3 arcsec

Catalogue number BK7	Catalogue number UV FS	Wavelength, nm	Diameter D, mm	Thickness T, mm	Price, EUR BK7 / UV FS
–	224-1103E	266	12.7	3.0	– / 96
–	223-1103E	355	12.7	3.0	– / 82
222-0103E	222-1103E	532	12.7	3.0	66 / 82
221-0103E	221-1103E	1064	12.7	3.0	66 / 82
–	224-1203E	266	25.4	6.0	– / 125
–	223-1203E	355	25.4	6.0	– / 111
222-0203E	222-1203E	532	25.4	6.0	88 / 111
221-0203E	221-1203E	1064	25.4	6.0	88 / 111
–	224-1403E	266	38.1	10.0	– / 176
–	223-1403E	355	38.1	10.0	– / 170
222-0403E	222-1403E	532	38.1	10.0	121 / 170
221-0403E	221-1403E	1064	38.1	10.0	121 / 170
–	224-1503E	266	50.8	12.0	– / 217
–	223-1503E	355	50.8	12.0	– / 212
222-0503E	222-1503E	532	50.8	12.0	148 / 212
221-0503E	221-1503E	1064	50.8	12.0	148 / 212

RELATED PRODUCTS

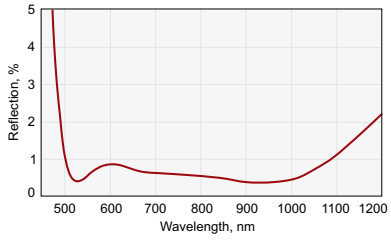
Uncoated Precision Windows

See page 1.12

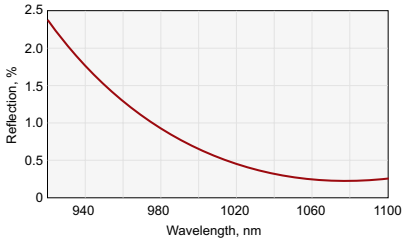
AR COATED LENS KITS

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.

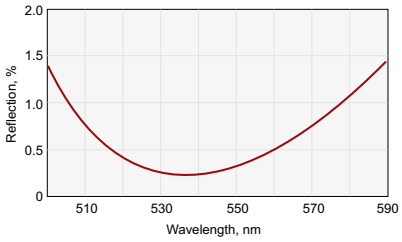
Large lens kit consists of 40 lenses and small lens kit consists of 15 lenses made either of N-BK7 glass or UV FS. Kits are available with multilayer anti-reflection coatings for Nd:YAG laser fundamental and harmonics wavelengths: 226 nm, 355 nm, 532 nm, 1064 nm.



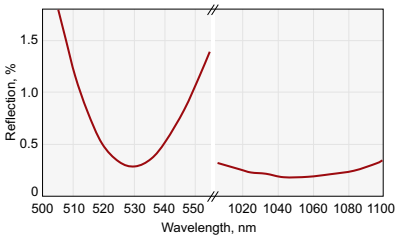
R<1.5%@500-1100 nm, AOI=0°



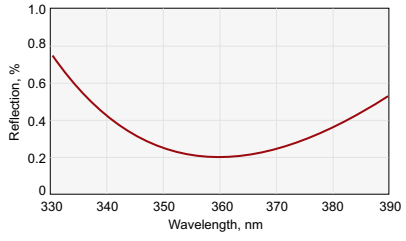
R<0.25%@1064 nm AOI=0°



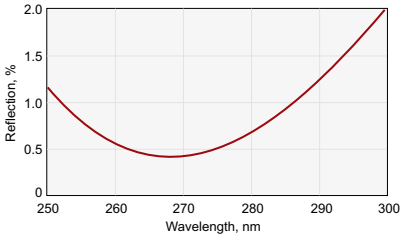
R<0.25%@532 nm AOI=0°



R<0.5%@532 nm+1064 nm, AOI=0°



R<0.25%@355 nm, AOI=0°



R<0.4%@266 nm, AOI=0°

BK7 Lenses Kits

Small Lenses Kit

Large kit of 40 pcs. N-BK7 lenses:

Code	Coating	Price, EUR
140-0240-AR400-700	BBAR @ 400–700 nm, R<0.9%	1820
140-0240-AR650-1100	BBAR @ 650–1100, R<1.0%	1930
140-0240-AR1050-1700	BBAR @ 1050–1700 nm, R<1.0%	2030
140-0240-AR532+1064	AR @ 532+1064 nm, R<0.5%	1750
140-0240-AR1064	AR @ 1064 nm, R<0.25%	1550
140-0240-AR532	AR @ 532 nm, R<0.25%	1550

Small kit of 15 pcs. N-BK7 lenses:

Code	Coating	Price, EUR
140-0215-AR400-700	BBAR @ 400–700 nm, R<0.9%	990
140-0215-AR650-1100	BBAR @ 650–1100 nm, R<1.0%	1050
140-0240-AR1050-1700	BBAR @ 1050–1700 nm, R<1.0%	1150
140-0215-AR532+1064	AR @ 532+1064 nm, R<0.5%	770
140-0215-AR1064	AR @ 1064 nm, R<0.25%	700
140-0215-AR532	AR @ 532 nm, R<0.25%	700

Small BK7 Lens Kit

Code	Type	Dia, mm	F, mm
110-0205E	pl/cx	25.4	30
110-0207E	pl/cx	25.4	40
110-0209E	pl/cx	25.4	50
110-0211E	pl/cx	25.4	60
110-0215E	pl/cx	25.4	75
110-0219E	pl/cx	25.4	100
110-0227E	pl/cx	25.4	150
110-0231E	pl/cx	25.4	200
110-0247E	pl/cx	25.4	500
110-0259E	pl/cx	25.4	1000
112-0207E	pl/cv	25.4	-40
112-0209E	pl/cv	25.4	-50
112-0215E	pl/cv	25.4	-75
112-0219E	pl/cv	25.4	-100
112-0227E	pl/cv	25.4	-150

Large BK7 Lens Kit

Code	Type	Dia, mm	F, mm
110-0205E	pl/cx	25.4	30
110-0207E	pl/cx	25.4	40
110-0209E	pl/cx	25.4	50
110-0211E	pl/cx	25.4	60
110-0215E	pl/cx	25.4	75
110-0219E	pl/cx	25.4	100
110-0223E	pl/cx	25.4	125
110-0227E	pl/cx	25.4	150
110-0231E	pl/cx	25.4	200
110-0235E	pl/cx	25.4	250
110-0239E	pl/cx	25.4	300
110-0241E	pl/cx	25.4	350
110-0243E	pl/cx	25.4	400
110-0247E	pl/cx	25.4	500
110-0251E	pl/cx	25.4	700
110-0259E	pl/cx	25.4	1000
111-0204E	bi/cx	25.4	25
111-0206E	bi/cx	25.4	30
111-0208E	bi/cx	25.4	40
111-0210E	bi/cx	25.4	50

Code	Type	Dia, mm	F, mm
111-0214E	bi/cx	25.4	60
111-0216E	bi/cx	25.4	75
111-0218E	bi/cx	25.4	100
111-0222E	bi/cx	25.4	150
111-0226E	bi/cx	25.4	200
111-0228E	bi/cx	25.4	250
111-0234E	bi/cx	25.4	500
111-0250E	bi/cx	25.4	1000
112-0207E	pl/cv	25.4	-40
112-0209E	pl/cv	25.4	-50
112-0215E	pl/cv	25.4	-75
112-0219E	pl/cv	25.4	-100
112-0227E	pl/cv	25.4	-150
112-0231E	pl/cv	25.4	-200
114-0204E	bi/cv	25.4	-25
114-0208E	bi/cv	25.4	-50
114-0212E	bi/cv	25.4	-75
114-0214E	bi/cv	25.4	-100
114-0220E	bi/cv	25.4	-150
114-0224E	bi/cv	25.4	-200

UV FS Lenses Kits

Large Lenses Kit

Large kit of 40 pcs. UV FS lenses:

Code	Coating	Price, EUR
140-1240-AR210-400	BBAR @ 210–400 nm, R<2%	3490
140-1240-AR350-900	BBAR @ 350–900 nm, R<1.5%	3290
140-1240-AR650-1100	BBAR @ 650–1100 nm, R<1.0%	3310
140-1240-AR532+1064	AR @ 532+1064 nm, R<0.5%	3130
140-1240-AR1064	AR @ 1064 nm, R<0.25%	2930
140-1240-AR532	AR @ 532 nm, R<0.25%	2930
140-1240-AR355	AR @ 355 nm, R<0.25%	3030
140-1240-AR266	AR @ 266 nm, R<0.4%	3130

Small kit of 15 pcs. UV FS lenses:

Code	Coating	Price, EUR
140-1215-AR210-400	BBAR @ 210–400 nm, R<2%	1830
140-1215-AR350-900	BBAR @ 350–900 nm, R<1.5%	1660
140-1215-AR650-1100	BBAR @ 650–1100 nm, R<1.0%	1670
140-1215-AR532+1064	AR @ 532+1064 nm, R<0.5%	1390
140-1215-AR1064	AR @ 1064 nm, R<0.25%	1320
140-1215-AR532	AR @ 532 nm, R<0.25%	1320
140-1215-AR355	AR @ 355 nm, R<0.25%	1350
140-1215-AR266	AR @ 266 nm, R<0.4%	1380

Small UV FS Lens Kit

Code	Type	Dia, mm	F, mm
110-1203E	pl/cx	25.4	30
110-1205E	pl/cx	25.4	50
110-1209E	pl/cx	25.4	75
110-1211E	pl/cx	25.4	100
110-1216E	pl/cx	25.4	125
110-1217E	pl/cx	25.4	150
110-1219E	pl/cx	25.4	200
110-1223E	pl/cx	25.4	300
110-1233E	pl/cx	25.4	500
110-1245E	pl/cx	25.4	1000
112-1205E	pl/cv	25.4	-50
112-1209E	pl/cv	25.4	-75
112-1211E	pl/cv	25.4	-100
112-1215E	pl/cv	25.4	-125
112-1217E	pl/cv	25.4	-150

Large UV FS Lens Kit

Code	Type	Dia, mm	F, mm
110-1203E	pl/cx	25.4	30
110-1205E	pl/cx	25.4	50
110-1209E	pl/cx	25.4	75
110-1210E	pl/cx	25.4	80
110-1211E	pl/cx	25.4	100
110-1216E	pl/cx	25.4	125
110-1217E	pl/cx	25.4	150
110-1219E	pl/cx	25.4	200
110-1221E	pl/cx	25.4	250
110-1223E	pl/cx	25.4	300
110-1225E	pl/cx	25.4	350
110-1227E	pl/cx	25.4	400
110-1233E	pl/cx	25.4	500
110-1235E	pl/cx	25.4	600
110-1239E	pl/cx	25.4	750
110-1245E	pl/cx	25.4	1000
111-1204E	bi/cx	25.4	25
111-1207E	bi/cx	25.4	40
111-1210E	bi/cx	25.4	50
111-1214E	bi/cx	25.4	75

Code	Type	Dia, mm	F, mm
111-1218E	bi/cx	25.4	100
111-1222E	bi/cx	25.4	150
111-1226E	bi/cx	25.4	200
111-1230E	bi/cx	25.4	250
111-1234E	bi/cx	25.4	300
111-1238E	bi/cx	25.4	400
111-1240E	bi/cx	25.4	500
111-1260E	bi/cx	25.4	1000
112-1205E	pl/cv	25.4	-50
112-1209E	pl/cv	25.4	-75
112-1211E	pl/cv	25.4	-100
112-1217E	pl/cv	25.4	-150
112-1219E	pl/cv	25.4	-200
112-1223E	pl/cv	25.4	-300
114-1204E	bi/cv	25.4	-25
114-1208E	bi/cv	25.4	-50
114-1212E	bi/cv	25.4	-75
114-1216E	bi/cv	25.4	-100
114-1220E	bi/cv	25.4	-150
114-1224E	bi/cv	25.4	-200

RELATED PRODUCTS

Uncoated Lens Kits
See page 1.46

Beam Expanders
See page 6.3

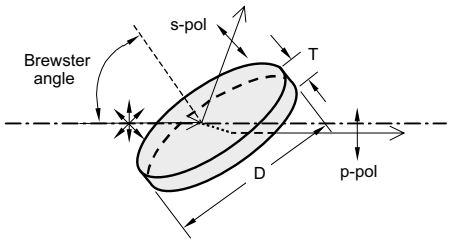
Self-Centring Lens Mounts 830-0010
See page 7.25

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.

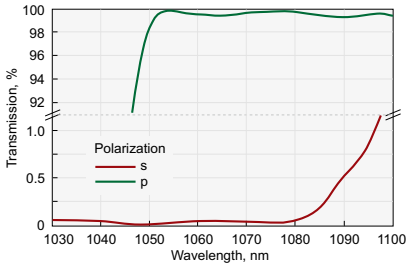
Nd:YAG Laser Line thin film polarizers are used in high energy lasers. They can be used as extracavity attenuators for Nd:YAG laser fundamental and its harmonics or intracavity Q-switch hold-off polarizers.The most efficient way to use these polarizers is at Brewster's angle – 56 ± 2°.



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%

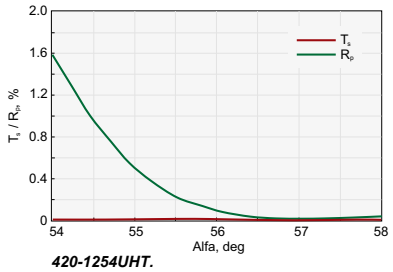
Round Polarizers. Material – UV FS; T_p > 98%, T_s < 0.1%; extinction ratio for transmitted light T_p/T_s: >1000:1

Catalogue number	Diameter D, mm	Thickness T, mm	Wavelength, nm	Price, EUR
420-1252HE	25.4	3	355	218
420-1254HE	25.4	3	532	185
420-1258HE	25.4	3	1064	216

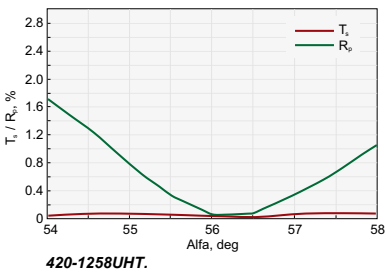
Rectangular Polarizers. Material – UV FS; T_p > 98%, T_s < 0.1%; extinction ratio for transmitted light T_p/T_s: >1000:1

Catalogue number	Rectangular dimensions		Thickness T, mm	Wavelength, nm	Price, EUR
	Length, mm	Width, mm			
420-1484HE	20	15	6	532	155
420-1584HE	30	20	6	532	210
420-1488HE	20	15	6	1064	165
420-1588HE	30	20	6	1064	220

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; T_s < 0.2 %, R_p < 0.2 % (R_s/T_p > 99.8/99.8 %)

Catalogue number	Diameter D, mm	Thickness T, mm	Wavelength, nm	Price, EUR
420-1254UHT	25.4	3.0	532	260
420-1258UHT	25.4	3.0	1064	304

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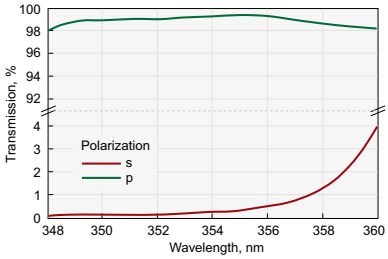
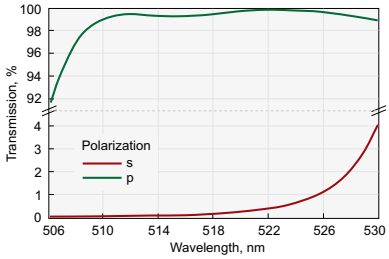
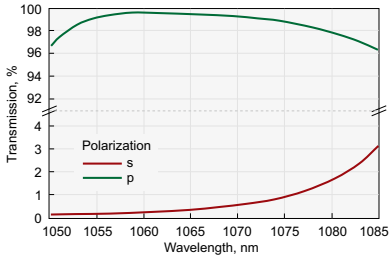
High Transmission Thin Film Polarizers



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 %

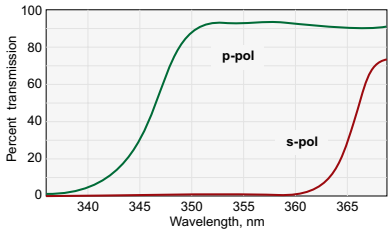
Round Polarizers. R_s / T_p > 99.5 / 99.0 %

Catalogue number	Diameter D, mm	Thickness T, mm	Wavelength, nm	Price, EUR
420-1252HT	25.4	3.0	355	237
420-1254HT	25.4	3.0	532	200
420-1258HT	25.4	3.0	1064	234

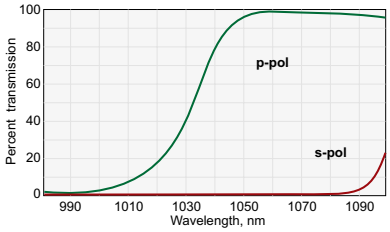
Rectangular Polarizers. R_s / T_p > 99.5 / 99.0 %

Catalogue number	Rectangular dimensions Length, mm	Width, mm	Thickness T, mm	Wavelength, nm	Price, EUR
420-1288HT	28.6	14.3	3.0	1064	270

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; R_s / T_p > 99.5 / 95.0 %

Catalogue number	Diameter D, mm	Thickness T, mm	Wavelength, nm	Price, EUR
420-0124E	12.7	3.0	532	108
420-0128E	12.7	3.0	1064	115
420-0254E	25.4	3.0	532	128
420-0258E	25.4	3.0	1064	155
420-0504E	50.8	6.0	532	206
420-0508E	50.8	6.0	1064	255

Rectangular Polarizers. Material – BK7; R_s / T_p > 99.5 / 95.0 %

Catalogue number	Rectangular dimensions Length, mm	Width, mm	Thickness T, mm	Wavelength, nm	Price, EUR
420-0284	28.6	14.3	3.0	532	142
420-0288	28.6	14.3	3.0	1064	170

Round Polarizers. Material – UV FS; R_s / T_p > 99.5 / 95.0 %

Catalogue number	Diameter D, mm	Thickness T, mm	Wavelength, nm	Price, EUR
420-1122E	12.7	3.0	355	164
420-1124E	12.7	3.0	532	131
420-1128E	12.7	3.0	1064	145
420-1252E	25.4	3.0	355	182
420-1254E	25.4	3.0	532	154
420-1258E	25.4	3.0	1064	180
420-1502E	50.8	6.0	355	325
420-1504E	50.8	6.0	532	295
420-1508E	50.8	6.0	1064	315

Rectangular Polarizers. Material – UV FS; R_s / T_p > 99.5 / 95.0 %

Catalogue number	Rectangular dimensions Length, mm	Width, mm	Thickness T, mm	Wavelength, nm	Price, EUR
420-1282	28.6	14.3	3.0	355	255
420-1284	28.6	14.3	3.0	532	215
420-1288	28.6	14.3	3.0	1064	225

RELATED PRODUCTS

Thin Film Laser Polarizers of other wavelengths
See page 1.54

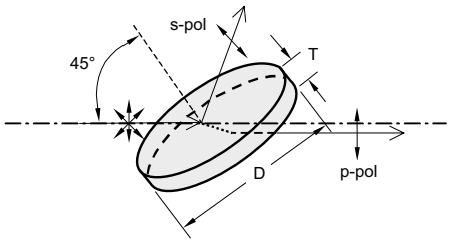
Glan and Wollaston Prisms
See page 1.61

Adapters for Polarizer at 56° 840-0117, 840-0118
See page 7.43

Variable Attenuator for Nd:YAG linearly Polarized Laser Beam 990-0070
See page 4.21

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. T_p > 98%, T_s < 0.1%.
Extinction ratio for transmitted light T_p/T_s: >1000:1

Catalogue number	Diameter D, mm	Thickness T, mm	Wavelength, nm	Price, EUR
420-1252i45HE	25.4	3	355	328
420-1254i45HE	25.4	3	532	295
420-1258i45HE	25.4	3	1064	315
420-1502i45HE	50.8	6	355	640
420-1504i45HE	50.8	6	532	555
420-1508i45HE	50.8	6	1064	620

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

Catalogue number	Diameter D, mm	Thickness T, mm	Wavelength, nm	Price, EUR
420-1252i45	25.4	3	355	238
420-1254i45	25.4	3	532	200
420-1258i45	25.4	3	1064	225
420-1502i45	50.8	6	355	455
420-1504i45	50.8	6	532	395
420-1508i45	50.8	6	1064	440

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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

- **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	Price, EUR	Catalogue number	Price, EUR
1064	460-4205D12	165	460-4405D12	165
532	460-4230D12	165	460-4430D12	165
355	460-4240D12	175	460-4440D12	175
266	460-4245D12	185	460-4445D12	185

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

Wavelength, nm	Retardation λ/2		Retardation λ/4	
	Catalogue number	Price, EUR	Catalogue number	Price, EUR
1064	460-4205	245	460-4405	245
532	460-4230	245	460-4430	245
355	460-4240	270	460-4440	270
266	460-4245	280	460-4445	280

RELATED PRODUCTS

Zero Order Optically Contacted Plates of other wavelengths
See page 1.64

Achromatic Air-Spaced Waveplates
See page 1.66

ZERO ORDER AIR-SPACED WAVEPLATES

- **For high power laser application**

Wavelength, nm	AR coating range, nm	Retardation λ/2		Retardation λ/4	
		Catalogue number	Price, EUR	Catalogue number	Price, EUR
1064	1035–1095	464-4205	310	464-4405	310
532	515–545	464-4230	310	464-4430	310
355	345–365	464-4240	335	464-4440	335
266	257–275	464-4245	345	464-4445	345
213	210–216	464-4253	420	464-4453	420

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%
Damage threshold	>10 J/cm², 10 nsec pulse, 1064 nm typical

RELATED PRODUCTS

Polarizer Holder 840-0180
See page 7.48

LOW ORDER WAVEPLATES

- **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	Price, EUR	Catalogue number	Price, EUR
1064	461-4205D12	105	461-4405D12	105
532	461-4230D12	105	461-4430D12	105
355	461-4240D12	115	461-4440D12	115

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

Wavelength, nm	Retardation λ/2		Retardation λ/4	
	Catalogue number	Price, EUR	Catalogue number	Price, EUR
1064	461-4205	160	461-4405	160
532	461-4230	160	461-4430	160
355	461-4240	192	461-4440	192

SPECIFICATIONS

Material	Single crystal quartz
Optical axis	normal to facet on circumference of retarder
Clear aperture	Ø17 mm (others dimensions on request)
Ring mount outer diameter	25.4 +0.0 / -0.2 mm
Nominal thickness of waveplate	0.15–0.35 mm
Wavefront distortion	λ/10 @ 633 nm
Surface quality	20-10 scratch & dig (MIL-PRF-13830B)
Parallelism	< 10 arcsec
AR coating	R < 0.4%
Damage threshold	10 J/cm², 10 nsec pulse, 1064 nm typical

RELATED PRODUCTS

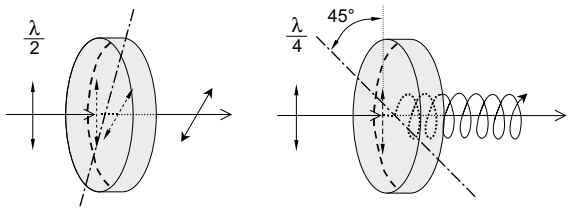
Low Order Plates of other wavelengths
See page 1.67

High Precision Rotation Polarizer, Waveplate Mount 840-0186
See page 7.49

MULTIPLE ORDER WAVEPLATES

- **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.



SPECIFICATIONS

Material	Single crystal quartz
Optical axis	Normal to facet on circumference of retarder
Clear aperture	Ø17 mm (others 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 1.68

Adjustable Polarizer Holder of Side Drive 840-0195
See page 7.52

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

Wavelength, nm	Retardation λ/2		Retardation λ/4	
	Catalogue number	Price, EUR	Catalogue number	Price, EUR
1064	462-4205D12	90	462-4405D12	90
532	462-4230D12	90	462-4430D12	90
355	462-4240D12	95	462-4440D12	95

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

Wavelength, nm	Retardation λ/2		Retardation λ/4	
	Catalogue number	Price, EUR	Catalogue number	Price, EUR
1064	462-4205	138	462-4405	138
532	462-4230	138	462-4430	138
355	462-4240	143	462-4440	143
266	462-4245	153	462-4445	153

MULTIPLE ORDER DUAL WAVELENGTH WAVEPLATES

- **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 / -0.2 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
Damage threshold	5 J/cm^2, 10 nsec pulse, 1064 nm typical

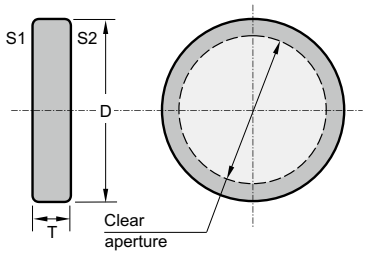
Retardation and Wavelength	Catalogue number	Price, EUR
λ @ 1064 nm + λ/2 @ 532 nm	**463-4120**	215
λ @ 1064 nm + λ/4 @ 532 nm	**463-4140**	215
λ/2 @ 1064 nm + λ @ 532 nm	**463-4210**	215
λ/2 @1064 nm + λ/2 @ 532 nm	**463-4220**	215
λ/2 @1064 nm + λ/4 @ 532 nm	**463-4240**	215
λ/4 @ 1064 nm + λ @ 532 nm	**463-4410**	215
λ/4 @ 1064 nm + λ/2 @ 532 nm	**463-4420**	215
λ/4 @ 1064 nm + λ/4 @ 532 nm	**463-4440**	215

POLARIZATION PLANE ROTATORS

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

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

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.



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/cm^2, 10 nsec pulse, 1064 nm typical

Catalogue number	Wavelength, nm	Rotation angle of polarization plane, deg	Price, EUR
470-4264	266	45	245
470-4269	266	90	245
470-4354	355	45	195
470-4359	355	90	195
470-4534	532	45	195
470-4539	532	90	195
470-4644	1064	45	215
470-4649	1064	90	215

Please contact us for other size or wavelengths requirements.

RELATED PRODUCTS

Polarization plane rotators of other wavelengths
See page 1.70

Kinematic Mirror and Beamsplitter Mount 840-0020
See page 7.33

Kinematic Positioning Mount 840-0193
See page 7.51

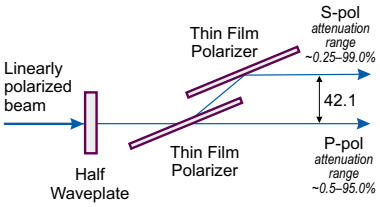
VARIABLE ATTENUATOR FOR Nd:YAG LINEARLY POLARIZED LASER BEAM 990-0070

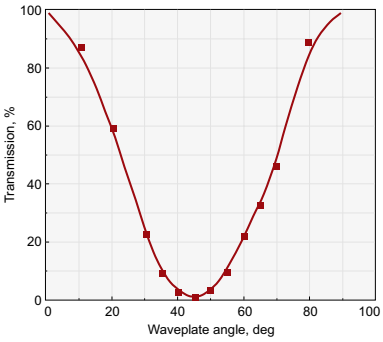
*Note: Movable base **820-0090**, Rod Holder **820-0050-02** and standard rod should be ordered seperately.*

- **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**

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/cm^2 pulsed at 1064 nm, typical
Polarization Contrast (after 1st polarizer)	>1:200
Polarization Contrast (after 2nd polarizer)	>1:500

Catalogue number	Wavelength, nm	Price, EUR
990-0070-266H *	266	1020
990-0070-355	355	750
990-0070-532	532	650
990-0070-1064	1064	650

** 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 4.15

Motorized Variable Attenuator for Linearly Polarized Laser Beam 990-0070M
See page 6.14

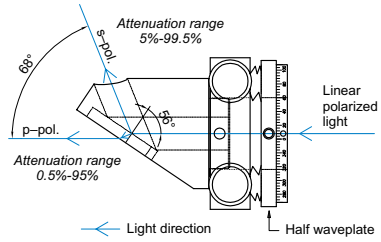
Beam dumps 990-0800, 990-0820
See page 6.21

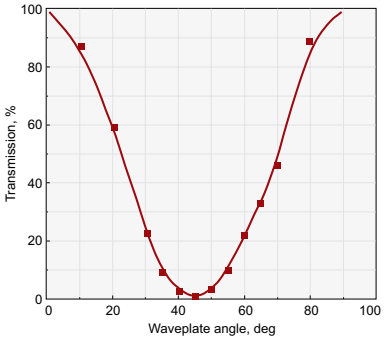
VARIABLE ATTENUATOR FOR Nd:YAG LINEARLY POLARIZED LASER BEAM 990-0071

*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.





- **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**
- **Weight – 0.25 kg**

SPECIFICATIONS

Aperture diameter	10 mm
Damage threshold	5 J/cm^2 pulsed at 1064 nm, typical
Polarization Contrast	>1:200

Catalogue number	Wavelength, nm	Price, EUR
990-0071-266H *	266	690
990-0071-355	355	475
990-0071-532	532	445
990-0071-1064	1064	445

** With Zero Order Air-Spaced half waveplate.*

RELATED PRODUCTS

Motorized Variable Attenuator for Linearly Polarized Laser Beam 990-0071M

See page 6.17

Multiple Order Plates for Nd:YAG applications

See page 4.19

Thin Film Laser Polarizers for Nd:YAG applications

See page 4.15

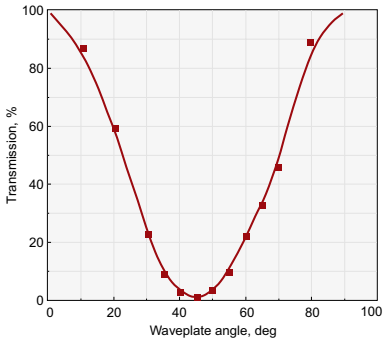
VARIABLE ATTENUATOR FOR Nd:YAG LASER PULSES 990-0072

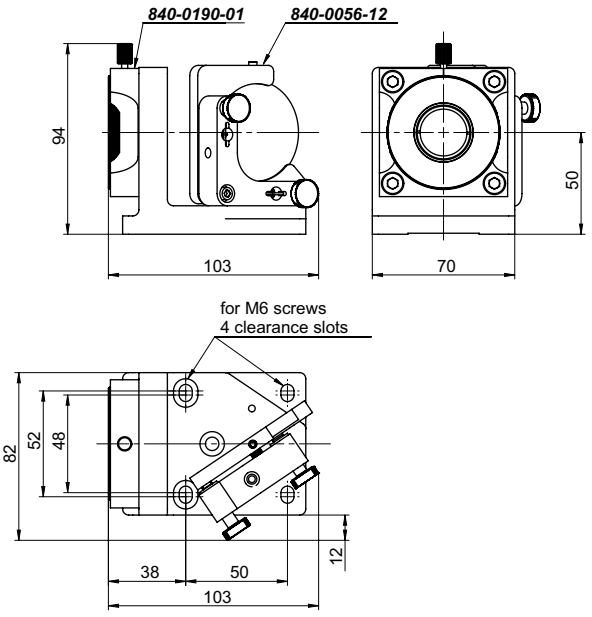
- **Divides laser beam into two beams of manually adjustable intensity ratio separated by 68° angle**
- **Large dynamic range**
- **Trasmitted beam shift ~1 mm**
- **High optical damage threshold**
- **Motorized version 990-0072M available online**

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

Catalogue number	Wavelength, nm	Price, EUR
990-0072-266H *	266	1085
990-0072-355	355	765
990-0072-532	532	735
990-0072-1064	1064	755

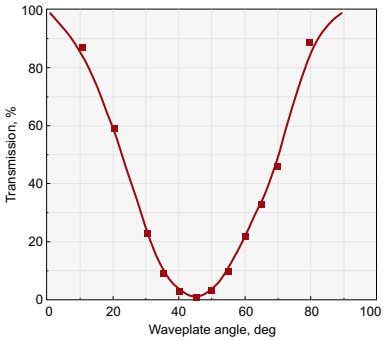
** With Zero Order Air-Spaced half waveplate.*

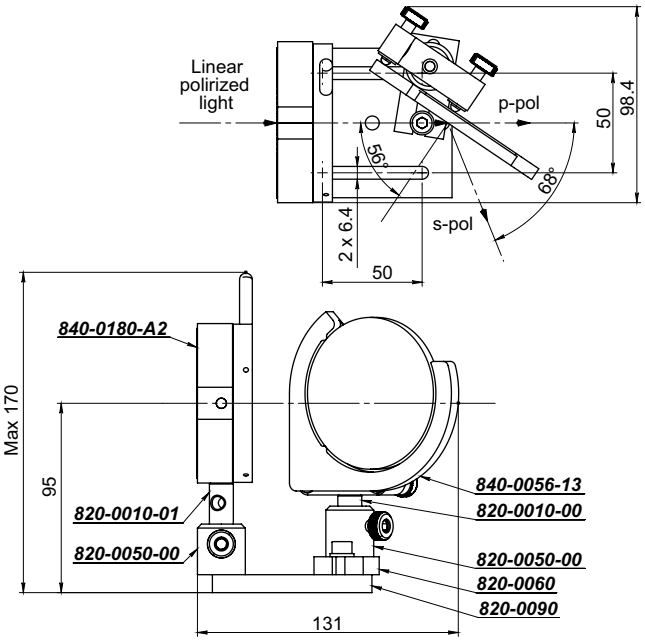
VARIABLE ATTENUATOR FOR Nd:YAG LASER PULSES 990-0073

- **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/cm², 10 ns pulse 10 Hz at 1064 nm, typical
Polarization Contrast	>1:200
Transmitted beam shift	~1.4 mm
Weight	0.6 kg

Catalogue number	Wavelength, nm	Price, EUR
990-0073-266H *	266	1790
990-0073-355	355	1460
990-0073-532	532	1440
990-0073-1064	1064	1515

** With Zero Order Air-Spaced half waveplate.*

Nd:YAG Laser Crystals

Nd:YAG CRYSTALS (Standard Rods)

EKSMA OPTICS offers standard specifications high optical quality Nd:YAG rods with high damage threshold AR @ 1064 nm coatings.

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

Code	Description	Diameter, mm	Length, mm	Doping, %	Wedge of the ends, deg	Coating	Application	Price, EUR
E-Y-3-0.9-A/A	Nd:YAG	3	53	0.9	0/0	AR/AR @ 1064 nm	Generation @ 1064 nm	215
E-Y-3-0.8-A/A	Nd:YAG	3	65	0.8	0/0	AR/AR @ 1064 nm	Generation @ 1064 nm	265
E-Y-3-1.1-A/A	Nd:YAG	3	65	1.1	0/0	AR/AR @ 1064 nm	Generation @ 1064 nm	325
E-Y-4-0.8-A/A	Nd:YAG	4	65	0.8	3/3 parallel	AR/AR @ 1064 nm	Generation @ 1064 nm	530
E-Y-4-1.1-A/A	Nd:YAG	4	65	1.1	3/3 parallel	AR/AR @ 1064 nm	Generation @ 1064 nm	530
E-Y-6.35-1.1-A/A	Nd:YAG	6.35	85*	1.1	3/3 parallel	AR/AR @ 1064 nm	Generation @ 1064 nm	890
E-Y-8-1.1-A/A	Nd:YAG	8	85*	1.1	3/3 parallel	AR/AR @ 1064 nm	Generation @ 1064 nm	1340
E-Y-10-1.1-A/A	Nd:YAG	10	85*	1.1	3/3 parallel	AR/AR @ 1064 nm	Generation @ 1064 nm	2200
E-Y-12-0.8-A/A	Nd:YAG	12	100*	0.8	3/3 parallel	AR/AR @ 1064 nm	Generation @ 1064 nm	4740
E-Y-12-1.1-A/A	Nd:YAG	12	100*	1.1	3/3 parallel	AR/AR @ 1064 nm	Generation @ 1064 nm	4740

** 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
See page 3.3

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.

Catalogue number	Size, mm	Orientation		Type	Coating	Application	Price, EUR
		Theta, deg	Phi, deg				
LBO-401	3x3x10	90	11.6	Type 1	AR/AR @ 1064+532 nm	SHG@1064 nm	245
LBO-402	3x3x15	90	11.6	Type 1	AR/AR @ 1064+532 nm	SHG@1064 nm	325
LBO-301	4x4x10	90	11.6	Type 1	AR/AR @ 1064+532 nm	SHG@1064 nm	510
LBO-302	4x4x15	90	11.6	Type 1	AR/AR @ 1064+532 nm	SHG@1064 nm	630
LBO-303	4x4x20	90	11.6	Type 1	AR/AR @ 1064+532 nm	SHG@1064 nm	745
LBO-501	5x5x10	90	11.6	Type 1	AR/AR @ 1064+532 nm	SHG@1064 nm	655
LBO-503	5x5x15	90	11.6	Type 1	AR/AR @ 1064+532 nm	SHG@1064 nm	765
LBO-502	5x5x20	90	11.6	Type 1	AR/AR @ 1064+532 nm	SHG@1064 nm	940
LBO-404	3x3x15	90	0	Type 1	AR/AR @ 1064+532 nm	NCPM SHG@1064 nm, T=149 ºC	325
LBO-405	3x3x20	90	0	Type 1	AR/AR @ 1064+532 nm	NCPM SHG@1064 nm, T=149 ºC	405
LBO-409	3x3x30	90	0	Type 1	AR/AR @ 1064+532 nm	NCPM SHG@1064 nm, T=149 ºC	710
LBO-410	3x3x50	90	0	Type 1	AR/AR @ 1064+532 nm	NCPM SHG@1064 nm, T=149 ºC	1300
LBO-304	4x4x10	90	0	Type 1	AR/AR @ 1064+532 nm	NCPM SHG@1064 nm, T=149 ºC	510
LBO-305	4x4x15	90	0	Type 1	AR/AR @ 1064+532 nm	NCPM SHG@1064 nm, T=149 ºC	630
LBO-306	4x4x20	90	0	Type 1	AR/AR @ 1064+532 nm	NCPM SHG@1064 nm, T=149 ºC	745

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.

Catalogue number	Size, mm	Orientation		Type	Coating	Application	Price, EUR
		Theta, deg	Phi, deg				
KTP-401	3x3x5	90	23.5	Type 2	AR/AR @ 1064+532 nm	SHG@1064 nm	76
KTP-402	3x3x10	90	23.5	Type 2	AR/AR @ 1064+532 nm	SHG@1064 nm	109
KTP-403	4x4x6	90	23.5	Type 2	AR/AR @ 1064+532 nm	SHG@1064 nm	118
KTP-404	7x7x9	90	23.5	Type 2	AR/AR @ 1064+532 nm	SHG@1064 nm	529

DKDP crystals

Large aperture DKDP crystals are used for high energy Q-switched lasers with large beam diameters.

Catalogue number	Size, mm	Orientation		Type	Coating	Application	Price, EUR
		Theta, deg	Phi, deg				
DKDP-401	15x15x13	36.5	45	Type 1	AR/AR @ 1064/1064+532 nm	SHG@1064 nm	485
DKDP-402	15x15x13	53.5	0	Type 2	AR/AR @ 1064/1064+532 nm	SHG@1064 nm	485
DKDP-404	12x12x20	53,5	0	Type 2	AR/AR @ 1064/1064+532 nm	SHG@1064 nm	475
DKDP-405	15x15x20	53,5	0	Type 2	AR/AR @ 1064/1064+532 nm	SHG@1064 nm	579

Please contact EKSMA OPTICS
for special OEM and large volume pricing.

RELATED PRODUCTS

Ovens with thermocontrollers and heaters for different crystal sizes

See pages 2.27–2.30

NONLINEAR CRYSTALS for THG@1064 nm

LBO crystals

Catalogue number	Size, mm	Orientation		Type	Coating	Application	Price, EUR
		Theta, deg	Phi, deg				
LBO-406	3x3x10	42.2	90	Type 2	AR/AR @ 1064+532/355 nm	THG@1064 nm	245
LBO-407	3x3x15	42.2	90	Type 2	AR/AR @ 1064+532/355 nm	THG@1064 nm	325
LBO-508	5x5x15	42.2	90	Type 2	AR/AR @ 1064+532/355 nm	THG@1064 nm	765

DKDP crystals

Catalogue number	Size, mm	Orientation		Type	Coating	Application	Price, EUR
		Theta, deg	Phi, deg				
DKDP-403	12x12x20	59.3	0	Type 2	AR/AR @ 1064+532/355 nm	THG@1064 nm	475
DKDP-406	15x15x20	59.3	0	Type 2	AR/AR @ 1064+532/355 nm	THG@1064 nm	579

NONLINEAR CRYSTALS for 4HG@1064 nm

BBO crystals

Catalogue number	Size, mm	Orientation		Type	Coating	Application	Price, EUR
		Theta, deg	Phi, deg				
BBO-700	7x7x6	47.6	90	Type 1	P/P @ 532/266 nm	SHG@532 nm	925

KDP crystals

Catalogue number	Size, mm	Orientation		Type	Coating	Application	Price, EUR
		Theta, deg	Phi, deg				
KDP-401	12x12x5	76.5	45	Type 1	AR/AR @ 532/266 nm	SHG@532 nm	408
KDP-402	15x15x7	76.5	45	Type 1	AR/AR @ 532/266 nm	SHG@532 nm	480

HOUSING ACCESSORIES

Ring Holders for Nonlinear Crystals

See page 2.25

Positioning Mount 840-0199 for Nonlinear Crystal Housing

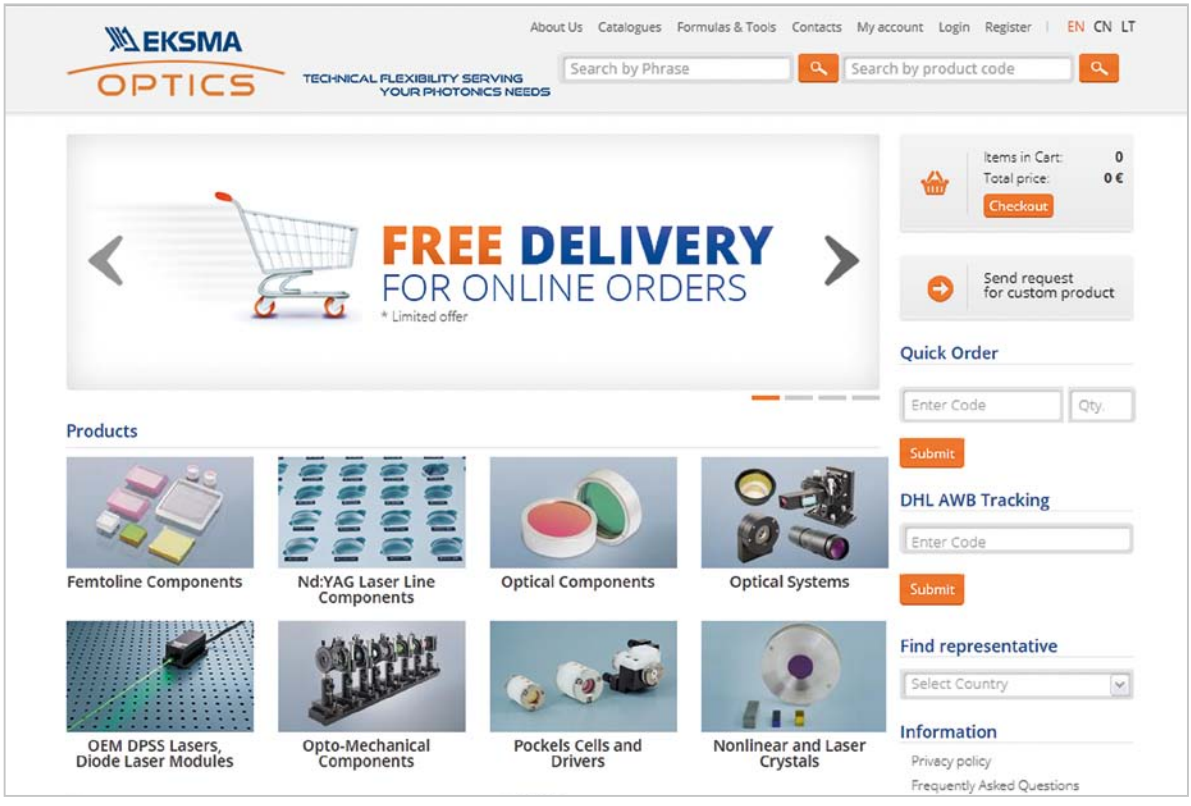
See page 2.26

Please visit

www.eksmaoptics.com

for

- online shopping
- product updates
- company news



Femt✸ Line Components

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OPTICAL COMPONENTS CLEANING INSTRUCTIONS

See page A.4

FemtoLine Laser Optics

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

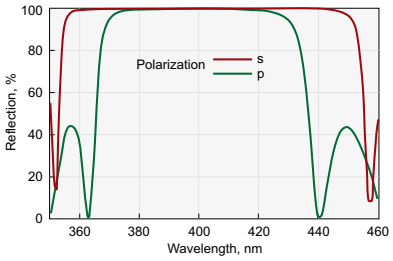
Material	UV grade Fused Silica or BK7 glass
S1 Surface Flatness	λ/10 at 633 nm
S1 Surface Quality	20–10 scratch & dig (MIL-PRF-13830B)
S2 Surface Quality	Commercial polish
Diameter Tolerance	+0.00 mm -0.12 mm
Thickness Tolerance	±0.25 mm
Wedge	< 3 min
Chamfer	0.3 mm at 45° typical

COATING

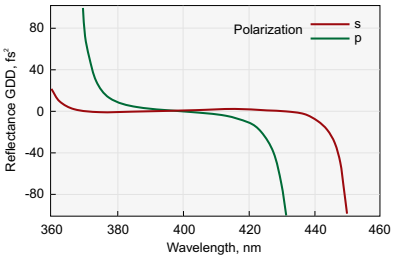
Technology	Electron beam multilayer dielectric or Ion beam sputtering
Adhesion and Durability	Per MIL-C-675A. Insoluble in lab solvents
Clear Aperture	Exceeds central 85% of diameter
Coating	Hard dielectric High Reflection R>99.5%
Angle of Incidence	0 or 45±3°
Designed for average polarization	$R=(R_s+R_p)/2$
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°

Size: **12.7 × 3 mm**

Wavelength, nm	**R,** % (s+p)/2 AOI=0° / AOI=45°	**Catalogue number** AOI=0°	AOI=45°	**Price,** EUR AOI=0° / AOI=45°
380-420	99.7 / 99.5	031-0400-i0	031-0400	57 / 57
500-530	99.7 / 99.5	031-0515-i0	031-0515	56 / 56
760-840	99.7 / 99.5	031-0800-i0	031-0800	61 / 61
1000-1060	99.7 / 99.5	031-1030-i0	031-1030	57 / 57

Size: **12.7 × 6 mm**

Wavelength, nm	**R,** % (s+p)/2 AOI=0° / AOI=45°	**Catalogue number** AOI=0°	AOI=45°	**Price,** EUR AOI=0° / AOI=45°
380-420	99.7 / 99.5	031-0400T6-i0	031-0400T6	57 / 57
500-530	99.7 / 99.5	031-0515T6-i0	031-0515T6	56 / 56
760-840	99.7 / 99.5	031-0800T6-i0	031-0800T6	61 / 61
1000-1060	99.7 / 99.5	031-1030T6-i0	031-1030T6	57 / 57

Size: **25.4 × 6 mm**

Wavelength, nm	**R,** % (s+p)/2 AOI=0° / AOI=45°	**Catalogue number** AOI=0°	AOI=45°	**Price,** EUR AOI=0° / AOI=45°
380-420	99.7 / 99.5	032-0400-i0	032-0400	89 / 89
500-530	99.7 / 99.5	032-0515-i0	032-0515	74 / 74
760-840	99.7 / 99.5	032-0800-i0	032-0800	85 / 85
1000-1060	99.7 / 99.5	032-1030-i0	032-1030	75 / 75

Size: **50.8 × 8 mm**

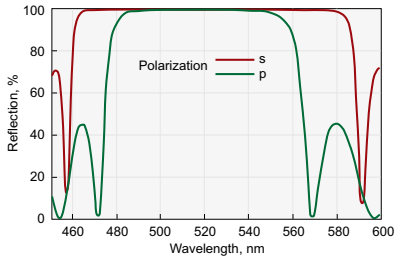
Wavelength, nm	**R,** % (s+p)/2 AOI=0° / AOI=45°	**Catalogue number** AOI=0°	AOI=45°	**Price,** EUR AOI=0° / AOI=45°
380-420	99.7 / 99.5	035-0400-i0	035-0400	133 / 133
500-530	99.7 / 99.5	035-0515-i0	035-0515	110 / 110
760-840	99.7 / 99.5	035-0800-i0	035-0800	133 / 133
1000-1060	99.7 / 99.5	035-1030-i0	035-1030	110 / 110

Size: **76.2 × 12.7 mm**

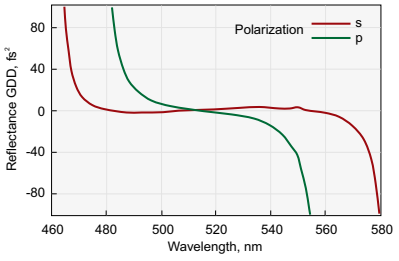
Wavelength, nm	**R,** % (s+p)/2 AOI=0° / AOI=45°	**Catalogue number** AOI=0°	AOI=45°	**Price,** EUR AOI=0° / AOI=45°
380-420	99.7 / 99.5	037-0400-i0	037-0400	199 / 199
500-530	99.7 / 99.5	037-0515-i0	037-0515	185 / 185
760-840	99.7 / 99.5	037-0800-i0	037-0800	199 / 199
1000-1060	99.7 / 99.5	037-1030-i0	037-1030	185 / 185

Low GDD Ultrafast Mirrors

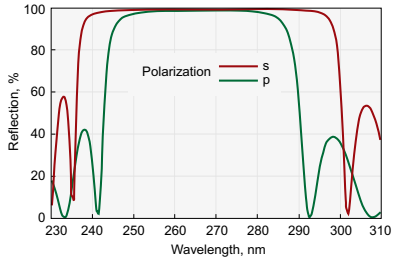
Substrate material:
UV grade Fused Silica



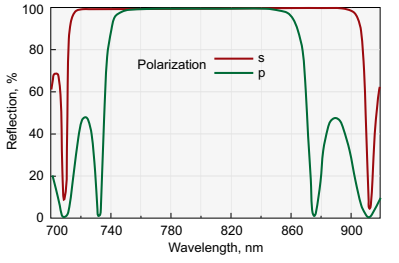
HR>99.5%@500-530 nm, AOI=45°



HRsp@500-530 GDD, AOI=45°



HR>99%@257-275 nm, AOI=45°



HR>99.5%@760-840 nm, AOI=45°

Size: **12.7 × 3 mm**

Wavelength, nm	**R,** % (s+p)/2 AOI=0° / AOI=45°	**Catalogue number** AOI=0°	AOI=45°	**Price,** EUR AOI=0° / AOI=45°
257-275	99.0 / 99.0	041-0266-i0	041-0266	71 / 71
333-353	99.7 / 99.5	041-0343-i0	041-0343	77 / 77
380-420	99.7 / 99.5	041-0400-i0	041-0400	67 / 67
500-530	99.7 / 99.5	041-0515-i0	041-0515	62 / 62
760-840	99.7 / 99.5	041-0800-i0	041-0800	75 / 75
1000-1060	99.7 / 99.5	041-1030-i0	041-1030	62 / 62

Size: **12.7 × 6 mm**

Wavelength, nm	**R,** % (s+p)/2 AOI=0° / AOI=45°	**Catalogue number** AOI=0°	AOI=45°	**Price,** EUR AOI=0° / AOI=45°
257-275	99.0 / 99.0	041-0266T6-i0	041-0266T6	71 / 71
333-353	99.7 / 99.5	041-0343T6-i0	041-0343T6	77 / 77
380-420	99.7 / 99.5	041-0400T6-i0	041-0400T6	67 / 67
500-530	99.7 / 99.5	041-0515T6-i0	041-0515T6	62 / 62
760-840	99.7 / 99.5	041-0800T6-i0	041-0800T6	75 / 75
	99.9 / 99.9	041-0800HHRT6-i0	041-0800HHRT6	108 / 108
1000-1060	99.7 / 99.5	041-1030T6-i0	041-1030T6	62 / 62
	99.9 / 99.9	041-1030HHRT6-i0	041-1030HHRT6	75 / 75

Size: **25.4 × 6 mm**

Wavelength, nm	**R,** % (s+p)/2 AOI=0° / AOI=45°	**Catalogue number** AOI=0°	AOI=45°	**Price,** EUR AOI=0° / AOI=45°
257-275	99.0 / 99.0	042-0266-i0	042-0266	99 / 99
333-353	99.7 / 99.5	042-0343-i0	042-0343	107 / 107
380-420	99.7 / 99.5	042-0400-i0	042-0400	95 / 95
500-530	99.7 / 99.5	042-0515-i0	042-0515	90 / 90
760-840	99.7 / 99.5	042-0800-i0	042-0800	97 / 97
760-840	99.9 / 99.9	042-0800HHR-i0	042-0800HHR	130 / 130
1000-1060	99.7 / 99.5	042-1030-i0	042-1030	90 / 90
1000-1060	99.9 / 99.9	042-1030HHR-i0	042-1030HHR	105 / 105
1400-1700	99.0 / 99.0	082-1417-i0	082-1417	210 / 210

Size: **50.8 × 8 mm**

Wavelength, nm	**R,** % (s+p)/2 AOI=0° / AOI=45°	**Catalogue number** AOI=0°	AOI=45°	**Price,** EUR AOI=0° / AOI=45°
257-275	99.0 / 99.0	045-0266-i0	045-0266	207 / 207
333-353	99.7 / 99.5	045-0343-i0	045-0343	187 / 187
380-420	99.7 / 99.5	045-0400-i0	045-0400	181 / 181
500-530	99.7 / 99.5	045-0515-i0	045-0515	169 / 169
760-840	99.7 / 99.5	045-0800-i0	045-0800	181 / 181
1000-1060	99.7 / 99.5	045-1030-i0	045-1030	169 / 169

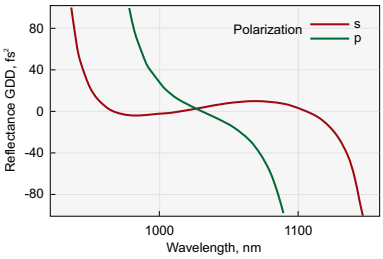
Size: **76.2 × 12.7 mm**

Wavelength, nm	**R,** % (s+p)/2 AOI=0° / AOI=45°	**Catalogue number** AOI=0°	AOI=45°	**Price,** EUR AOI=0° / AOI=45°
257-275	99.0 / 99.0	047-0266-i0	047-0266	290 / 290
333-353	99.7 / 99.5	047-0343-i0	047-0343	281 / 281
380-420	99.7 / 99.5	047-0400-i0	047-0400	272 / 272
500-530	99.7 / 99.5	047-0515-i0	047-0515	258 / 258
760-840	99.7 / 99.5	047-0800-i0	047-0800	272 / 272
1000-1060	99.7 / 99.5	047-1030-i0	047-1030	258 / 258

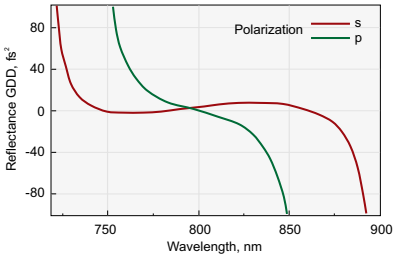
Recommended for high power laser applications operating in UV region.

RELATED PRODUCTS

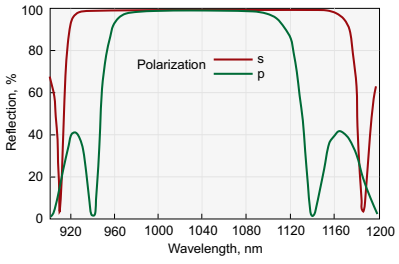
Adapter for Mirror at 45° 840-0115
See page 7.41



HRsp@1000-1060 GDD, AOI=45°



HRsp@760-840 GDD, AOI=45°



HR>99.5%@1000-1060 nm, AOI=45°

DUAL BAND MIRRORS

SPECIFICATIONS

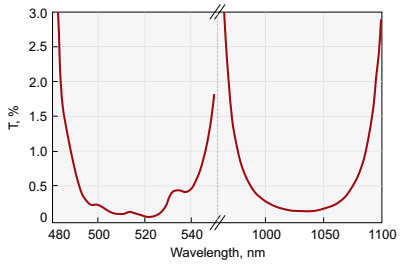
Coating	Hard dielectric High Reflection R>99.5%
Angle of Incidence	0 or 45±3°
Designed for average polarization	$R=(R_s+R_p)/2$
Laser Damage Threshold	>50 mJ/cm², 50 fsec pulse, 800 nm typical

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

Dual Band Mirrors

Substrate material: **BK7 grade A**



HR>99.5%@500-530 nm+1000-1060 nm, AOI = 45°

Size: **12.7 × 3 mm**

Wavelength, nm	**R,** % (s+p)/2 AOI=0° / AOI=45°	**Catalogue number** AOI=0°	AOI=45°	**Price,** EUR AOI=0° / AOI=45°
390-410+780-820	99.7 / 99.5	051-4080-i0	051-4080	85 / 85
500-530+1000-1060	99.7 / 99.5	051-5103-i0	051-5103	85 / 85

Size: **12.7 × 6 mm**

Wavelength, nm	**R,** % (s+p)/2 AOI=0° / AOI=45°	**Catalogue number** AOI=0°	AOI=45°	**Price,** EUR AOI=0° / AOI=45°
390-410+780-820	99.7 / 99.5	051-4080T6-i0	051-4080T6	85 / 85
500-530+1000-1060	99.7 / 99.5	051-5103T6-i0	051-5103T6	85 / 85

Size: **25.4 × 6 mm**

Wavelength, nm	**R,** % (s+p)/2 AOI=0° / AOI=45°	**Catalogue number** AOI=0°	AOI=45°	**Price,** EUR AOI=0° / AOI=45°
390-410+780-820	99.7 / 99.5	052-4080-i0	052-4080	103 / 103
500-530+1000-1060	99.7 / 99.5	052-5103-i0	052-5103	103 / 103

Size: **50.8 × 8 mm**

Wavelength, nm	**R,** % (s+p)/2 AOI=0° / AOI=45°	**Catalogue number** AOI=0°	AOI=45°	**Price,** EUR AOI=0° / AOI=45°
390-410+780-820	99.7 / 99.5	055-4080-i0	055-4080	151 / 151
500-530+1000-1060	99.7 / 99.5	055-5103-i0	055-5103	151 / 151

Size: **76.2 × 12.7 mm**

Wavelength, nm	**R,** % (s+p)/2 AOI=0° / AOI=45°	**Catalogue number** AOI=0°	AOI=45°	**Price,** EUR AOI=0° / AOI=45°
390-410+780-820	99.7 / 99.5	057-4080-i0	057-4080	227 / 227
500-530+1000-1060	99.7 / 99.5	057-5103-i0	057-5103	227 / 227

Dual Band Mirrors

Substrate material: **UV grade Fused Silica**

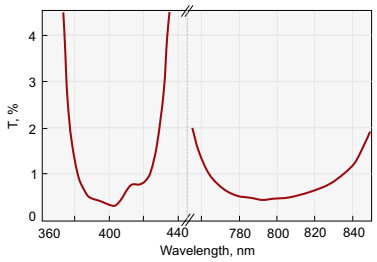
Recommended for high power laser applications operating in UV region.

Size: **12.7 × 3 mm**

Wavelength, nm	**R,** % (s+p)/2 AOI=0° / AOI=45°	**Catalogue number** AOI=0°	AOI=45°	**Price,** EUR AOI=0° / AOI=45°
390-410+780-820	99.7 / 99.5	061-4080-i0	061-4080	110 / 110
500-530+1000-1060	99.7 / 99.5	061-5103-i0	061-5103	110 / 110

Size: **12.7 × 6 mm**

Wavelength, nm	**R,** % (s+p)/2 AOI=0° / AOI=45°	**Catalogue number** AOI=0°	AOI=45°	**Price,** EUR AOI=0° / AOI=45°
390-410+780-820	99.7 / 99.5	061-4080T6-i0	061-4080T6	110 / 110
500-530+1000-1060	99.7 / 99.5	061-5103T6-i0	061-5103T6	110 / 110



HR>99%@400 nm + 800 nm, AOI = 45°

Size: **25.4 × 6 mm**

Wavelength, nm	**R,** % (s+p)/2 AOI=0° / AOI=45°	**Catalogue number** AOI=0°	AOI=45°	**Price,** EUR AOI=0° / AOI=45°
390-410+780-820	99.7 / 99.5	**062-4080-i0**	**062-4080**	128 / 128
500-530+1000-1060	99.7 / 99.5	**062-5103-i0**	**062-5103**	128 / 128

Size: **50.8 × 8 mm**

Wavelength, nm	**R,** % (s+p)/2 AOI=0° / AOI=45°	**Catalogue number** AOI=0°	AOI=45°	**Price,** EUR AOI=0° / AOI=45°
390-410+780-820	99.7 / 99.5	**065-4080-i0**	**065-4080**	214 / 214
500-530+1000-1060	99.7 / 99.5	**065-5103-i0**	**065-5103**	214 / 214

Size: **76.2 × 12.7 mm**

Wavelength, nm	**R,** % (s+p)/2 AOI=0° / AOI=45°	**Catalogue number** AOI=0°	AOI=45°	**Price,** EUR AOI=0° / AOI=45°
390-410+780-820	99.7 / 99.5	**067-4080-i0**	**067-4080**	321 / 321
500-530+1000-1060	99.7 / 99.5	**067-5103-i0**	**067-5103**	321 / 321

BROADBAND LOW GDD ULTRAFAST MIRRORS

- **High reflectivity and low group delay dispersion in broad region centered at 800 nm**
- **R_s > 99% @ 700-930 nm, $|GDD_s|$ < 30 fs² @ 700-930 nm**
- **R_p > 99% @ 730-870 nm, $|GDD_s|$ < 30 fs² @ 730-870 nm**

SPECIFICATIONS

Coating	Hard Dielectric High Reflection or Ion Beam Sputtering
Angle of Incidence	0 or 45±3°
Designed for average polarization	$R=(R_s+R_p)/2$
Laser Damage Threshold	>50 mJ/cm², 50 fsec pulse, 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

Substrate material:
BK7 grade A

Catalogue number AOI = 0°	AOI = 45°	**Diameter,** mm	**Thickness T,** mm	**Wavelength,** nm	**R,** % (s+p)/2	**Price,** EUR AOI=0° / AOI=45°
071-7288-i0	**071-7288**	12.7	3.0	720-880	99.0	86 / 86
071-7288T6-i0	**071-7288T6**	12.7	6.0	720-880	99.0	86 / 86
072-7288-i0	**072-7288**	25.4	6.0	720-880	99.0	104 / 104
074-7288-i0	**074-7288**	38.1	8.0	720-880	99.0	195 / 195
075-7288-i0	**075-7288**	50.8	8.0	720-880	99.0	220 / 220
077-7288-i0	**077-7288**	76.2	12.7	720-880	99.0	395 / 395
078-7288-i0	**078-7288**	101.6	15.0	720-880	99.0	540 / 540

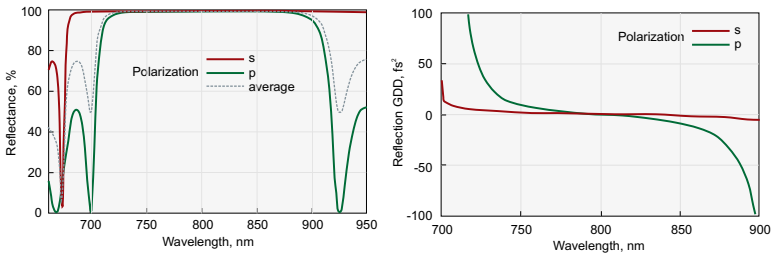
Substrate material:
UV grade Fused Silica

Catalogue number AOI = 0°	AOI = 45°	**Diameter,** mm	**Thickness T,** mm	**Wavelength,** nm	**R,** % (s+p)/2	**Price,** EUR AOI=0° / AOI=45°
081-7288-i0	**081-7288**	12.7	3.0	720-880	99.0	111 / 111
081-7288T6-i0	**081-7288T6**	12.7	6.0	720-880	99.0	111 / 111
082-7288-i0	**082-7288**	25.4	6.0	720-880	99.0	129 / 129
082-7288HHR-i0	**082-7288HHR**	25.4	6.0	720-880	99.9 / 99.8	145 / 145
084-7288-i0	**084-7288**	38.1	8.0	720-880	99.0	225 / 225
085-7288-i0	**085-7288**	50.8	8.0	720-880	99.0	255 / 255
087-7288-i0	**087-7288**	76.2	12.7	720-880	99.0	460 / 460
088-7288-i0	**088-7288**	101.6	15.0	720-880	99.0	612 / 612

RELATED PRODUCTS

Metallic Coated Mirrors
See page 1.24

Kinematic Mirror / Beamsplitter Mounts 840-0056
See page 7.38



HR>99% @720-880nm, AOI=45°

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LASER HARMONIC SEPARATORS

- **Offered on Ø 0.5 or 1 inch UV FS substrates with surface flatness λ/10**

Harmonic separators are dichroic beam-splitters 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.

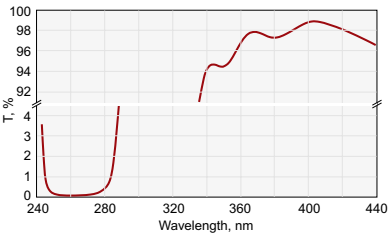
SUBSTRATE

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

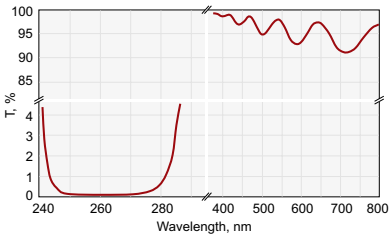
COATING

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/cm², 50 fsec pulse, 800 nm typical

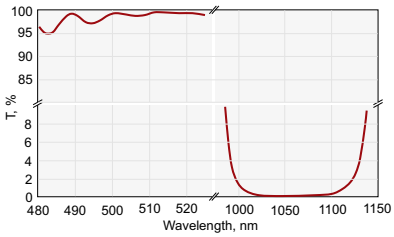
Reflected wavelength, nm, R > 99.5%	Transmitted wavelength, nm	Transmission, %	AOI	Substrate material	Catalogue number Ø12.7x3 mm	Ø25.4x3 mm	Ø50.8x8 mm	Price, EUR Ø12.7 / Ø25.4 / Ø50.8
257-275	780-820	>95	0	UV FS	041-2800	042-2800	045-2800	145 / 175 / 265
257-275	780-820	>95	45	UV FS	041-2805	042-2805	045-2805	145 / 175 / 265
257-275	390-410	>95	0	UV FS	041-2400	042-2400	045-2400	145 / 175 / 265
257-275	390-410	>95	45	UV FS	041-2405	042-2405	045-2405	145 / 175 / 265
257-275	400+800	>90	0	UV FS	041-2480	042-2480	045-2480	165 / 195 / 295
257-275	400+800	>90	45	UV FS	041-2485	042-2485	045-2485	165 / 195 / 295
390-410	780-820	>95	0	UV FS	041-4800	042-4800	045-4800	145 / 175 / 265
390-410	780-820	>95	45	UV FS	041-4805	042-4805	045-4805	145 / 175 / 265
800	400	>93	0	UV FS	041-0840	042-0840	045-0840	140 / 170 / 255
800	400	>93	45	UV FS	041-0845	042-0845	045-0845	140 / 170 / 255
333-353	1000-1060	>95	0	UV FS	041-3130	042-3130	045-3130	135 / 165 / 245
333-353	1000-1060	>95	45	UV FS	041-3135	042-3135	045-3135	135 / 165 / 245
333-353	500-530	>95	0	UV FS	041-3450	042-3450	045-3450	135 / 165 / 245
333-353	500-530	>95	45	UV FS	041-3455	042-3455	045-3455	135 / 165 / 245
333-353	515+1030	>90	0	UV FS	041-3530	042-3530	045-3530	155 / 185 / 275
333-353	515+1030	>90	45	UV FS	041-3535	042-3535	045-3535	155 / 185 / 275
500-530	1000-1060	>95	0	UV FS	041-5130	042-5130	045-5130	135 / 165 / 245
500-530	1000-1060	>95	45	UV FS	041-5135	042-5135	045-5135	135 / 165 / 245
1030	515	>93	0	UV FS	041-6510	042-6510	045-6510	140 / 170 / 255
1030	515	>93	45	UV FS	041-6515	042-6515	045-6515	140 / 170 / 255



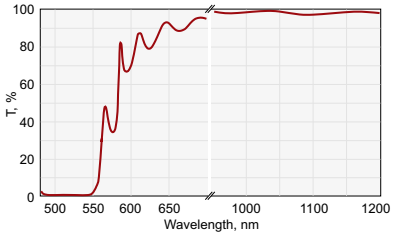
042-2405.
HR>99.5% @ 257-275 nm + HT>95% @ 390-410 nm, AOI=45°



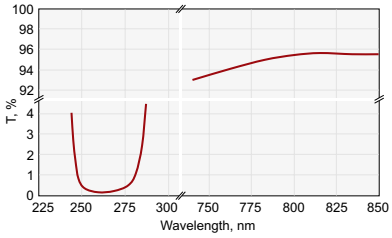
042-2485.
HR>99.5% @ 257-275 nm + HT>90% @ 400+800 nm, AOI=45°



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°

RELATED PRODUCTS

Pellin-Broca Prisms. *See page 1.51*

Adapter for Beamsplitter at 45° 840-0116. *See page 7.41*

Kinematic Mirror and Beamsplitter Mount 840-0020. *See page 7.33*

LASER OUTPUT COUPLERS

- **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 1.49)*.

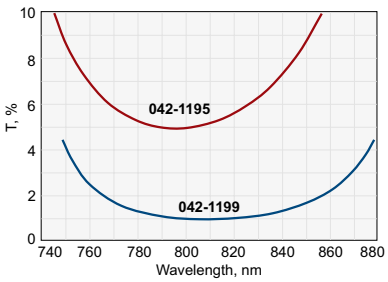
SUBSTRATE

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

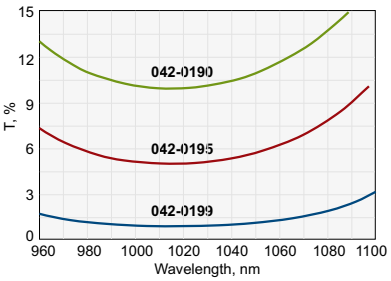
COATING

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/cm², 50 fsec pulse, 800 nm typical

Wavelength, nm	Reflection, %	Transmission, %	Substrate material	Catalogue number Ø12.7 × 3 mm	Ø25.4 × 6 mm	Ø50.8 × 8 mm	Price, EUR Ø12.7 / Ø25.4 / Ø50.8
1030	50±3	50±3	UV FS	041-0150	042-0150	045-0150	105 / 125 / 205
1030	60±3	40±3	UV FS	041-0160	042-0160	045-0160	105 / 125 / 205
1030	65±3	35±3	UV FS	041-0165	042-0165	045-0165	105 / 125 / 205
1030	70±3	30±3	UV FS	041-0170	042-0170	045-0170	105 / 125 / 205
1030	75±3	25±3	UV FS	041-0175	042-0175	045-0175	105 / 125 / 205
1030	80±3	20±3	UV FS	041-0180	042-0180	045-0180	105 / 125 / 205
1030	85±3	15±3	UV FS	041-0185	042-0185	045-0185	105 / 125 / 205
1030	90±2	10±2	UV FS	041-0190	042-0190	045-0190	112 / 132 / 220
1030	95±2	5±2	UV FS	041-0195	042-0195	045-0195	112 / 132 / 220
1030	97±1	3±1	UV FS	041-0197	042-0197	045-0197	119 / 139 / 245
1030	98±1	2±1	UV FS	041-0198	042-0198	045-0198	119 / 139 / 245
1030	99.0±0.5	1.0±0.5	UV FS	041-0199	042-0199	045-0199	126 / 146 / 255
800	50±3	50±3	UV FS	041-1150	042-1150	045-1150	105 / 125 / 205
800	60±3	40±3	UV FS	041-1160	042-1160	045-1160	105 / 125 / 205
800	65±3	35±3	UV FS	041-1165	042-1165	045-1165	105 / 125 / 205
800	70±3	30±3	UV FS	041-1170	042-1170	045-1170	105 / 125 / 205
800	75±3	25±3	UV FS	041-1175	042-1175	045-1175	105 / 125 / 205
800	80±3	20±3	UV FS	041-1180	042-1180	045-1180	105 / 125 / 205
800	85±3	15±3	UV FS	041-1185	042-1185	045-1185	105 / 125 / 205
800	90±2	10±2	UV FS	041-1190	042-1190	045-1190	112 / 132 / 220
800	95±2	5±2	UV FS	041-1195	042-1195	045-1195	112 / 132 / 220
800	97±1	3±1	UV FS	041-1197	042-1197	045-1197	119 / 139 / 245
800	98±1	2±1	UV FS	041-1198	042-1198	045-1198	119 / 139 / 245
800	99.0±0.5	1.0±0.5	UV FS	041-1199	042-1199	045-1199	126 / 146 / 255



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%*

RELATED PRODUCTS

Uncoated Elliptical Mirrors
See page 1.10

Kinematic Mirror and Beamsplitter Mount 840-0020
See page 7.33

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.

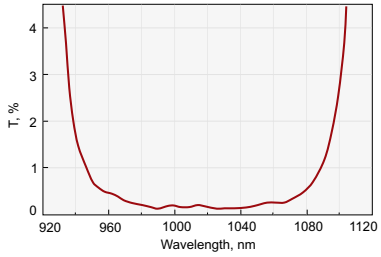
Back side can be AR coated to avoid back reflection from second surface on request.

SUBSTRATE

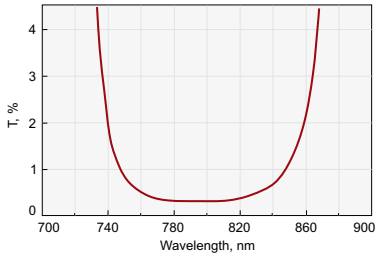
Material	UV grade Fused Silica or BK7 glass
S1 Surface Flatness	λ/10 at 633 nm
S1 Surface Quality	20–10 scratch & dig (MIL-PRF-13830B)
S2 Surface Quality	Commercial polish
Diameter Tolerance	+0.00 mm-0.12 mm
Thickness Tolerance	±0.25
Chamfer	0.3 mm at 45° typical

COATING

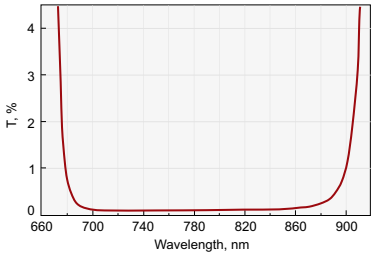
Technology	Electron beam multilayer dielectric
Adhesion and Durability	Per MIL-C-675A. Insoluble in lab solvents
Clear Aperture	Exceeds central 85% of diameter
Angle of Incidence	0-8° (normal)
Coating	Hard dielectric high reflection: R>99.7% at 800 nm and 1030 nm R>99% at 720 – 880 nm
Laser Damage Threshold	>100 mJ/cm², 50 fsec pulse, 800 nm typical



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		
			Catalogue number		Price, EUR	Catalogue number		Price, EUR
			Ø25.4×6 mm	Ø50.8×10 mm	Ø25.4 / Ø50.8	Ø25.4×6 mm	Ø50.8×10 mm	Ø25.4 / Ø50.8
1030±30	Plano-plano	-∞	032-1030-i0	035-1030-i0 *	75 / 110	042-1030-i0	045-1030-i0 *	90 / 169
1030±30	Plano-concave	-50	012-8005	015-8005	99 / 145	022-8005	025-8005	119 / 209
1030±30	Plano-concave	-100	012-8010	015-8010	99 / 145	022-8010	025-8010	119 / 209
1030±30	Plano-concave	-150	012-8015	015-8015	99 / 145	022-8015	025-8015	119 / 209
1030±30	Plano-concave	-200	012-8020	015-8020	99 / 145	022-8020	025-8020	119 / 209
1030±30	Plano-concave	-250	012-8025	015-8025	99 / 145	022-8025	025-8025	119 / 209
1030±30	Plano-concave	-500	012-8050	015-8050	99 / 145	022-8050	025-8050	119 / 209
1030±30	Plano-concave	-1000	012-8100	015-8100	99 / 145	022-8100	025-8100	119 / 209
1030±30	Plano-concave	-2000	012-8200	015-8200	99 / 145	022-8200	025-8200	119 / 209
1030±30	Plano-concave	-2500	012-8250	015-8250	99 / 145	022-8250	025-8250	119 / 209
1030±30	Plano-concave	-4000	012-8400	015-8400	99 / 145	022-8400	025-8400	119 / 209
1030±30	Plano-concave	-5000	012-8500	015-8500	99 / 145	022-8500	025-8500	119 / 209
1030±30	Plano-convex	+100	012-9010	015-9010	103 / 155	022-9010	025-9010	123 / 219
1030±30	Plano-convex	+200	012-9020	015-9020	103 / 155	022-9020	025-9020	123 / 219
1030±30	Plano-convex	+500	012-9050	015-9050	103 / 155	022-9050	025-9050	123 / 219
1030±30	Plano-convex	+1000	012-9100	015-9100	103 / 155	022-9100	025-9100	123 / 219
1030±30	Plano-convex	+2000	012-9200	015-9200	103 / 155	022-9200	025-9200	123 / 219
1030±30	Plano-convex	+4000	012-9400	015-9400	103 / 155	022-9400	025-9400	123 / 219

** Thickness of plano-plano rear mirrors of Ø50.8 is 8 mm.*

Wavelength, nm	Substrate type	Radius, mm	Substrate material BK7			Substrate material UVFS		
			Catalogue number		Price, EUR	Catalogue number		Price, EUR
			Ø25.4×6 mm	Ø50.8×10 mm	Ø25.4 / Ø50.8	Ø25.4×6 mm	Ø50.8×10 mm	Ø25.4 / Ø50.8
800±20	Plano-plano	-∞	032-0800-i0	035-0800-i0 *	85 / 133	042-0800-i0	045-0800-i0 *	97 / 181
800±20	Plano-concave	-50	062-8005	065-8005	99 / 145	082-8005	085-8005	119 / 209
800±20	Plano-concave	-100	062-8010	065-8010	99 / 145	082-8010	085-8010	119 / 209
800±20	Plano-concave	-150	062-8015	065-8015	99 / 145	082-8015	085-8015	119 / 209
800±20	Plano-concave	-200	062-8020	065-8020	99 / 145	082-8020	085-8020	119 / 209
800±20	Plano-concave	-250	062-8025	065-8025	99 / 145	082-8025	085-8025	119 / 209
800±20	Plano-concave	-500	062-8050	065-8050	99 / 145	082-8050	085-8050	119 / 209
800±20	Plano-concave	-1000	062-8100	065-8100	99 / 145	082-8100	085-8100	119 / 209
800±20	Plano-concave	-2000	062-8200	065-8200	99 / 145	082-8200	085-8200	119 / 209
800±20	Plano-concave	-2500	062-8250	065-8250	99 / 145	082-8250	085-8250	119 / 209
800±20	Plano-concave	-4000	062-8400	065-8400	99 / 145	082-8400	085-8400	119 / 209
800±20	Plano-concave	-5000	062-8500	065-8500	99 / 145	082-8500	085-8500	119 / 209
800±20	Plano-convex	+100	062-9010	065-9010	103 / 155	082-9010	085-9010	123 / 219
800±20	Plano-convex	+200	062-9020	065-9020	103 / 155	082-9020	085-9020	123 / 219
800±20	Plano-convex	+500	062-9050	065-9050	103 / 155	082-9050	085-9050	123 / 219
800±20	Plano-convex	+1000	062-9100	065-9100	103 / 155	082-9100	085-9100	123 / 219
800±20	Plano-convex	+2000	062-9200	065-9200	103 / 155	082-9200	085-9200	123 / 219
800±20	Plano-convex	+4000	062-9400	065-9400	103 / 155	082-9400	085-9400	123 / 219

** Thickness of plano-plano rear mirrors of Ø50.8 is 8 mm.*

Wavelength, nm	Substrate type	Radius, mm	Substrate material BK7			Substrate material UVFS		
			Catalogue number		Price, EUR	Catalogue number		Price, EUR
			Ø25.4×6 mm	Ø50.8×10 mm	Ø25.4 / Ø50.8	Ø25.4×6 mm	Ø50.8×10 mm	Ø25.4 / Ø50.8
720-880	Plano-plano	∞	072-7288-i0	075-7288-i0 *	104 / 220	082-7288-i0	085-7288-i0 *	129 / 255
720-880	Plano-concave	-50	062-8005B	065-8005B	128 / 245	082-8005B	085-8005B	153 / 280
720-880	Plano-concave	-100	062-8010B	065-8010B	128 / 245	082-8010B	085-8010B	153 / 280
720-880	Plano-concave	-150	062-8015B	065-8015B	128 / 245	082-8015B	085-8015B	153 / 280
720-880	Plano-concave	-200	062-8020B	065-8020B	128 / 245	082-8020B	085-8020B	153 / 280
720-880	Plano-concave	-250	062-8025B	065-8025B	128 / 245	082-8025B	085-8025B	153 / 280
720-880	Plano-concave	-500	062-8050B	065-8050B	128 / 245	082-8050B	085-8050B	153 / 280
720-880	Plano-concave	-1000	062-8100B	065-8100B	128 / 245	082-8100B	085-8100B	153 / 280
720-880	Plano-concave	-2000	062-8200B	065-8200B	128 / 245	082-8200B	085-8200B	153 / 280
720-880	Plano-concave	-2500	062-8250B	065-8250B	128 / 245	082-8250B	085-8250B	153 / 280
720-880	Plano-concave	-3000	062-8300B	065-8300B	128 / 245	082-8300B	085-8300B	153 / 280
720-880	Plano-concave	-4000	062-8400B	065-8400B	128 / 245	082-8400B	085-8400B	153 / 280
720-880	Plano-concave	-5000	062-8500B	065-8500B	128 / 245	082-8500B	085-8500B	153 / 280
720-880	Plano-convex	100	062-9010B	065-9010B	132 / 250	082-9010B	085-9010B	157 / 285
720-880	Plano-convex	200	062-9020B	065-9020B	132 / 250	082-9020B	085-9020B	157 / 285
720-880	Plano-convex	500	062-9050B	065-9050B	132 / 250	082-9050B	085-9050B	157 / 285
720-880	Plano-convex	600	062-9060B	065-9060B	132 / 250	082-9060B	085-9060B	157 / 285
720-880	Plano-convex	1000	062-9100B	065-9100B	132 / 250	082-9100B	085-9100B	157 / 285
720-880	Plano-convex	1500	062-9150B	065-9150B	132 / 250	082-9150B	085-9150B	157 / 285
720-880	Plano-convex	2000	062-9200B	065-9200B	132 / 250	082-9200B	085-9200B	157 / 285
720-880	Plano-convex	4000	062-9400B	065-9400B	132 / 250	082-9400B	085-9400B	157 / 285

** Thickness of plano-plano rear mirrors of Ø50.8 is 8 mm.*

RELATED PRODUCTS

Uncoated Curved Windows

See page 1.8

Kinematic Mirror Mount 840-0010

See page 7.33

Kinematic Mirror and Beamsplitter Mount 840-0020

See page 7.33

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 1.11)*.

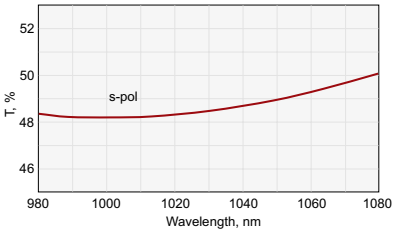
SUBSTRATE

Material	UV FS
S1 Surface Flatness	λ/10 at 633 nm
S1 Surface Quality	20-10 scratch & dig (MIL-PRF-13830B)
S2 Surface Flatness	λ/10 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
Parallelism	30 arcsec
Chamfer	0.3 mm at 45° typical

Please contact us for wedged beamsplitters or choose wedged substrates from Wedge Prisms (page 1.49)

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%



032-7450S. *Rs=50% @ 1030 nm, AOI=45°*

Designed for average polarization: $R=(R_s+R_p)/2$ and $T=(T_s+T_p)/2$

Laser Damage Threshold: >100 mJ/cm², 50 fsec pulse, 800 nm typical

Wavelength, nm	Reflection, %	Transmission, %	Substrate material	Catalogue number Ø12.7 × 3 mm	Ø25.4 × 3 mm	Ø50.8 × 8 mm	Price, EUR Ø12.7 / Ø25.4 / Ø50.8
1030	20±3	80±3	UV FS	031-7420A	032-7420A	035-7420A	105 / 125 / 205
1030	30±3	70±3	UV FS	031-7430A	032-7430A	035-7430A	105 / 125 / 205
1030	50±3	50±3	UV FS	031-7450A	032-7450A	035-7450A	105 / 125 / 205
1030	70±3	30±3	UV FS	031-7470A	032-7470A	035-7470A	105 / 125 / 205
1030	80±3	20±3	UV FS	031-7480A	032-7480A	035-7480A	105 / 125 / 205
515	20±3	80±3	UV FS	031-7520A	032-7520A	035-7520A	103 / 123 / 200
515	30±3	70±3	UV FS	031-7530A	032-7530A	035-7530A	103 / 123 / 200
515	50±3	50±3	UV FS	031-7550A	032-7550A	035-7550A	103 / 123 / 200
515	70±3	30±3	UV FS	031-7570A	032-7570A	035-7570A	103 / 123 / 200
515	80±3	20±3	UV FS	031-7580A	032-7580A	035-7580A	103 / 123 / 200
343	20±3	80±3	UV FS	031-7620A	032-7620A	035-7620A	110 / 140 / 245
343	30±3	70±3	UV FS	031-7630A	032-7630A	035-7630A	110 / 140 / 245
343	50±3	50±3	UV FS	031-7650A	032-7650A	035-7650A	110 / 140 / 245
343	70±3	30±3	UV FS	031-7670A	032-7670A	035-7670A	110 / 140 / 245
343	80±3	20±3	UV FS	031-7680A	032-7680A	035-7680A	110 / 140 / 245
800	20±3	80±3	UV FS	041-7720A	042-7720A	045-7720A	105 / 125 / 205
800	30±3	70±3	UV FS	041-7730A	042-7730A	045-7730A	105 / 125 / 205
800	50±3	50±3	UV FS	041-7750A	042-7750A	045-7750A	105 / 125 / 205
800	70±3	30±3	UV FS	041-7770A	042-7770A	045-7770A	105 / 125 / 205
800	80±3	20±3	UV FS	041-7780A	042-7780A	045-7780A	105 / 125 / 205
400	20±3	80±3	UV FS	041-7820A	042-7820A	045-7820A	103 / 123 / 200
400	30±3	70±3	UV FS	041-7830A	042-7830A	045-7830A	103 / 123 / 200
400	50±3	50±3	UV FS	041-7850A	042-7850A	045-7850A	103 / 123 / 200
400	70±3	30±3	UV FS	041-7870A	042-7870A	045-7870A	103 / 123 / 200
400	80±3	20±3	UV FS	041-7880A	042-7880A	045-7880A	103 / 123 / 200
266	20±3	80±3	UV FS	041-7920A	042-7920FA	045-7920A	115 / 145 / 265
266	30±3	70±3	UV FS	041-7930A	042-7930FA	045-7930A	115 / 145 / 265
266	50±3	50±3	UV FS	041-7950A	042-7950FA	045-7950A	115 / 145 / 265
266	70±3	30±3	UV FS	041-7970A	042-7970FA	045-7970A	115 / 145 / 265
266	80±3	20±3	UV FS	041-7980A	042-7980FA	045-7980A	115 / 145 / 265

Designed for S- polarization. Laser Damage Threshold: >100 mJ/cm², 50 fsec pulse, 800 nm typical

Wavelength, nm	Reflection, %	Transmission, %	Substrate material	Catalogue number			Price, EUR
				Ø12.7 × 3 mm	Ø25.4 × 3 mm	Ø50.8 × 8 mm	Ø12.7 / Ø25.4 / Ø50.8
1030	20±3	80±3	UV FS	031-7420S	032-7420S	035-7420S	105 / 125 / 205
1030	30±3	70±3	UV FS	031-7430S	032-7430S	035-7430S	105 / 125 / 205
1030	50±3	50±3	UV FS	031-7450S	032-7450S	035-7450S	105 / 125 / 205
1030	70±3	30±3	UV FS	031-7470S	032-7470S	035-7470S	105 / 125 / 205
1030	80±3	20±3	UV FS	031-7480S	032-7480S	035-7480S	105 / 125 / 205
515	20±3	80±3	UV FS	031-7520S	032-7520S	035-7520S	103 / 123 / 200
515	30±3	70±3	UV FS	031-7530S	032-7530S	035-7530S	103 / 123 / 200
515	50±3	50±3	UV FS	031-7550S	032-7550S	035-7550S	103 / 123 / 200
515	70±3	30±3	UV FS	031-7570S	032-7570S	035-7570S	103 / 123 / 200
515	80±3	20±3	UV FS	031-7580S	032-7580S	035-7580S	103 / 123 / 200
343	20±3	80±3	UV FS	031-7620S	032-7620S	035-7620S	110 / 140 / 245
343	30±3	70±3	UV FS	031-7630S	032-7630S	035-7630S	110 / 140 / 245
343	50±3	50±3	UV FS	031-7650S	032-7650S	035-7650S	110 / 140 / 245
343	70±3	30±3	UV FS	031-7670S	032-7670S	035-7670S	110 / 140 / 245
343	80±3	20±3	UV FS	031-7680S	032-7680S	035-7680S	110 / 140 / 245
800	20±3	80±3	UV FS	041-7720S	042-7720S	045-7720S	105 / 125 / 205
800	30±3	70±3	UV FS	041-7730S	042-7730S	045-7730S	105 / 125 / 205
800	50±3	50±3	UV FS	041-7750S	042-7750S	045-7750S	105 / 125 / 205
800	70±3	30±3	UV FS	041-7770S	042-7770S	045-7770S	105 / 125 / 205
800	80±3	20±3	UV FS	041-7780S	042-7780S	045-7780S	105 / 125 / 205
400	20±3	80±3	UV FS	041-7820S	042-7820S	045-7820S	103 / 123 / 200
400	30±3	70±3	UV FS	041-7830S	042-7830S	045-7830S	103 / 123 / 200
400	50±3	50±3	UV FS	041-7850S	042-7850S	045-7850S	103 / 123 / 200
400	70±3	30±3	UV FS	041-7870S	042-7870S	045-7870S	103 / 123 / 200
400	80±3	20±3	UV FS	041-7880S	042-7880S	045-7880S	103 / 123 / 200
266	20±3	80±3	UV FS	041-7920S	042-7920FS	045-7920S	115 / 145 / 265
266	30±3	70±3	UV FS	041-7930S	042-7930FS	045-7930S	115 / 145 / 265
266	50±3	50±3	UV FS	041-7950S	042-7950FS	045-7950S	115 / 145 / 265
266	70±3	30±3	UV FS	041-7970S	042-7970FS	045-7970S	115 / 145 / 265
266	80±3	20±3	UV FS	041-7980S	042-7980FS	045-7980S	115 / 145 / 265

Designed for P- polarization. Laser Damage Threshold: >100 mJ/cm², 50 fsec pulse, 800 nm typical

Wavelength, nm	Reflection, %	Transmission, %	Substrate material	Catalogue number			Price, EUR
				Ø12.7 × 3 mm	Ø25.4 × 3 mm	Ø50.8 × 8 mm	Ø12.7 / Ø25.4 / Ø50.8
1030	20±3	80±3	UV FS	031-7420P	032-7420P	035-7420P	105 / 125 / 205
1030	30±3	70±3	UV FS	031-7430P	032-7430P	035-7430P	105 / 125 / 205
1030	50±3	50±3	UV FS	031-7450P	032-7450P	035-7450P	105 / 125 / 205
1030	70±3	30±3	UV FS	031-7470P	032-7470P	035-7470P	105 / 125 / 205
1030	80±3	20±3	UV FS	031-7480P	032-7480P	035-7480P	105 / 125 / 205
515	20±3	80±3	UV FS	031-7520P	032-7520P	035-7520P	103 / 123 / 200
515	30±3	70±3	UV FS	031-7530P	032-7530P	035-7530P	103 / 123 / 200
515	50±3	50±3	UV FS	031-7550P	032-7550P	035-7550P	103 / 123 / 200
515	70±3	30±3	UV FS	031-7570P	032-7570P	035-7570P	103 / 123 / 200
515	80±3	20±3	UV FS	031-7580P	032-7580P	035-7580P	103 / 123 / 200
343	20±3	80±3	UV FS	031-7620P	032-7620P	035-7620P	110 / 140 / 245
343	30±3	70±3	UV FS	031-7630P	032-7630P	035-7630P	110 / 140 / 245
343	50±3	50±3	UV FS	031-7650P	032-7650P	035-7650P	110 / 140 / 245
343	70±3	30±3	UV FS	031-7670P	032-7670P	035-7670P	110 / 140 / 245
343	80±3	20±3	UV FS	031-7680P	032-7680P	035-7680P	110 / 140 / 245
800	20±3	80±3	UV FS	041-7720P	042-7720P	045-7720P	105 / 125 / 205
800	30±3	70±3	UV FS	041-7730P	042-7730P	045-7730P	105 / 125 / 205
800	50±3	50±3	UV FS	041-7750P	042-7750P	045-7750P	105 / 125 / 205
800	70±3	30±3	UV FS	041-7770P	042-7770P	045-7770P	105 / 125 / 205
800	80±3	20±3	UV FS	041-7780P	042-7780P	045-7780P	105 / 125 / 205
400	20±3	80±3	UV FS	041-7820P	042-7820P	045-7820P	103 / 123 / 200
400	30±3	70±3	UV FS	041-7830P	042-7830P	045-7830P	103 / 123 / 200
400	50±3	50±3	UV FS	041-7850P	042-7850P	045-7850P	103 / 123 / 200
400	70±3	30±3	UV FS	041-7870P	042-7870P	045-7870P	103 / 123 / 200
400	80±3	20±3	UV FS	041-7880P	042-7880P	045-7880P	103 / 123 / 200
266	20±3	80±3	UV FS	041-7920P	042-7920FP	045-7920P	115 / 145 / 265
266	30±3	70±3	UV FS	041-7930P	042-7930FP	045-7930P	115 / 145 / 265
266	50±3	50±3	UV FS	041-7950P	042-7950FP	045-7950P	115 / 145 / 265
266	70±3	30±3	UV FS	041-7970P	042-7970FP	045-7970P	115 / 145 / 265
266	80±3	20±3	UV FS	041-7980P	042-7980FP	045-7980P	115 / 145 / 265

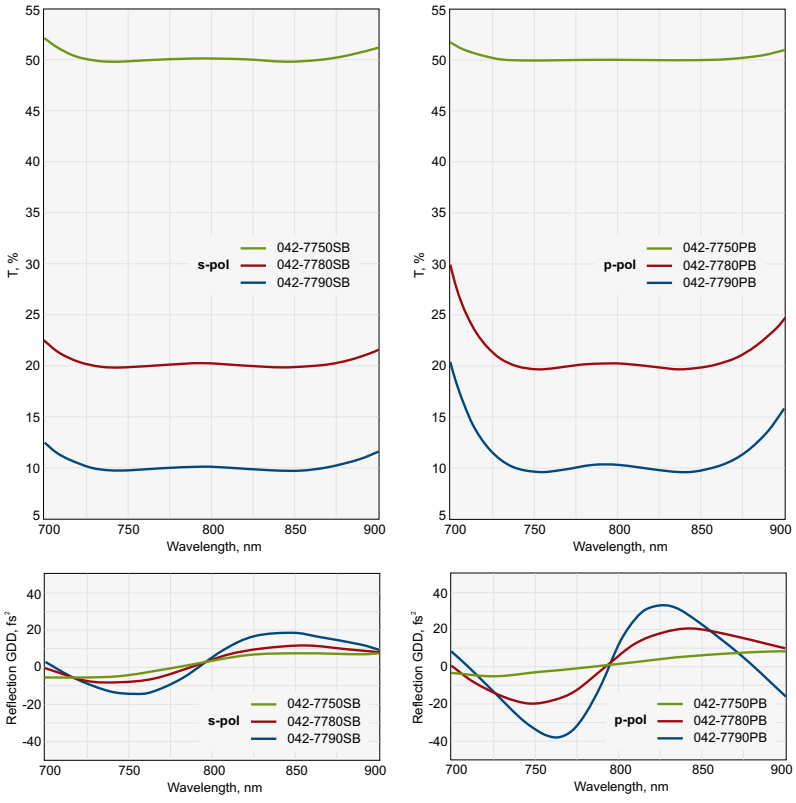
Broadband Laser Beamsplitters

Designed for S- polarization. Laser Damage Threshold: >50 mJ/cm², 50 fsec pulse, 800 nm typical

Wavelength, nm	Reflection, %	Transmission, %	Substrate material	Catalogue number Ø25.4 × 3 mm	Catalogue number Ø50.8 × 6 mm	Price, EUR Ø25.4 / Ø50.8
720 – 880	8±1	92±1	UV FS	042-7708SB	045-7708SB	110 / 185
720 – 880	20±5	80±5	UV FS	042-7720SB	045-7720SB	185 / 340
720 – 880	30±5	70±5	UV FS	042-7730SB	045-7730SB	185 / 340
720 – 880	40±5	60±5	UV FS	042-7740SB	045-7740SB	185 / 340
720 – 880	50±5	50±5	UV FS	042-7750SB	045-7750SB	185 / 340
720 – 880	60±5	40±5	UV FS	042-7760SB	045-7760SB	190 / 360
720 – 880	70±5	30±5	UV FS	042-7770SB	045-7770SB	195 / 390
720 – 880	80±5	20±5	UV FS	042-7780SB	045-7780SB	195 / 390
720 – 880	90±3	10±3	UV FS	042-7790SB	045-7790SB	215 / 440
720 – 880	95±2	5±2	UV FS	042-7795SB	045-7795SB	225 / 470

Designed for P- polarization. Laser Damage Threshold: >50 mJ/cm², 50 fsec pulse, 800 nm typical

Wavelength, nm	Reflection, %	Transmission, %	Substrate material	Catalogue number Ø25.4 × 3 mm	Catalogue number Ø50.8 × 6 mm	Price, EUR Ø25.4 / Ø50.8
750 – 850	10±2	90±2	UV FS	042-7710PB	045-7710PB	185 / 340
750 – 850	20±5	80±5	UV FS	042-7720PB	045-7720PB	185 / 340
750 – 850	25±5	75±5	UV FS	042-7725PB	045-7725PB	185 / 340
750 – 850	30±5	70±5	UV FS	042-7730PB	045-7730PB	185 / 340
750 – 850	40±5	60±5	UV FS	042-7740PB	045-7740PB	185 / 340
750 – 850	50±5	50±5	UV FS	042-7750PB	045-7750PB	185 / 340
750 – 850	60±5	40±5	UV FS	042-7760PB	045-7760PB	190 / 360
750 – 850	70±5	30±5	UV FS	042-7770PB	045-7770PB	195 / 390
750 – 850	75±5	25±5	UV FS	042-7775PB	045-7775PB	195 / 390
750 – 850	80±5	20±5	UV FS	042-7780PB	045-7780PB	195 / 390
750 – 850	90±3	10±3	UV FS	042-7790PB	045-7790PB	215 / 440
750 – 850	95±2	5±2	UV FS	042-7795PB	045-7795PB	225 / 470



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°*

RELATED PRODUCTS

Uncoated Elliptical Mirrors
See page 1.10

Kinematic Mirror and Beamsplitter Mount 840-0030-02
See page 7.33

Adapter for Beamsplitter at 45° 840-0116
See page 7.41

Flipping Mirror / Beamsplitter Mount 840-0155
See page 7.45

THIN LENSES

- **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**

EKSMA OPTICS introduces Ultrathin Lenses series for femtosecond applications. Femtosecond application often requires Low Group Delay Dispersion optics. Our below given Thin UVFS lenses are ideal in this case.

Other sizes and focal length are available on request.

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

Thin Plano-Convex Lenses, Ø12.7 mm

Uncoated lenses. Material – **UVFS**. Diameter **D = Ø12.7 mm**

Catalogue number	Centre Thickness CT, mm	Edge Thickness ET, mm	Focal Length, mm @ 800 nm	Radius, mm	Price, EUR
110-1106ET	2.5	1.0	30	13.6	60
110-1108ET	1.8	0.7	40	18.1	60
110-1109ET	1.9	1.0	50	22.7	60
110-1111ET	1.8	1.2	75	34.0	60
110-1115ET	1.5	0.9	100	45.3	60
110-1117ET	1.4	1.0	125	56.7	60
110-1119ET	1.5	1.2	150	68.0	60
110-1121ET	1.2	1.0	175	79.3	60
110-1123ET	1.2	1.0	200	90.7	60
110-1126ET	1.1	1.0	250	113.3	60
110-1129ET	1.1	1.0	300	136.0	60
110-1133ET	1.1	1.0	400	181.3	60
110-1135ET	1.1	1.0	450	204.0	60
110-1137ET	1.1	1.0	500	226.7	60

Thin Plano-Convex Lenses, Ø25.4 mm

Uncoated lenses. Material – **UVFS**. Diameter **D = Ø25.4 mm**

Catalogue number	Centre Thickness CT, mm	Edge Thickness ET, mm	Focal Length, mm @ 800 nm	Radius, mm	Price, EUR
110-1205ET	4.9	1.0	50	22.7	80
110-1209ET	3	0.5	75	34.0	80
110-1211ET	2.5	0.7	100	45.3	80
110-1216ET	2	0.6	125	56.7	80
110-1217ET	2	0.8	150	68.0	80
110-1219ET	2	1.1	200	90.7	80
110-1223ET	2	1.4	300	136.0	80
110-1225ET	2	1.5	350	158.7	80
110-1227ET	2	1.6	400	181.3	80
110-1231ET	2	1.6	450	204.0	80
110-1233ET	2	1.6	500	266.7	80
110-1245ET	1.5	1.3	1000	453.3	80
110-1255ET	1.4	1.3	1500	680.0	80
110-1265ET	1.4	1.3	2000	906.6	80

Thin Plano-Convex Lenses, Ø50.8 mm

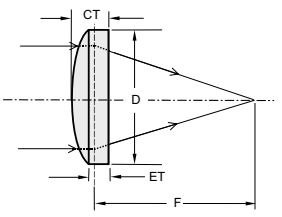
Uncoated lenses. Material – **UVFS**. Diameter **D = Ø50.8 mm**

Catalogue number	Centre Thickness CT, mm	Edge Thickness ET, mm	Focal Length, mm @ 800 nm	Radius, mm	Price, EUR
110-1505ET	14	2.5	75	34.0	180
110-1509ET	10.3	2.5	100	45.3	180
110-1511ET	7.4	2.5	150	68.0	180
110-1515ET	6.1	2.5	200	90.7	180
110-1519ET	4.9	2.5	300	136.0	180
110-1523ET	4.3	2.5	400	181.3	180
110-1527ET	3.9	2.5	500	266.7	180
110-1545ET	3.2	2.5	1000	453.3	180
110-1550ET	3	2.5	1500	680.0	180
110-1555ET	2.9	2.5	2000	906.6	180
110-1566ET	2.7	2.5	3000	1360.0	180
110-1568ET	2.7	2.5	4000	1813.3	180
110-1567ET	2.6	2.5	5000	2266.6	180
110-1570ET	2.6	2.5	6000	2719.9	180

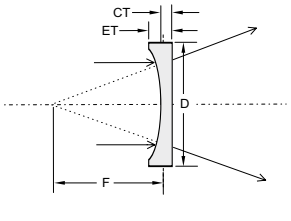
Thin Plano-Concave Lenses, Ø12.7 mm

Uncoated lenses. Material – **UVFS**. Diameter **D = Ø12.7 mm**

Catalogue number	Centre Thickness CT, mm	Edge Thickness ET, mm	Focal Length, mm @ 800 nm	Radius, mm	Price, EUR
112-1104ET	1	3.5	-20	-9.1	60
112-1106ET	1	2.5	-30	-13.6	60
112-1108ET	1	2.1	-40	-18.1	60
112-1109ET	1	1.9	-50	-22.7	60
112-1110ET	1	1.7	-60	-27.2	60
112-1112ET	1	1.5	-75	-34.0	60
112-1113ET	1	1.5	-80	-36.3	60
112-1115ET	1	1.4	-100	-45.3	60
112-1117ET	1	1.3	-125	-56.7	60
112-1119ET	1	1.2	-150	-68.0	60



Plano-convex lens



Plano-concave lens

EKSMA OPTICS • Tel.: +370 5 272 99 00 • Fax: +370 5 272 92 99 • info@eksmaoptics.com • www.eksmaoptics.com

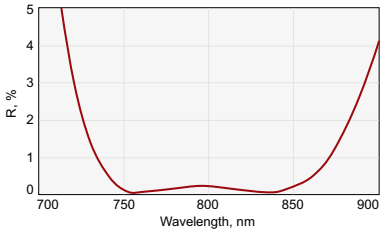
Available Standard Coatings for Thin Lenses

SPECIFICATIONS

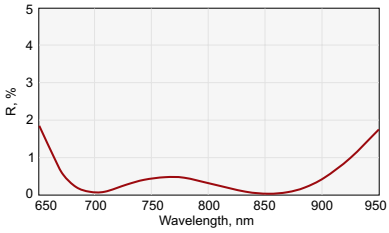
Technology	Electron beam multilayer dielectric
Adhesion and Durability	Per MIL-C-675A. Insoluble in lab solvents
Clear Aperture	Exceeds central 85% of diameter
Angle of Incidence	0°
Coated Surface Flatness	λ/10 at 633 nm over clear aperture

Available Coatings

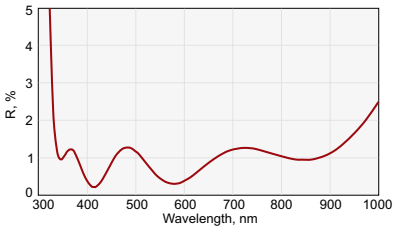
Coating suffix	Wavelength	Reflection per surface	Laser Damage Threshold	Price per unit to be addded, EUR/pc.
AR	760 – 840 nm	R<0.5%	100 mJ/cm²	29
BBAR	700 – 900 nm	R<0.5%	50 mJ/cm²	50
UBBAR	350 – 900 nm	R<1.5%	50 mJ/cm²	60
AR1030	1000 – 1060 nm	R<0.3%	100 mJ/cm²	29
AR515	500 – 530 nm	R<0.4%	100 mJ/cm²	29
AR400	380 – 420 nm	R<0.5%	100 mJ/cm²	29
AR343	333 – 353 nm	R<0.5%	100 mJ/cm²	29
ARD	515 + 1030 nm	R<0.5%	100 mJ/cm²	35



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

Coating suffix	Wavelength	Reflection per surface	Laser Damage Threshold	Price per unit to be addded, EUR/pc.
AR800HT	760 – 840 nm	R<0.1%	100 mJ/cm²	105
ARB800HT	700 – 900 nm	R<0.1%	100 mJ/cm²	115
AR400HT	380 – 420 nm	R<0.2%	50 mJ/cm²	105
ARD800HT	400 + 800 nm	R<0.2%	50 mJ/cm²	115
AR1030HT	1000 – 1060 nm	R<0.1%	100 mJ/cm²	105
AR515HT	500 – 530 nm	R<0.1%	50 mJ/cm²	105
AR343HT	333 – 353 nm	R<0.2%	25 mJ/cm²	135
ARD1030HT	515 + 1030 nm	R<0.1%	50 mJ/cm²	115

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** + **AR**, Price: 80 + 29 EUR= 109 EUR/pc.

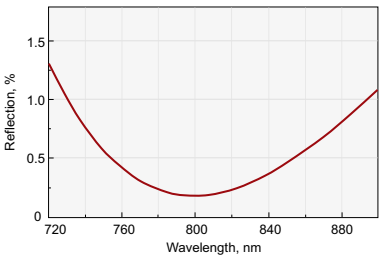
Lens code | Coating code | Lens price | Coating price

AR COATED LENS KITS

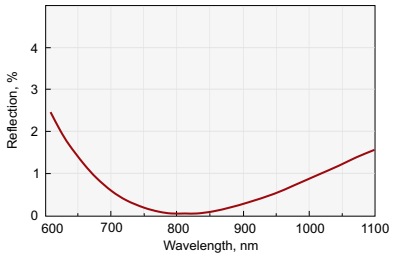
Large Lenses Kit

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.

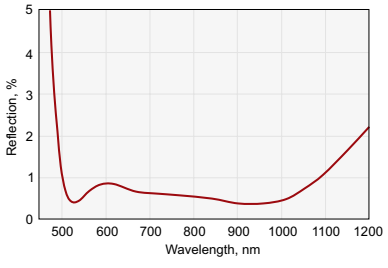
Large lens kit consists of 40 lenses and small lens kit consists of 15 lenses made of UVFS. Kits are available with laser line and broadband multilayer anti-reflection coatings.



R<0.5% @ 760-840 nm, AOI= 0°



R<0.8% @ 700-900 nm, AOI= 0°



R<1.5% @ 500-1100 nm, AOI=0°

Large UV FS Lenses Kit (40 pcs.)

Code	Coating	Price, EUR
140-1240-AR210-400	BBAR @ 210–400 nm, R<2%	3490
140-1240-AR350-900	BBAR @ 350–900 nm, R<1.5%	3290
140-1240-AR760-840	BBAR @ 760–840 nm, R<0.4%	3040
140-1240-AR700-900	BBAR @ 700–900 nm, R<0.8%	3210
140-1240-AR650-1100	BBAR @ 650–1100 nm, R<1%	3310
140-1240-AR266	AR @ 266 nm, R<0.4%	3130
140-1240-AR1030	AR @ 1030 nm, R<0.25%	2930
140-1240-AR515	AR @ 515 nm, R<0.25%	2930
140-1240-AR343	AR @ 343 nm, R<0.3%	3030
140-1240-AR258	AR @ 258 nm, R<0.4%	3130

Large UV FS Lens Kit

Code	Type	Dia, mm	F, mm
110-1203E	pl/cx	25.4	30
110-1205E	pl/cx	25.4	50
110-1209E	pl/cx	25.4	75
110-1210E	pl/cx	25.4	80
110-1211E	pl/cx	25.4	100
110-1216E	pl/cx	25.4	125
110-1217E	pl/cx	25.4	150
110-1219E	pl/cx	25.4	200
110-1221E	pl/cx	25.4	250
110-1223E	pl/cx	25.4	300
110-1225E	pl/cx	25.4	350
110-1227E	pl/cx	25.4	400
110-1233E	pl/cx	25.4	500
110-1235E	pl/cx	25.4	600
110-1239E	pl/cx	25.4	750
110-1245E	pl/cx	25.4	1000
111-1204E	bi/cx	25.4	25
111-1207E	bi/cx	25.4	40
111-1210E	bi/cx	25.4	50
111-1214E	bi/cx	25.4	75

Code	Type	Dia, mm	F, mm
111-1218E	bi/cx	25.4	100
111-1222E	bi/cx	25.4	150
111-1226E	bi/cx	25.4	200
111-1230E	bi/cx	25.4	250
111-1234E	bi/cx	25.4	300
111-1238E	bi/cx	25.4	400
111-1240E	bi/cx	25.4	500
111-1260E	bi/cx	25.4	1000
112-1205E	pl/cv	25.4	-50
112-1209E	pl/cv	25.4	-75
112-1211E	pl/cv	25.4	-100
112-1217E	pl/cv	25.4	-150
112-1219E	pl/cv	25.4	-200
112-1223E	pl/cv	25.4	-300
114-1204E	bi/cv	25.4	-25
114-1208E	bi/cv	25.4	-50
114-1212E	bi/cv	25.4	-75
114-1216E	bi/cv	25.4	-100
114-1220E	bi/cv	25.4	-150
114-1224E	bi/cv	25.4	-200

Small UV FS Lenses Kit (15 pcs.)

Code	Coating	Price, EUR
140-1215-AR210-400	BBAR @ 210–400 nm, R<2%	1830
140-1215-AR350-900	BBAR @ 350–900 nm, R<1.5%	1660
140-1215-AR760-840	BBAR @ 760–840 nm, R<0.4%	1530
140-1215-AR700-900	BBAR @ 700–900 nm, R<0.8%	1610
140-1215-AR650-1100	BBAR @ 650–1100 nm, R<1%	1670
140-1215-AR266	AR @ 266 nm, R<0.4%	1380
140-1215-AR1030	AR @ 1030 nm, R<0.25%	1320
140-1215-AR515	AR @ 515 nm, R<0.25%	1320
140-1215-AR343	AR @ 343 nm, R<0.3%	1350
140-1215-AR258	AR @ 258 nm, R<0.4%	1380

Small UV FS Lens Kit

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

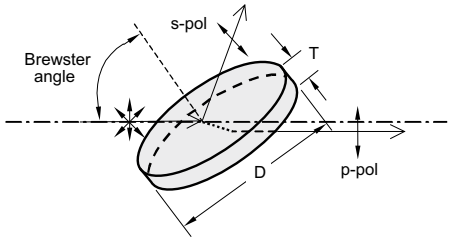
Code	Type	Dia, mm	F, mm
110-1233E	pl/cx	25.4	500
110-1245E	pl/cx	25.4	1000
112-1205E	pl/cv	25.4	-50
112-1209E	pl/cv	25.4	-75
112-1211E	pl/cv	25.4	-100
112-1215E	pl/cv	25.4	-125
112-1217E	pl/cv	25.4	-150

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, 800 nm typical

Thin Film Polarizers with High Extinction Ratio

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

Catalogue number	Diameter D, mm	Thickness T, mm	Wavelength, nm	Price, EUR
420-1242HE	25.4	3	343	218
420-1244HE	25.4	3	515	185
420-1256HE	25.4	3	800	185
420-1248HE	25.4	3	1030	216

Rectangular Polarizers. Material – UV FS. T_p > 98%, T_s < 0.1%. Extinction ratio for transmitted light T_p/T_s: >1000:1

Catalogue number	Rectangular dimensions Length, mm	Width, mm	Thickness T, mm	Wavelength, nm	Price, EUR
420-1478HE	20	15	6	1030	165
420-1578HE	30	20	6	1030	220

High Transmission Thin Film Polarizers

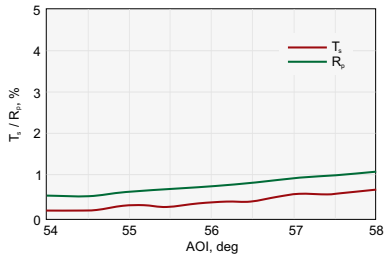
Round Polarizers. Material – UV FS. R_s / T_p > 99.5 / 99.0%. Extinction ratio for transmitted light T_p/T_s >200:1

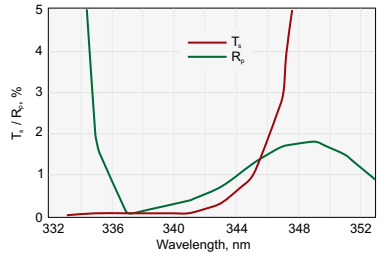
Catalogue number	Diameter D, mm	Thickness T, mm	Wavelength, nm	Price, EUR
420-1242HT	25.4	3.0	343	237
420-1244HT	25.4	3.0	515	200
420-1256HT	25.4	3.0	800	200
420-1248HT	25.4	3.0	1030	234

Ultra High Transmission Thin Film Polarizers

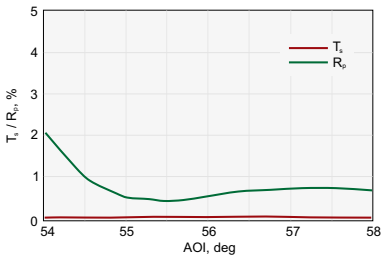
Round Polarizers. Material – UV FS. T_s < 0.2%, R_p < 0.2%. Extinction ratio for transmitted light T_p/T_s >200:1

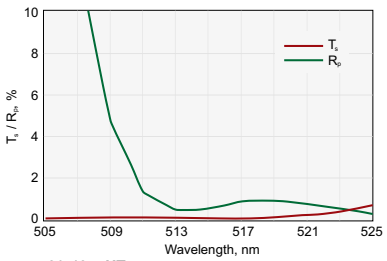
Catalogue number	Diameter D, mm	Thickness T, mm	Wavelength, nm	Price, EUR
420-1256UHT	25.4	3.0	800	260
420-1248UHT	25.4	3.0	1030	304



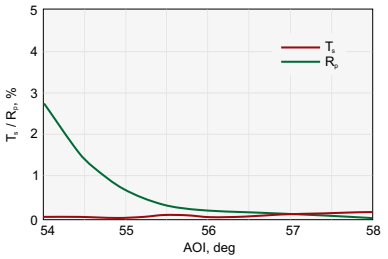


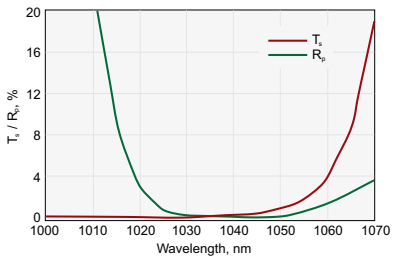
420-1242HT.
High Transmission @ 343 nm, Rs/Tp > 99.5/99.0 %, AOI=56°





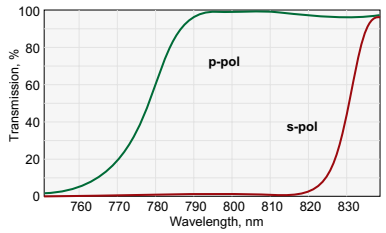
420-1244HT.
High Transmission @ 515 nm, Rs/Tp > 99.5/99.0 %, AOI=56°



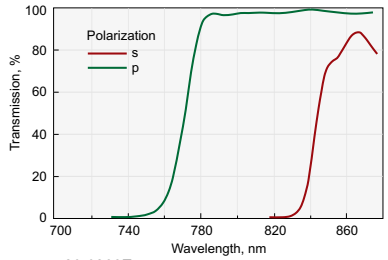


420-1248HT.
High Transmission @ 1030 nm, Rs/Tp > 99.5/99.0 %, AOI=56°

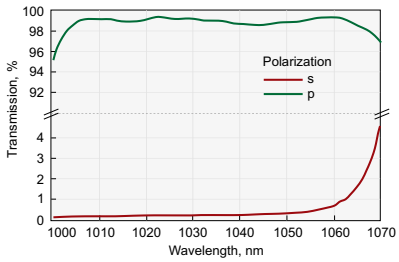
Standard Thin Film Polarizers



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.

RELATED PRODUCTS

Glan Laser Polarizing, Wollaston Prisms
See page 1.61

Adapters for Polarizer at 56° 840-0117, 840-0118
See page 7.43

Variable Attenuators for Linearly Polarized Laser Beam 990-0070
See page 5.25

Round Polarizers. Material – BK7. R_s / T_p > 99.5 / 95.0%.
Extinction ratio for transmitted light T_p/T_s >200:1

Catalogue number	Diameter D, mm	Thickness T, mm	Wavelength, nm	Price, EUR
420-0114E	12.7	3.0	515	108
420-0126E	12.7	3.0	800	108
420-0136E	12.7	3.0	780-820	160
420-0118E	12.7	3.0	1030	115
420-0138E	12.7	3.0	1010-1050	160
420-0244E	25.4	3.0	515	128
420-0256E	25.4	3.0	800	128
420-0266E	25.4	3.0	780-820	189
420-0248E	25.4	3.0	1030	155
420-0268E	25.4	3.0	1010-1050	189
420-0514E	50.8	6.0	515	206
420-0506E	50.8	6.0	800	215
420-0526E	50.8	6.0	780-820	309
420-0518E	50.8	6.0	1030	255
420-0528E	50.8	6.0	1010-1050	335

Rectangular Polarizers. Material – BK7. R_s / T_p > 99.5 / 95.0%.
Extinction ratio for transmitted light T_p/T_s >200:1

Catalogue number	Rectangular dimensions Length, mm	Width, mm	Thickness T, mm	Wavelength, nm	Price, EUR
420-0274	28.6	14.3	3.0	515	142
420-0286	28.6	14.3	3.0	800	142
420-0296	28.6	14.3	3.0	780-820	220
420-0278	28.6	14.3	3.0	1030	170
420-0298	28.6	14.3	3.0	1010-1050	220

Round Polarizers. Material – UV FS. R_s / T_p > 99.5 / 95.0%.
Extinction ratio for transmitted light T_p/T_s >200:1

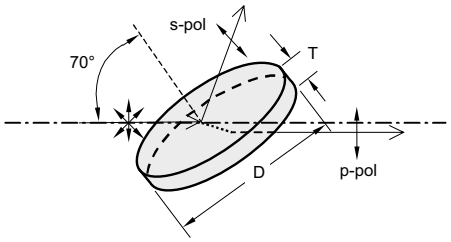
Catalogue number	Diameter D, mm	Thickness T, mm	Wavelength, nm	Price, EUR
420-1112E	12.7	3.0	343	164
420-1123E	12.7	3.0	400	131
420-1114E	12.7	3.0	515	131
420-1126E	12.7	3.0	800	131
420-1136E	12.7	3.0	780-820	196
420-1118E	12.7	3.0	1030	145
420-1138E	12.7	3.0	1010-1050	196
420-1242E	25.4	3.0	343	182
420-1253E	25.4	3.0	400	154
420-1244E	25.4	3.0	515	154
420-1256E	25.4	3.0	800	154
420-1266E	25.4	3.0	780-820	231
420-1248E	25.4	3.0	1030	180
420-1268E	25.4	3.0	1010-1050	231
420-1512E	50.8	6.0	343	325
420-1503E	50.8	6.0	400	295
420-1514E	50.8	6.0	515	295
420-1506E	50.8	6.0	800	305
420-1526E	50.8	6.0	780-820	404
420-1518E	50.8	6.0	1030	315
420-1528E	50.8	6.0	1010-1050	404

Rectangular Polarizers. Material – UV FS. R_s / T_p > 99.5 / 95.0%.
Extinction ratio for transmitted light T_p/T_s >2 00:1

Catalogue number	Rectangular dimensions Length, mm	Width, mm	Thickness T, mm	Wavelength, nm	Price, EUR
420-1272	28.6	14.3	3.0	343	255
420-1283	28.6	14.3	3.0	400	215
420-1274	28.6	14.3	3.0	515	215
420-1286	28.6	14.3	3.0	800	215
420-1296	28.6	14.3	3.0	780-820	315
420-1278	28.6	14.3	3.0	1030	225
420-1298	28.6	14.3	3.0	1010-1050	315

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/cm^2.



SPECIFICATIONS

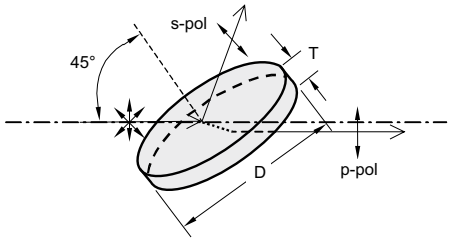
Substrate material	UV FS
Surface quality	20-10 scratch & dig (MIL-PRF-13830B)
Transmitted wavefront distortion	λ/10 @ 633 nm
Clear aperture	>90% of diameter
Angle of incidence (AOI)	70 ± 2°
Parallelism	<30 arcsec

Rectangular Polarizers. Material – UV FS. R_s / T_p > 99.5 / 95.0%.
Extinction ratio for transmitted light T_p/T_s >200:1

Catalogue number	Rectangular dimensions Length, mm	Width, mm	Thickness T, mm	Centre wavelength, nm	Operating wavelength region, nm	Price, EUR
420-1696BBi70	60.0	20.0	4.0	800	750 – 850	435
420-1698BBi70	60.0	20.0	4.0	1030	980 – 1080	435

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/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

TF Polarizers with High Extinction Ratio

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

Catalogue number	Diameter D, mm	Thickness T, mm	Wavelength, nm	Price, EUR
420-1242i45HE	25.4	3	343	328
420-1244i45HE	25.4	3	515	295
420-1248i45HE	25.4	3	1030	315
420-1512i45HE	50.8	6	343	640
420-1514i45HE	50.8	6	515	555
420-1518i45HE	50.8	6	1030	620

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

Catalogue number	Diameter D, mm	Thickness T, mm	Wavelength, nm	Price, EUR
420-1242i45	25.4	3	343	238
420-1244i45	25.4	3	515	200
420-1248i45	25.4	3	1030	225
420-1512i45	50.8	6	343	455
420-1514i45	50.8	6	515	395
420-1518i45	50.8	6	1030	440

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

- **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 no.	Price, EUR	Catalogue no.	Price, EUR
1030	1000-1060	460-4208D12	165	460-4408D12	165
800	760-840	460-4215D12	165	460-4415D12	165
780	740-820	460-4220D12	165	460-4420D12	165
515	500-530	460-4232D12	165	460-4432D12	165
400	380-420	460-4235D12	165	460-4435D12	165
343	333-353	460-4241D12	175	460-4441D12	175
266	257-275	460-4245D12	185	460-4445D12	185
257	250-265	460-4246D12	185	460-4446D12	185

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 no.	Price, EUR	Catalogue no.	Price, EUR
1030	1000-1060	460-4208	245	460-4408	245
800	760-840	460-4215	245	460-4415	245
780	740-820	460-4220	245	460-4420	245
515	500-530	460-4232	245	460-4432	245
400	380-420	460-4235	245	460-4435	245
343	333-353	460-4241	270	460-4441	270
266	257-275	460-4245	280	460-4445	280
257	250-265	460-4246	280	460-4446	280

RELATED PRODUCTS

Achromatic Air-Spaced Waveplates
See page 1.66

Polarizer Holder 840-0180
See page 7.48

High Precision Rotation Polarizer, Waveplate Mount 840-0186
See page 7.49

ZERO ORDER AIR-SPACED WAVEPLATES

- **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

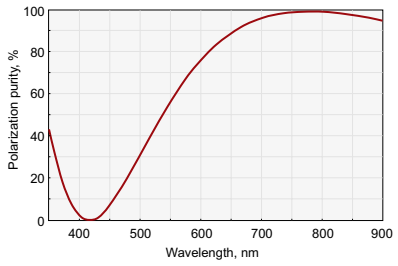
Center wavelength, nm	AR coating range, nm	Retardation λ/2		Retardation λ/4	
		Catalogue no.	Price, EUR	Catalogue no.	Price, EUR
1030	1000-1060	464-4208	310	464-4408	310
800	760-840	464-4215	310	464-4415	310
780	740-820	464-4220	310	464-4420	310
515	500-530	464-4232	310	464-4432	310
400	380-420	464-4235	310	464-4435	310
343	333-353	464-4241	335	464-4441	335
266	257-275	464-4245	345	464-4445	345
257	250-265	464-4246	345	464-4446	345

HOUSING ACCESSORIES

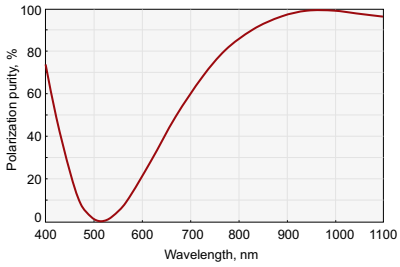
Polarizer Holder
840-0180
See page 7.48

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)
Wavefront distortion	λ/10 @ 633 nm
Parallelism	<10 arcsec
AR coating	R<0.5%

Code	Description	AR coated	Laser Damage Threshold	Application	Price, EUR
465-4211	optically contacted λ/2@800 nm + λ@400 nm	800+400 nm	>10 mJ/cm², 50 fsec pulse, 800 nm typical	Ti: Sapphire	345
466-4211	air-spaced λ/2@800 nm + λ@400 nm	800+400 nm	100 mJ/cm², 50 fsec pulse, 800 nm typical	Ti: Sapphire	410
465-4212	optically contacted λ/2@1030 nm + λ@515 nm	1030+515 nm	>10 mJ/cm², 50 fsec pulse, 1030 nm typical	Yb: KGW/KYW	345
466-4212	air-spaced λ/2@1030 nm + λ@515 nm	1030+515 nm	100 mJ/cm², 50 fsec pulse, 1030 nm typical	Yb: KGW/KYW	410

HOUSING ACCESSORIES

Polarizer Holder
840-0180
See page 7.48

LOW ORDER WAVEPLATES

- **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 no.	Price, EUR	Catalogue no.	Price, EUR
1030	461-4208D12	105	461-4408D12	105
800	461-4215D12	105	461-4415D12	105
780	461-4220D12	105	461-4420D12	105
515	461-4232D12	105	461-4432D12	105

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

Wavelength, nm	Retardation λ/2		Retardation λ/4	
	Catalogue no.	Price, EUR	Catalogue no.	Price, EUR
1030	461-4208	160	461-4408	160
800	461-4215	160	461-4415	160
780	461-4220	160	461-4420	160
515	461-4232	160	461-4432	160
400	461-4235	160	461-4435	160
343	461-4241	192	461-4441	192

RELATED PRODUCTS

Low Order Plates of other wavelengths
See page 1.67

High Precision Rotation Polarizer, Waveplate Mount 840-0186
See page 7.49

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	Price, EUR
λ @ 800 nm + λ/2 @ 400 nm	463-4121	215
λ @ 800 nm + λ/4 @ 400 nm	463-4141	215
λ/2 @ 800 nm + λ @ 400 nm	463-4211	215
λ/2 @ 800 nm + λ/2 @ 400 nm	463-4221	215
λ/2 @ 800 nm + λ/4 @ 400 nm	463-4241	215
λ/4 @ 800 nm + λ @ 400 nm	463-4411	215
λ/4 @ 800 nm + λ/2 @ 400 nm	463-4421	215
λ/4 @ 800 nm + λ/4 @ 400 nm	463-4441	215

RELATED PRODUCTS

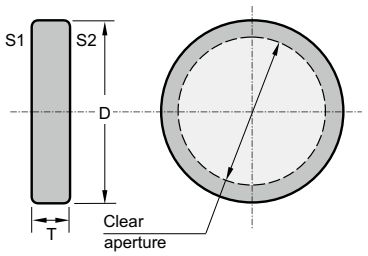
Dual Wavelength Plates of other wavelengths
See page 1.69

High Precision Rotation Polarizer, Waveplate Mount 840-0186
See page 7.49

POLARIZATION PLANE ROTATORS

- **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.



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

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

Catalogue number	Center wavelength, nm	Rotation angle of polarization plane, deg	AR coating range, nm	Price, EUR
470-4904	1030	45	1000-1060	215
470-4909	1030	90	1000-1060	215
470-4804	800	45	760-840	195
470-4809	800	90	760-840	195
470-4784	780	45	740-820	195
470-4789	780	90	740-820	195
470-4514	515	45	500-530	195
470-4519	515	90	500-530	195
470-4044	400	45	380-420	195
470-4049	400	90	380-420	195
470-4344	343	45	333-353	195
470-4349	343	90	333-353	195
470-4264	266	45	257-275	245
470-4269	266	90	257-275	245
470-4254	257	45	250-265	245
470-4259	257	90	250-265	245

RELATED PRODUCTS

Polarization plane rotators of other wavelengths
See page 1.70

Kinematic Mirror and Beamsplitter Mount 840-0020
See page 7.33

Kinematic Positioning Mount 840-0193
See page 7.51

GROUP VELOCITY DELAY COMPENSATION PLATES

Compensation plates are made of calcite. Plates are available with different orientation for different Group Velocity Delay compensation – starting from tens of femtosecond up to tens of picosecond delay compensation.

Standard GVD compensation plates are adjusted for required compensation by angular tuning changing the angle of incidence. Suggested AOI is -5 to +5 deg, however they also can operate at larger AOI.

Standard plates are made of 16×14 mm aperture, clear aperture Ø12 mm and mounted in to 1" ring holder. The optical axis is at special orientation – non parallel to faces of plate.

AR coatings for custom wavelengths are also available.

Standard GVP compensation plates have clear aperture Ø12 mm. However, on special requests clear apertures up to 20 mm diameter can be produced.

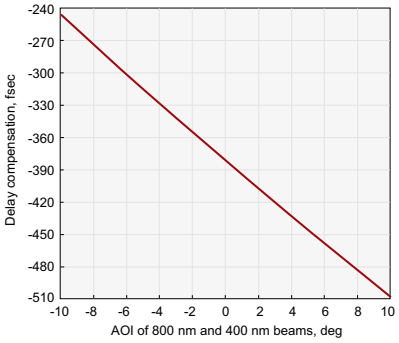
SPECIFICATIONS

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

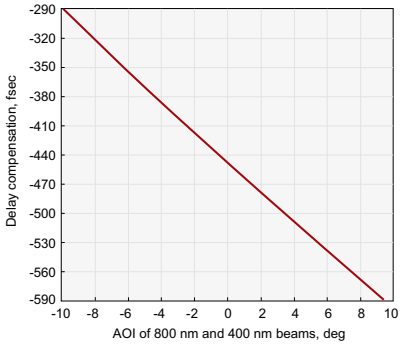
Standard Calcite plates for delay compensation between 800 nm ("o" polarization) and 400 nm ("e" polarization) pulses

Code	Delay compensation range*	Coatings	Price, EUR
225-2113	310 – 450 fsec	BBAR @ 800+400 nm	470
225-2114	370 – 520 fsec	BBAR @ 800+400 nm	470
225-2111	410 – 580 fsec	BBAR @ 800+400 nm	470
225-2115	440 – 630 fsec	BBAR @ 800+400 nm	470

**GVD compensation range at Angle Of Incidence from -5° to +5°.*



225-2113.



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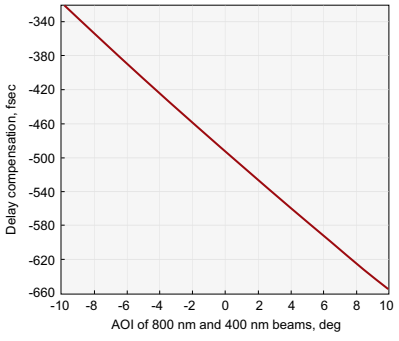

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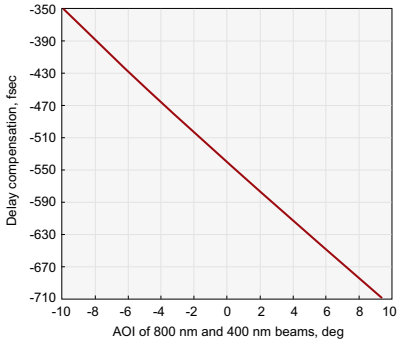


225-2115.

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).

RELATED PRODUCTS

Thin BBO Crystals for SHG and THG of Ti:Sapphire laser wavelengths

See pages 5.31

Femtokits for THG of Femtosecond Ti:Sapphire Lasers

See page 5.34

Positioning Mount 840-0199 for Nonlinear Crystal Housing

See page 2.26

CRYSTAL WINDOWS FOR WHITE LIGHT (CONTINUUM) GENERATION

new

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

Catalogue number	Material	Diameter, mm	Thickness, mm	Transmitted wavefront distortion	Price, EUR
555-7121	YAG	12.7	1.0	λ/4	185
555-7122	YAG	12.7	2.0	λ/4	185
555-7123	YAG	12.7	3.0	λ/10	195
555-7124	YAG	12.7	4.0	λ/10	195
555-7126	YAG	12.7	6.0	λ/10	215
555-7128	YAG	12.7	8.0	λ/10	230
555-7251	YAG	25.4	1.0	λ/4	225
555-7252	YAG	25.4	2.0	λ/4	225
555-7253	YAG	25.4	3.0	λ/10	245
555-7254	YAG	25.4	4.0	λ/10	245

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

Catalogue number	Material	Diameter, mm	Thickness, mm	Transmitted wavefront distortion	Price, EUR
550-7120	Sapphire	12.7	0.5	1 λ	26
550-7121	Sapphire	12.7	1.0	1 λ	25
550-7122	Sapphire	12.7	2.0	1 λ	25
550-7123	Sapphire	12.7	3.0	1 λ	25
550-7124	Sapphire	12.7	4.0	1 λ	27
550-7125	Sapphire	12.7	5.0	1 λ	29
550-7126	Sapphire	12.7	6.0	1 λ	30
550-7128	Sapphire	12.7	8.0	1 λ	50
550-7200	Sapphire	20.0	0.5	1 λ	35
550-7201	Sapphire	20.0	1.0	1 λ	35
550-7215	Sapphire	20.0	1.5	1 λ	35
550-7202	Sapphire	20.0	2.0	1 λ	35
550-7250	Sapphire	25.4	0.5	1 λ	45
550-7251	Sapphire	25.4	1.0	1 λ	45
550-7252	Sapphire	25.4	2.0	1 λ	45
550-7253	Sapphire	25.4	3.0	1 λ	45
550-7254	Sapphire	25.4	4.0	1 λ	45
550-7255	Sapphire	25.4	5.0	1 λ	50
550-7256	Sapphire	25.4	6.0	1 λ	70
550-7258	Sapphire	25.4	8.0	1 λ	80

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 - λ/10 @ 633 nm
Parallelism	<1 arcmin
Coating	uncoated

Standard CaF_2 windows

Catalogue number	Material	Diameter, mm	Thickness, mm	Transmitted wavefront distortion	Price, EUR
531-5123	CaF_2	12.7	3.0	λ/6	120
531-5124	CaF_2	12.7	4.0	λ/8	140
531-5251	CaF_2	25.4	1.0	λ/4	160
531-5252	CaF_2	25.4	2.0	λ/4	160
531-5253	CaF_2	25.4	3.0	λ/4	160
531-5254	CaF_2	25.4	4.0	λ/10	180
531-5255	CaF_2	25.4	5.0	λ/10	180

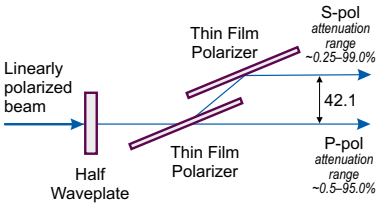
VARIABLE ATTENUATOR FOR FEMTOSECOND LINEARLY POLARIZED LASER BEAM 990-0070

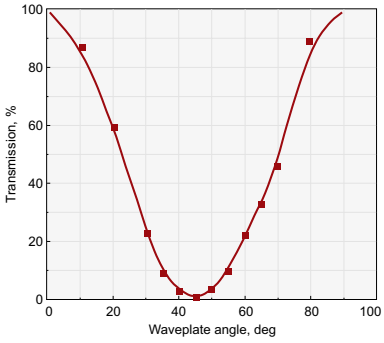
*Note: Movable base **820-0090**, Rod Holder **820-0050-02** and standard rod should be ordered seperately.*

- **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**

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

Catalogue number	Wavelength, nm	Price, EUR
990-0070-257	257	945
990-0070-266	266	945
990-0070-343	343	840
990-0070-400	400	740
990-0070-400B	390-410	890
990-0070-515	515	740
990-0070-515B	505-525	890
990-0070-800	800	740
990-0070-800B	780-820	890
990-0070-1030	1030	740
990-0070-1030B	1010-1050	890

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

Catalogue number	Wavelength, nm	Price, EUR
990-0070-257H	257	1020
990-0070-266H	266	1020
990-0070-343H	343	915
990-0070-400H	400	815
990-0070-400HB	390-410	965
990-0070-515H	515	815
990-0070-515HB	505-525	965
990-0070-800H	800	815
990-0070-800HB	780-820	965
990-0070-1030H	1030	815
990-0070-1030HB	1010-1050	965

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 5.19

Femtoline Thin Film Laser Polarizers
See page 5.16

Neutral Density Filters
See page 1.14

Motorized Variable Attenuator for Linearly Polarized Laser Beam 990-0070M
See page 6.14

Beam dumps 990-0800, 990-0820
See page 6.21

BROADBAND VARIABLE ATTENUATOR FOR FEMTOSECOND LASER PULSES 990-0070HBBi70

990-0070-800HBBi70

990-0070-800HBBi70M

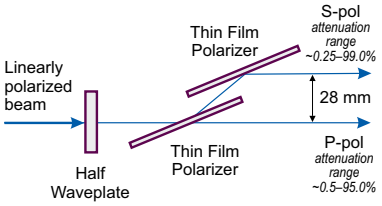
- **Divides laser beam into two parallel beams of manually adjustable intensity ratio**
- **Large dynamic range**
- **Transmitted beam shift ~ 2.6 mm**
- **High optical damage threshold**

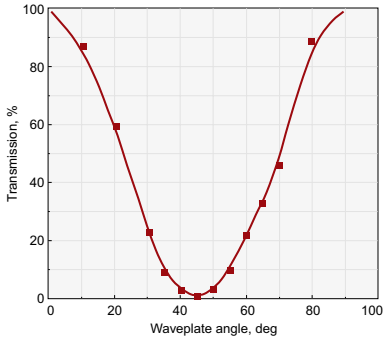
This variable attenuator/beamsplitter consists of a special design opto-mechanical adapter and a precision opto-mechanical holder 840-0197. Two thin film polarizers, operating at AOI=70° and reflecting s-polarized light while transmitting p-polarized light, are housed into the adapter. A quartz zero 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

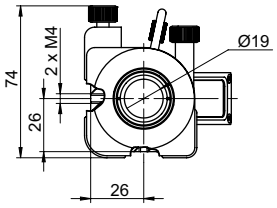
Aperture diameter	12 mm
Operating bandwidth	100 nm
Damage treshold	50 mJ/cm^2 pulsed at 800 nm, 50 fsec, 50 Hz
Polarization contrast (after 1st polarizer)	>1:200
Polarization contrast (after 2nd polarizer)	>1:500

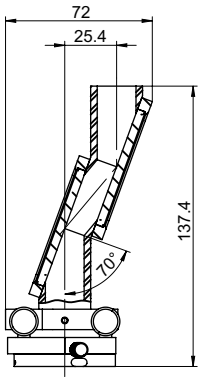
Manual attenuators

Catalogue number	Wavelength, nm	Price, EUR
990-0070-800HBBi70	750-850	1270
990-0070-1030HBBi70	980-1080	1270

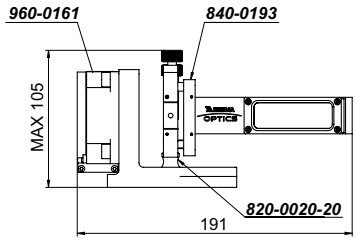
Motorized attenuators

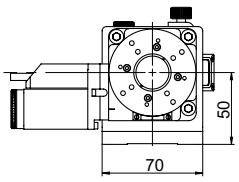
Catalogue number	Wavelength, nm	Price, EUR
990-0070-800HBBi70M	750-850	2050
990-0070-1030HBBi70M	980-1080	2050



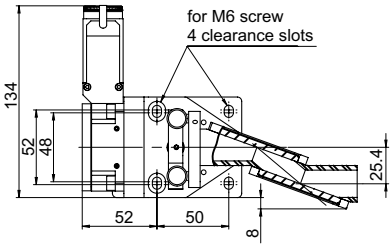


990-0070-800HBBi70





990-0070-800HBBi70M



RELATED PRODUCTS

Neutral Density Filters
See page 1.14

Femtoline Zero Order Optically Contacted / Air-Spaced Plates
See page 5.19

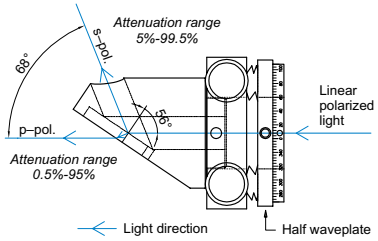
Femtoline Thin Film Laser Polarizers
See page 5.16

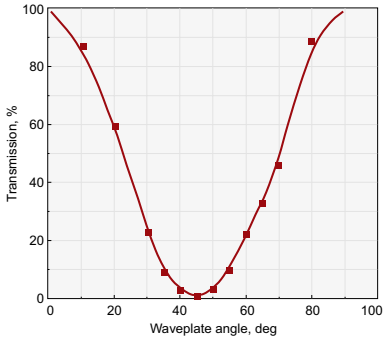
VARIABLE ATTENUATOR FOR FEMTOSECOND LINEARLY POLARIZED LASER BEAM 990-0071

*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.





- **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**

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

Catalogue number	Wavelength, nm	Price, EUR
990-0071-257	257	625
990-0071-266	266	625
990-0071-343	343	600
990-0071-400	400	550
990-0071-400B	390-410	650
990-0071-515	515	550
990-0071-515B	505-525	650
990-0071-800	800	550
990-0071-800B	780-820	650
990-0071-1030	1030	550
990-0071-1030B	1010-1050	650

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

Catalogue number	Wavelength, nm	Price, EUR
990-0071-257H	257	690
990-0071-266H	266	690
990-0071-343H	343	665
990-0071-400H	400	615
990-0071-400HB	390-410	715
990-0071-515H	515	615
990-0071-515HB	505-525	715
990-0071-800H	800	615
990-0071-800HB	780-820	715
990-0071-1030H	1030	615
990-0071-1030HB	1010-1050	715

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 1.14

Femtoline Zero Order Optically Contacted / Air-Spaced Plates
See page 5.19

Femtoline Thin Film Laser Polarizers
See page 5.16

Motorized Variable Attenuator for Linearly Polarized Laser Beam 990-0071M
See page 6.17

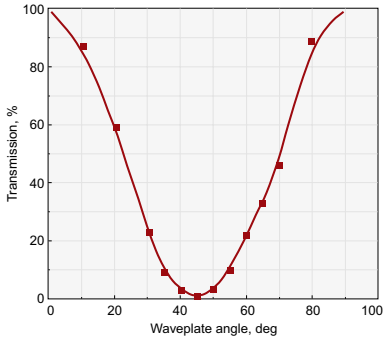
VARIABLE ATTENUATOR FOR FEMTOSECOND LASER PULSES 990-0072

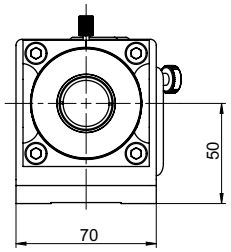
- **Divides laser beam into two beams of manually adjustable intensity ratio separated by 68° angle**
- **Large dynamic range**
- **Trasmitted beam shift ~1 mm**
- **High optical damage threshold**
- **Motorized version 990-0072M available online**

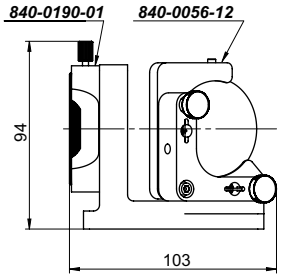
This variable attenuator/beamsplitter consists of Polarizer Holder 840-0190-01 and Kinematic Mirror/Beamsplitter Mount 840-0056-12. UVFS Thin Film Brewster type polarizer diameter 50.8 mm, which reflect s-polarized light while transmitting p-polarized light, is housed into Beamsplitter Mount 840-0056-12. 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.

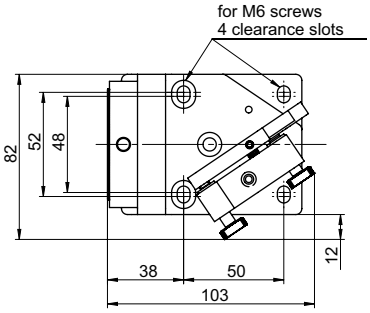
The intensity ratio of those two separted and different polarized beams may be continuously varied without alteration of other beam parameters by rotating the waveplate. The intensity of either exit beam, or their intensity ratio, can be controlled over a wide dynamic range. P-polarization could be selected 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

Catalogue number	Wavelength, nm	Price, EUR
990-0072-266	266	950
990-0072-343	343	895
990-0072-400	400	865
990-0072-515	515	865
990-0072-800	800	880
990-0072-800B	780-820	980
990-0072-1030	1030	890
990-0072-1030B	1010-1050	980

A quartz Zero Order (optically contacted) Half Waveplate Ø25.4 mm is housed in rotating holder 840-0190-01.

For High Power Laser Applications

Catalogue number	Wavelength, nm	Price, EUR
990-0072-266H	266	1085
990-0072-343H	343	1030
990-0072-400H	400	1000
990-0072-515H	515	1000
990-0072-800H	800	1015
990-0072-800HB	780-820	1115
990-0072-1030H	1030	1025
990-0072-1030HB	1010-1050	1115

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 1.14

Femtoline Thin Film Laser Polarizers
See page 5.16

Femtoline Zero Order Optically Contacted / Air-Spaced Plates
See page 5.19

Motorized Variable Attenuator for Linearly Polarized Laser Beam 990-0072M
For more information visit www.eksmaoptics.com

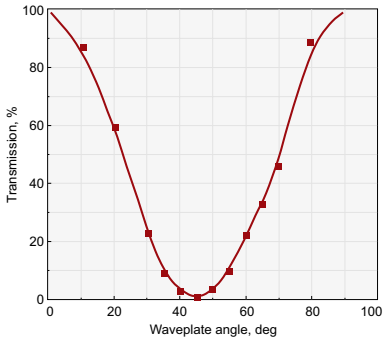
VARIABLE ATTENUATOR FOR FEMTOSECOND LASER PULSES 990-0073

- **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.

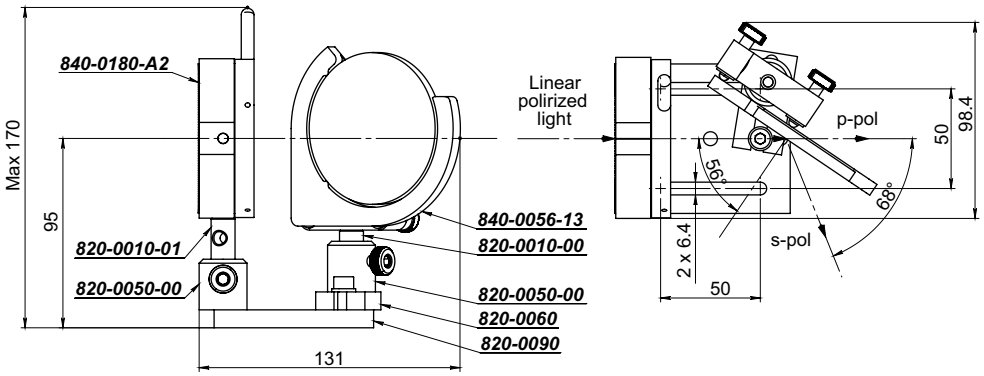
The intensity ratio of those two separated and different polarized beams may be continuously varied without alteration of other beam parameters by rotating the waveplate. The intensity of either exit beam, or their intensity ratio, can be controlled over a wide dynamic range. P-polarization could be 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



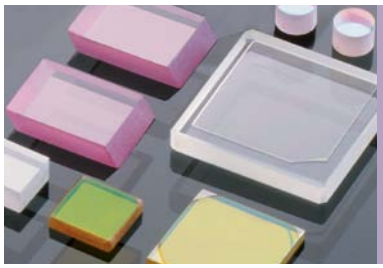
Catalogue number	Wavelength, nm	Price, EUR
990-0073-266	266	1690
990-0073-343	343	1560
990-0073-400	400	1540
990-0073-515	515	1540
990-0073-800	800	1560
990-0073-800B	780-820	1790
990-0073-1030	1030	1615
990-0073-1030B	1010-1050	1850

A quartz Zero Order (optically contacted) Half Waveplate Ø40 mm is housed in rotating holder 840-0180-A2.

For High Power Laser Applications

Catalogue number	Wavelength, nm	Price, EUR
990-0073-266H	266	1790
990-0073-343H	343	1660
990-0073-400H	400	1640
990-0073-515H	515	1640
990-0073-800H	800	1660
990-0073-800HB	780-820	1890
990-0073-1030H	1030	1715
990-0073-1030HB	1010-1050	1950

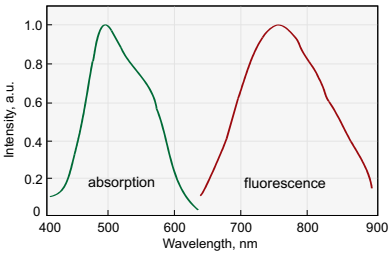
A quartz Zero Order Air-Spaced Half Waveplate Ø40 mm is housed in rotating holder 840-0180-A2.



FemtoLine Laser Crystals

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

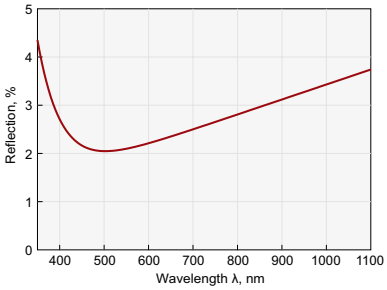
BBO crystals less than 100 µm thickness can be supplied optically contacted on UV Fused Silica substrate sizes 10×10×1 mm or 12×12×2 mm. Other sizes of substrates are also available on request. Minimum aperture of optically contacted BBO is 5×5 mm, maximum aperture is 10×10 mm. The tolerance of crystal 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.

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



Typical P-coating for BBO SHG@800 nm application

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*

Code	Aperture, mm	UV FS support size, mm	θ, deg	φ, deg	Coating	Price, EUR
BBO-600H	6×6	10×10×2	29.2	90	P/P@400-800 nm	948
BBO-800H	8×8	10×10×2	29.2	90	P/P@400-800 nm	990
BBO-1000H	10×10	12×12×2	29.2	90	P/P@400-800 nm	1110

** 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

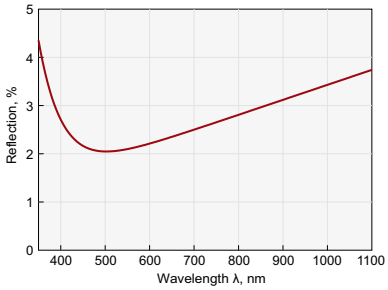
Code	Aperture, mm	θ, deg	φ, deg	Coating	Price, EUR
BBO-601H	6×6	29.2	90	P/P@400-800 nm	505
BBO-801H	8×8	29.2	90	P/P@400-800 nm	710
BBO-1001H	10×10	29.2	90	P/P@400-800 nm	800
BBO-1201H	12×12	29.2	90	P/P@400-800 nm	1295
BBO-1501H	15×15	29.2	90	P/P@400-800 nm	2040
BBO-2001H	20×20	29.2	90	P/P@400-800 nm	3785
BBO-2201H	22×22	29.2	90	P/P@400-800 nm	5155

SHG BBO crystal, Thickness = 0.2 mm

Code	Aperture, mm	θ, deg	φ, deg	Coating	Price, EUR
BBO-602H	6×6	29.2	90	P/P@400-800 nm	505
BBO-802H	8×8	29.2	90	P/P@400-800 nm	710
BBO-1002H	10×10	29.2	90	P/P@400-800 nm	790
BBO-1202H	12×12	29.2	90	P/P@400-800 nm	1285
BBO-1502H	15×15	29.2	90	P/P@400-800 nm	2020
BBO-2002H	20×20	29.2	90	P/P@400-800 nm	3725
BBO-2202H	22×22	29.2	90	P/P@400-800 nm	5150

SHG BBO crystal, Thickness = 0.5 mm

Code	Aperture, mm	θ, deg	φ, deg	Coating	Price, EUR
BBO-603H	6×6	29.2	90	P/P@400-800 nm	440
BBO-803H	8×8	29.2	90	P/P@400-800 nm	665
BBO-1003H	10×10	29.2	90	P/P@400-800 nm	760
BBO-1203H	12×12	29.2	90	P/P@400-800 nm	1265
BBO-1503H	15×15	29.2	90	P/P@400-800 nm	1980
BBO-2003H	20×20	29.2	90	P/P@400-800 nm	3720
BBO-2203H	22×22	29.2	90	P/P@400-800 nm	5150



P-protective coating curve of Type 1 (θ=29.2°, φ=90°) BBO crystal used for SHG@800 nm

SHG BBO crystal, Thickness = 1 mm

Code	Aperture, mm	θ, deg	φ, deg	Coating	Price, EUR
BBO-604H	6×6	29.2	90	P/P@400-800 nm	390
BBO-804H	8×8	29.2	90	P/P@400-800 nm	615
BBO-1004H	10×10	29.2	90	P/P@400-800 nm	765
BBO-1204H	12×12	29.2	90	P/P@400-800 nm	1150
BBO-1504H	15×15	29.2	90	P/P@400-800 nm	1860
BBO-2004H	20×20	29.2	90	P/P@400-800 nm	3575
BBO-2204H	22×22	29.2	90	P/P@400-800 nm	4580

SHG BBO crystal, Thickness = 2 mm

Code	Aperture, mm	θ, deg	φ, deg	Coating	Price, EUR
BBO-605H	6×6	29.2	90	P/P@400-800 nm	360
BBO-805H	8×8	29.2	90	P/P@400-800 nm	620
BBO-1005H	10×10	29.2	90	P/P@400-800 nm	830
BBO-1205H	12×12	29.2	90	P/P@400-800 nm	1200
BBO-1505H	15×15	29.2	90	P/P@400-800 nm	1910
BBO-2005H	20×20	29.2	90	P/P@400-800 nm	3625
BBO-2205H	22×22	29.2	90	P/P@400-800 nm	4630

HOUSING ACCESSORIES

Ring Holders for Nonlinear Crystals

See page 2.25

Positioning Mount 840-0199 for Nonlinear Crystal Housing

See page 2.26

BBO for THG @ 800 nm

BBO crystal, Thickness = 0.01 mm, optically contacted

Code	Aperture, mm	UV FS support size, mm	θ, deg	φ, deg	Coating	Price, EUR
BBO-606H	6×6	10×10×2	44.3	90	P/P@400-800/266	1020
BBO-806H	8×8	10×10×2	44.3	90	P/P@400-800/266	1060
BBO-1006H	10×10	12×12×2	44.3	90	P/P@400-800/266	1175

BBO crystal, Thickness = 0.02 mm, optically contacted

Code	Aperture, mm	UV FS support size, mm	θ, deg	φ, deg	Coating	Price, EUR
BBO-607H	6×6	10×10×2	44.3	90	P/P@400-800/266	1020
BBO-807H	8×8	10×10×2	44.3	90	P/P@400-800/266	1060
BBO-1007H	10×10	12×12×2	44.3	90	P/P@400-800/266	1175

BBO crystal, Thickness = 0.05 mm, optically contacted

Code	Aperture, mm	UV FS support size, mm	θ, deg	φ, deg	Coating	Price, EUR
BBO-608H	6×6	10×10×2	44.3	90	P/P@400-800/266	948
BBO-808H	8×8	10×10×2	44.3	90	P/P@400-800/266	990
BBO-1008H	10×10	12×12×2	44.3	90	P/P@400-800/266	1110

THG BBO crystal, Thickness = 0.1 mm

Code	Aperture, mm	θ, deg	φ, deg	Coating	Price, EUR
BBO-609H	6×6	44.3	90	P/P@400-800/266	505
BBO-809H	8×8	44.3	90	P/P@400-800/266	710
BBO-1009H	10×10	44.3	90	P/P@400-800/266	800
BBO-1209H	12×12	44.3	90	P/P@400-800/266	1330
BBO-1509H	15×15	44.3	90	P/P@400-800/266	2140
BBO-2009H	20×20	44.3	90	P/P@400-800/266	3925
BBO-2209H	22×22	44.3	90	P/P@400-800/266	5355

THG BBO crystal, Thickness = 0.2 mm

Code	Aperture, mm	θ, deg	φ, deg	Coating	Price, EUR
BBO-610H	6×6	44.3	90	P/P@400-800/266	505
BBO-810H	8×8	44.3	90	P/P@400-800/266	710
BBO-1010H	10×10	44.3	90	P/P@400-800/266	790
BBO-1210H	12×12	44.3	90	P/P@400-800/266	1285
BBO-1510H	15×15	44.3	90	P/P@400-800/266	2020
BBO-2010H	20×20	44.3	90	P/P@400-800/266	3915
BBO-2210H	22×22	44.3	90	P/P@400-800/266	5310

THG BBO crystal, Thickness = 0.5 mm

Code	Aperture, mm	θ, deg	φ, deg	Coating	Price, EUR
BBO-611H	6×6	44.3	90	P/P@400-800/266	440
BBO-811H	8×8	44.3	90	P/P@400-800/266	665
BBO-1011H	10×10	44.3	90	P/P@400-800/266	760
BBO-1211H	12×12	44.3	90	P/P@400-800/266	1265
BBO-1511H	15×15	44.3	90	P/P@400-800/266	1980
BBO-2011H	20×20	44.3	90	P/P@400-800/266	3900
BBO-2211H	22×22	44.3	90	P/P@400-800/266	5300

THG BBO crystal, Thickness = 1 mm

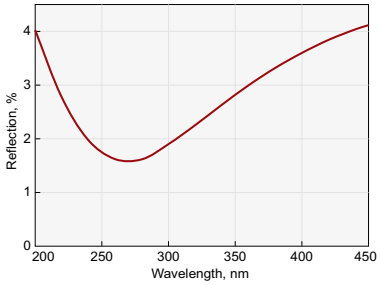
Code	Aperture, mm	θ, deg	φ, deg	Coating	Price, EUR
BBO-612H	6×6	44.3	90	P/P@400-800/266	390
BBO-812H	8×8	44.3	90	P/P@400-800/266	625
BBO-1012H	10×10	44.3	90	P/P@400-800/266	785
BBO-1212H	12×12	44.3	90	P/P@400-800/266	1210
BBO-1512H	15×15	44.3	90	P/P@400-800/266	1920
BBO-2012H	20×20	44.3	90	P/P@400-800/266	3860
BBO-2212H	22×22	44.3	90	P/P@400-800/266	4960

RELATED PRODUCTS

Zero Order Dual Wavelength Plates
See page 5.20

Ring Holders for Nonlinear Crystals
See page 2.25

Positioning Mount 840-0199 for Nonlinear Crystal Housing
See page 2.26



P-protective coating curve of Type 1 (θ=44.3°, φ=90°) BBO crystal's exit face used for THG@800 nm

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.

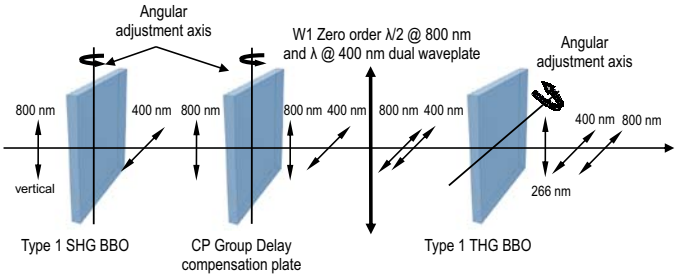
Basic Femtokit FK Series

Mounted Femtokit FK Series

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.

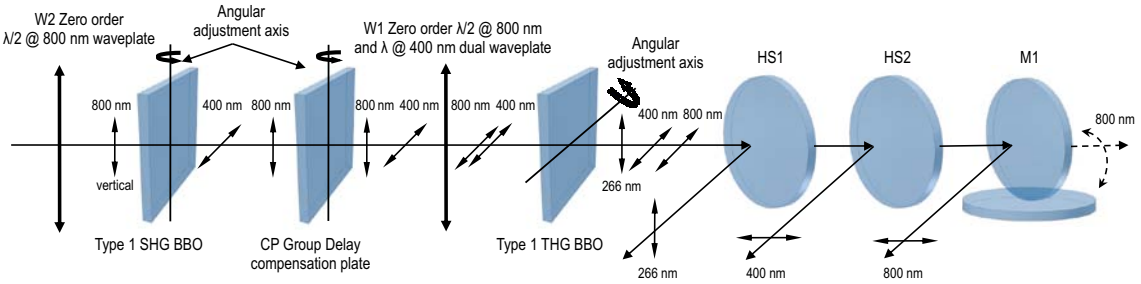
The thickness of SHG BBO crystal, THG BBO crystal and group delay compensation plate is different in each kit and is optimal for certain pulse duration of fundamental harmonic to avoid harmonic pulses broadening.



Fundamental pulse duration	Basic FemtoKit FK Series		Basic Mounted FemtoKit FK Series	
	Code	Price, EUR	Code	Price, EUR
150 – 250 fsec	FK-800-200	1710	FK-800-200-M	2658
120 – 150 fsec	FK-800-130	1760	FK-800-130-M	2708
70 – 120 fsec	FK-800-100	1760	FK-800-100-M	2708
30 – 70 fsec	FK-800-050	2268	FK-800-050-M	3216
15 – 30 fsec	FK-800-020	2340	FK-800-020-M	3288

Non-standard kits with larger apertures of BBO crystals and thicknesses optimal for other pulse durations are available on request.

Extended FemtoKit FKE Series



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.

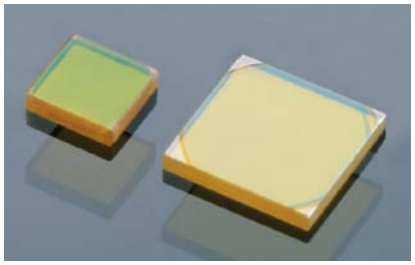
Fundamental pulse duration	Extended FemtoKit FKE Series		Extended Mounted FemtoKit FKE Series	
	Code	Price, EUR	Code	Price, EUR
150 – 250 fsec	FKE-800-200	2402	FKE-800-200-M	4122
120 – 150 fsec	FKE-800-130	2452	FKE-800-130-M	4172
70 – 120 fsec	FKE-800-100	2452	FKE-800-100-M	4172
30 – 70 fsec	FKE-800-050	2960	FKE-800-050-M	4680
15 – 30 fsec	FKE-800-020	3032	FKE-800-020-M	4752

Non-standard kits with larger apertures of BBO crystals and thicknesses optimal for other pulse durations are available on request.

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 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 Coatings for $AgGaS_2$ crystals

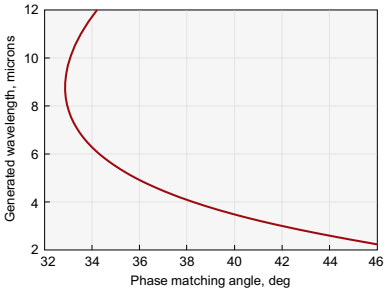
BBAR coating – is multilayer dialectric antireflection coating made at specified wavelength range. Standard coating is designed to reduce reflection losses at input side at 1.1-2.6 micron range and output side at 2.6-11 micron range

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.

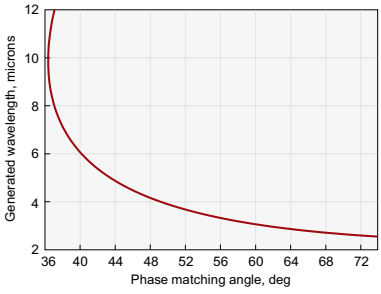
BBAR coating is designed to minimise dispersion of ultrashort pulses and also features high damage threshold.

$AgGaS_2$	Size, mm			Orientation		Coating	Application	Price, EUR
	W	H	L	θ	φ			
AGS-401H	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	835
AGS-402H	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	1345
AGS-403H	5	5	0.4	34	45	BBAR/BBAR @ 3-6 / 1.5-3 μm	SHG @ 3-6 μm, Type 1	995
AGS-404H	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	995
AGS-801H	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	2340
AGS-802H	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	2140

Crystals are mounted into open ring holders (see page 2.25).



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 2.25

Positioning Mount 840-0199 for Nonlinear Crystal Housing

See page 2.26

Yb:KGW AND Yb:KYW CRYSTALS LASER LINES AND HARMONICS

- **High absorption coefficient at 981 nm**
- **High stimulated emission cross section**
- **Low laser threshold**
- **Extremely low quantum defect λ_{pump} / λ_{se}**
- **Broad polarized output at 1023–1060 nm**
- **High slope efficiency with diode pumping (~ 60%)**
- **High Yb doping concentration**

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.

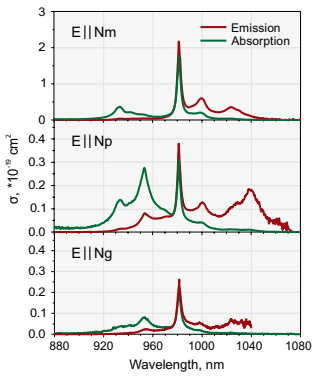
We believe that Yb:KGW and Yb:KYW are some of the best materials for high power thin disk lasers generating femtosecond pulses.

CUSTOM MANUFACTURING CAPABILITIES

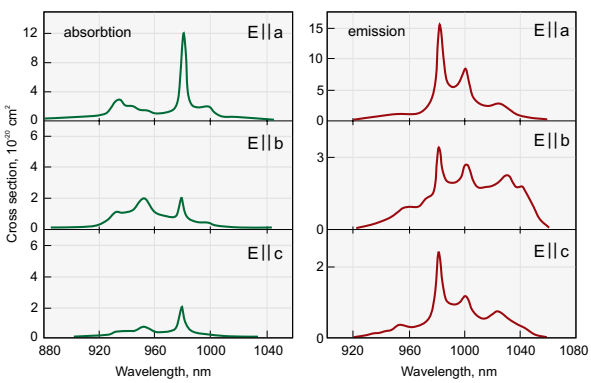
- Various shapes (slabs, rods, cubes, disks)
- Different dopant levels
- Diversified coatings
- Attractive prices for introductory quantities to OEMs

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

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BBO AND LBO CRYSTALS FOR Yb:KGW/KYW FREQUENCY CONVERSION

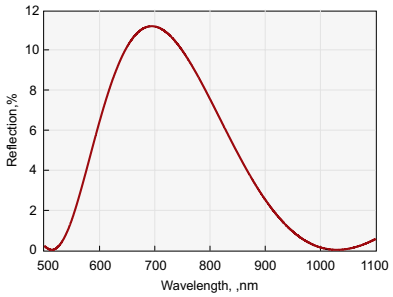
EKSMA OPTICS recommends the following thickness BBO and LBO crystals for Yb:KGW/KYW frequency conversion depending on fundamental wavelength pulse duration, assuming it is spectrum limited Gausian pulse.

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	0.5 mm
100 fs	1 mm
150 fs	1.5 mm
200 fs	2 mm



Typical AR@1030+515 nm coating for LBO or BBO SHG@1030 nm application

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

Code	Aperture, mm	θ, deg	φ, deg	Coating	Price, EUR
LBO-601H	6×6	90	13.8	AR/AR@515+1030 nm	515
LBO-801H	8×8	90	13.8	AR/AR@515+1030 nm	620
LBO-1001H	10×10	90	13.8	AR/AR@515+1030 nm	650

SHG LBO crystals, Type 1, Thickness = 1.9 mm

Code	Aperture, mm	θ, deg	φ, deg	Coating	Price, EUR
LBO-602H	6×6	90	13.8	AR/AR@515+1030 nm	460
LBO-802H	8×8	90	13.8	AR/AR@515+1030 nm	610
LBO-1002H	10×10	90	13.8	AR/AR@515+1030 nm	815

SHG LBO crystals, Type 1, Thickness = 2.8 mm

Code	Aperture, mm	θ, deg	φ, deg	Coating	Price, EUR
LBO-603H	6×6	90	13.8	AR/AR@515+1030 nm	545
LBO-803H	8×8	90	13.8	AR/AR@515+1030 nm	790
LBO-1003H	10×10	90	13.8	AR/AR@515+1030 nm	1035

SHG LBO crystals, Type 1, Thickness = 3.7 mm

Code	Aperture, mm	θ, deg	φ, deg	Coating	Price, EUR
LBO-604H	6×6	90	13.8	AR/AR@515+1030 nm	465
LBO-804H	8×8	90	13.8	AR/AR@515+1030 nm	660
LBO-1004H	10×10	90	13.8	AR/AR@515+1030 nm	895

BBO for SHG @ 1030 nm

SHG BBO crystals, Type 1, Thickness = 0.5 mm

Code	Aperture, mm	θ, deg	φ, deg	Coating	Price, EUR
BBO-651H	6×6	23.4	90	AR/AR@515+1030 nm	495
BBO-851H	8×8	23.4	90	AR/AR@515+1030 nm	640
BBO-1051H	10×10	23.4	90	AR/AR@515+1030 nm	760

SHG BBO crystals, Type 1, Thickness = 1 mm

Code	Aperture, mm	θ, deg	φ, deg	Coating	Price, EUR
BBO-652H	6×6	23.4	90	AR/AR@515+1030 nm	430
BBO-852H	8×8	23.4	90	AR/AR@515+1030 nm	560
BBO-1052H	10×10	23.4	90	AR/AR@515+1030 nm	785

SHG BBO crystals, Type 1, Thickness = 1.5 mm

Code	Aperture, mm	θ, deg	φ, deg	Coating	Price, EUR
BBO-653H	6×6	23.4	90	AR/AR@515+1030 nm	475
BBO-853H	8×8	23.4	90	AR/AR@515+1030 nm	600
BBO-1053H	10×10	23.4	90	AR/AR@515+1030 nm	795

SHG BBO crystals, Type 1, Thickness = 2 mm

Code	Aperture, mm	θ, deg	φ, deg	Coating	Price, EUR
BBO-654H	6×6	23.4	90	AR/AR@515+1030 nm	480
BBO-854H	8×8	23.4	90	AR/AR@515+1030 nm	630
BBO-1054H	10×10	23.4	90	AR/AR@515+1030 nm	835

BBO for THG @ 1030 nm

Code	Aperture, mm	Thick-ness, mm	θ, deg	φ, deg	Coating	Price, EUR
BBO-631H	6×6	0.15	32.5	90	AR/AR@ 1030+515/343 nm	725
BBO-632H	6×6	0.25	32.5	90	AR/AR@ 1030+515/343 nm	665
BBO-633H	6×6	0.4	32.5	90	AR/AR@ 1030+515/343 nm	605
BBO-634H	6×6	0.55	32.5	90	AR/AR@ 1030+515/343 nm	540

BBO for 4HG @ 1030 nm

Code	Aperture, mm	Thick-ness, mm	θ, deg	φ, deg	Coating	Price, EUR
BBO-641H	6×6	0.1	50	90	P/P@ 515/257 nm	600
BBO-642H	6×6	0.15	50	90	P/P@ 515/257 nm	570
BBO-643H	6×6	0.2	50	90	P/P@ 515/257 nm	550
BBO-644H	6×6	0.3	50	90	P/P@ 515/257 nm	535

Optical Systems
Selection Guide

F-Theta Lens
page 6.2

Compact Beam Expander
page 6.3

Zoom Beam Expander
page 6.3

Simple Telescope Kit
page 6.4

Gauss-to-Top Hat Beam Shaping Lens
page 6.5

Continuously Variable Attenuator / Beamsplitter ***990-0060***
page 6.12

Variable Attenuators for linearly polarized laser beam ***990-0070***
page 6.13

Motorized Variable Attenuator for linearly polarized laser beam ***990-0070M***
page 6.14

Variable Attenuators for linearly polarized laser beam ***990-0071***
page 6.16

Motorized Variable Attenuator for linearly polarized laser beam ***990-0071M***
page 6.17

Variable Attenuator for femtosecond laser pulses ***990-0072***
page 6.18

Variable Attenuator for femtosecond and Nd:YAG laser pulses ***990-0073***
page 6.19

Precision Spatial Filter ***990-1000***
online

Y-Z Positioner for lens, pinholes and objectives ***990-0100, 990-0200***
online

Y-Z Positioners for lens, pinholes and objectives ***990-0050, 990-0051***
online

Precision Pinholes
online

Microscope Objectives
online

Unmounted Iris Diaphragms
online

Mounted Iris Diaphragms
online

Mounts for iris diaphragms
online

Motorized Iris Diaphragms ***995 Series***
online

Motorized Iris Diaphragms ***996 Series***
online

Motorized Iris Diaphragms ***997 Series***
online

Variable Wheel Attenuator ***990-0604***
online

Closed Variable Wheel Attenuator ***990-0704***
online

Filters Holder with 90° Flip ***990-0400***
page 6.20

Motorized Variable Two Wheels Attenuators ***991-0602***
online

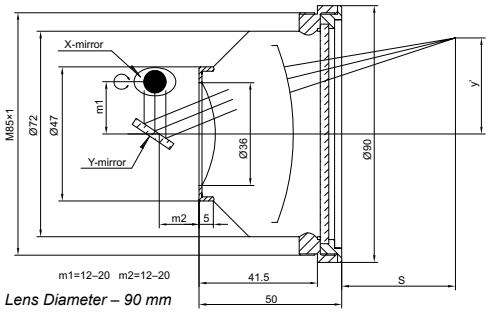
Motorized Closed Variable Two Wheels Attenuators ***991-0702***
online

Air-cooled Beam Dump ***990-0800***
page 6.21

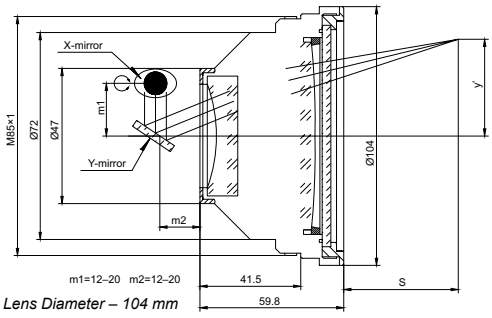
Water-cooled Beam Dump ***990-0820***
page 6.21

F-THETA LENS

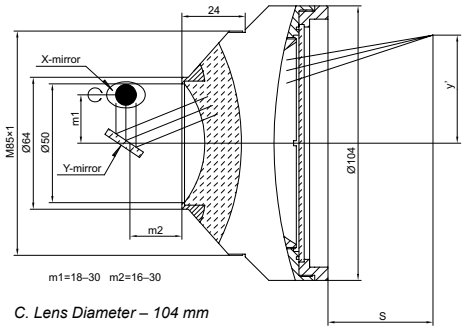
F-Theta lenses are designed to provide a flat field on the image plane for scanning and engraving applications where a high power laser and a set of rotating mirrors are used to scan across a given field.



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

Catalogue number	Focus length, mm	Working distance S, mm	Max. scan area, mm²	Max. scan angle, θ max	Input beam diameter, mm	Spot size, µm	Drawing	Price, EUR
150-1001	100	115	70×70	±28°	12	16	A	420
150-1601	160	176	110×110	±28°	12	26	A	420
150-2101	210	230	145×145	±28°	12	34	A	420
150-2541	254	284	175×175	±28°	16	31	A	420
150-2901	290	324	200×200	±28°	16	31	A	420
150-3301	330	346	220×220	±28°	16	40	A	420
150-4201	420	467	300×300	±28°	16	50	A	420

Wavelength – 532 nm, Lens Diameter – 90 mm

Catalogue number	Focus length, mm	Working distance S, mm	Max. scan area, mm²	Max. scan angle, θ max	Input beam diameter, mm	Spot size, µm	Drawing	Price, EUR
150-1002	100	115	70×70	±28°	12	10	A	460
150-1602	160	186	110×110	±28°	12	16	A	460

Wavelength – 355 nm

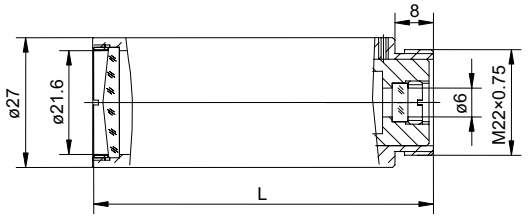
Catalogue number	Focus length, mm	Working distance S, mm	Max. scan area, mm²	Max. scan angle, θ max	Input beam diameter, mm	Spot size, µm	Drawing	Price, EUR
150-1003	100	136	70×70	±28°	7	10	A	930
150-1603	160	199	110×110	±28°	7	15	B	930

Best mirror places m1/m2 – 24/24 mm, screw size – M85×1

Wavelength – 1064 nm, Lens Diameter – 104 mm

Catalogue number	Focus length, mm	Working distance S, mm	Max. scan area, mm²	Max. scan angle, θ max	Input beam diameter, mm	Spot size, µm	Drawing	Price, EUR
151-1631	163	185	110×110	±28°	20	17	C	520
151-2101	210	255	150×150	±28°	20	24	C	520
151-2541	254	285	175×175	±28°	20	31	C	520
151-4201	420	467	300×300	±28°	20	55	C	520
151-6501	650	697	400×400	±25°	20	85	C	520

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

RELATED PRODUCT

Large Rod Small Mounting Clamp (aluminium) 810-0062A

See page 7.12

Catalogue number	Wavelength, nm	Expansion ratio	Beam expander size L, mm	Transmission, %	Price, EUR
160-0021	1064	2X	51	>96	235
160-0251	1064	2.5X	51	>96	235
160-0031	1064	3X	68	>96	235
160-0041	1064	4X	75	>96	235
160-0051	1064	5X	73	>96	235
160-0061	1064	6X	75	>96	235
160-0081	1064	8X	77	>96	235
160-0101	1064	10X	70	>96	235
160-0022	532	2X	51	>96	235
160-0252	532	2.5X	51	>96	235
160-0032	532	3X	68	>96	235
160-0042	532	4X	75	>96	235
160-0052	532	5X	73	>96	235
160-0062	532	6X	75	>96	235
160-0082	532	8X	77	>96	235
160-0102	532	10X	70	>96	235
160-0043	355	4X	75	>96	250
160-0063	355	6X	75	>96	250
160-0083	355	8X	68	>96	250
160-0103	355	10X	71	>96	250

Compact beam expanders of other expansion ratio are available upon request.

ZOOM BEAM EXPANDER

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.

Catalogue number	Wavelength, nm	Expantion ratio	Input Clear Aperture, mm	Output Clear Aperture, mm	Length, mm	Price, EUR
165-1181	1064	1x-8x	12	33	162	860
165-1281	1064	2x-8x	12	33	143.3	860
165-1185	532	1x-8x	12	33	162	860
165-1285	532	2x-8x	12	33	139.9	860
165-1183	355	1x-8x	12	33	162	1120
165-1283	355	2x-8x	12	33	158.5	860

- **Adjustable 1X – 8X or 2X – 8X expansion ratio**
- **Adjustable divergence**
- **Galilean design**

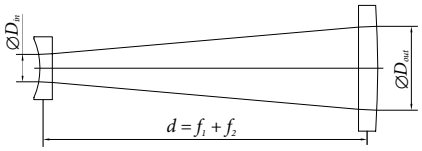
Visit our e-shop
www.eksmaoptics.com
and find the drawings of all zoom beam expanders

RELATED PRODUCT

Universal Adjustable Optics Mount 830-0035

See page 7.28

SIMPLE TELESCOPE KIT



Simple lenses are subject to optical aberrations. In many cases these aberrations can be compensated to a great extent by using a combination of simple lenses with complementary aberrations. A compound lens is a collection of simple lenses of different shapes and made of materials of different refractive indexes, arranged one after the other with a common axis.

If two thin lenses are separated in air by some distance d (where d is smaller than the focal length of the first lens), the focal length for the combined system is given by

$$\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2} - \frac{d}{f_1 \cdot f_2}$$

The distance from the second lens to the focal point of the combined lenses is called the back focal length (BFL).

$$BFL = \frac{f_2 \cdot (d - f_1)}{d - (f_1 + f_2)}$$

If the separation distance is equal to the sum of the focal lengths ($d = f_1 + f_2$), the combined focal length and BFL are infinite. This corresponds to a pair of lenses that transform a parallel (collimated) beam into another collimated beam. This type of system is called an afocal system, since it produces no net convergence or divergence of the beam. Two lenses at this separation form the simplest type of optical telescope. Although the system does not alter the divergence of a collimated beam, it does alter the width of the beam. The magnification of such a telescope is given by

$$M = -\frac{f_2}{f_1} = \frac{D_{out}}{D_{in}} \quad \frac{(exit\ diameter)}{(input\ diameter)}$$

which is the ratio of the input beam width to the output beam width. Note the sign convention: a telescope with two convex lenses ($f_1 > 0, f_2 > 0$) produces a negative magnification, indicating an inverted image. A concave plus a convex lens ($f_1 < 0 < f_2$) produces a positive magnification and the image is upright.

Code	Material	Coating	Price, EUR
140-0008	BK7	Uncoated	771
141-0008	BK7	1064 nm, R<0.2%	1075
142-0008	BK7	532 nm + 1064 nm, R<0.5%	1110
147-0008	BK7	400-700 nm, R<0.9%	1260
140-1008	UV FS	Uncoated	1170
144-1008	UV FS	266 nm, R<0.4%	1470
146-1008	UV FS	210-400 nm, R<1.5%	1680
143-1008	UV FS	355 nm, R<0.25%	1465
141-1008	UV FS	532 nm + 1064 nm, R<0.5%	1485
145-1008	UV FS	350-900 nm, R<1.5%	1685
148-1008	UV FS	650-950 nm, R<1%	1645

Any other antireflection coating wavelength region is available on request.

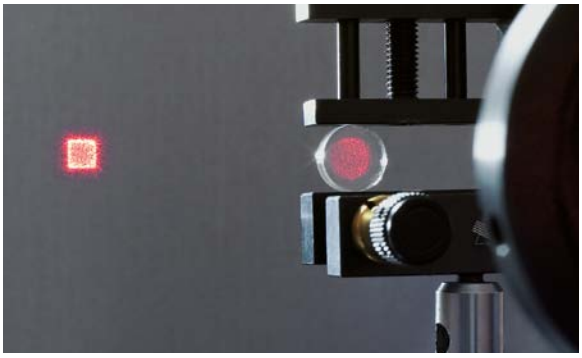
Each kit includes 8 lenses, aluminium optical rail 810-0005-02, two aluminium rail carriers 810-0007-06, self centering lens mounts 830-0010 and 830-0020, two rod holders 820-0050-02 and two rods 820-0010-02. Net weight – 1.4 kg.

Simple Telescope Kit

Material: BK7		Material: UV FS		Focal length f_1, mm	Focal length f_2, mm	Distance between lenses $d=f_1+f_2$, mm *	Magnification, M
Lens 1	Lens 2	Lens 1	Lens 2				
BK7 bi/cv Ø12.7 mm 114-0104	BK7 pl/cx Ø50.8 mm	UV FS bi/cv Ø12.7 mm 114-1104	UV FS pl/cx Ø50.8 mm	-12.7			
	110-0502		110-1505		+75	62	5.9
	110-0505		110-1509		+100	87	7.7
	110-0507		110-1511		+150	137	11.8
	110-0509		110-1515		+200	187	15.7
	110-0511		110-1517		+250	237	19.7
BK7 bi/cv Ø25.4 mm 114-0204	BK7 pl/cx Ø50.8 mm	UV FS bi/cv Ø25.4 mm 114-1204	UV FS pl/cx Ø50.8 mm	-25			
	110-0502		110-1505		+75	50	3
	110-0505		110-1509		+100	75	4
	110-0507		110-1511		+150	125	6
	110-0509		110-1515		+200	175	8
	110-0511		110-1517		+250	225	10
BK7 pl/cv Ø25.4 mm 112-0209	BK7 pl/cx Ø50.8 mm	UV FS pl/cv Ø25.4 mm 112-1205	UV FS pl/cx Ø50.8 mm	-50			
	110-0502		110-1505		+75	25	1.5
	110-0505		110-1509		+100	50	2
	110-0507		110-1511		+150	100	3
	110-0509		110-1515		+200	150	4
	110-0511		110-1517		+250	200	5

* Note that distance between lenses d is the distance between focal planes of the lenses and is given theoretically (the thickness of lenses is not included into calculation). It also depends on wavelength. The distance should be adjusted ±10 mm in each particular case.

GAUSS-TO-TOP HAT BEAM SHAPING LENS



Gauss-to-Top Hat Beam Shaping Lens is a lens of a special form, used to distribute energy of Gaussian beam to Top Hat profile.

GTH beam shapers operate within a large wavelength range from VIS to NIR.

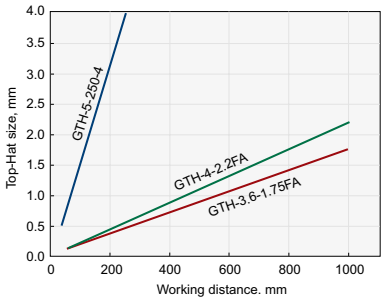
Top Hat beam shapers GTH-4-2.2 and GTH-3.6-1.75 work together with nearly any focusing optic. Top Hat profile is generated in the focal plane of this focusing optic. By varying the focal length it is possible to scale Top Hat size and working distance.

GTH-5-250-4 is an exception to the other beam shapers because a focal length of 250 mm is integrated. However, Top Hat size can also be scaled by using additional lenses.

- **Square Top Hat beam profile**
- **Efficiency >95 %**
- **Top Hat width from 50 µm to several cm**

LENS SPECIFICATIONS

Material	LF5 Schott glass n = 1.5659 @ 1060 nm, n = 1.5848 @ 546 nm, n = 1.6192 @ 365 nm
Clear aperture	Ø11.0 mm
Damage threshold (uncoated)	>3 J/cm² @ 532 nm, 10 ns
Mounting	Mounted into 1" ring holder



Top Hat width in relation to the working distance

GTH-5-250-4 GAUSS-TO-TOP-HAT BEAM SHAPING LENS

Square top hat size and corresponding working distance can be changed by placing an extra lens or objective behind beam shaping lens GTH-5-250-4.

Dependence of square size and working distance vs focal length of additional lens or objective:

Focal length, mm	**Top hat square size,** mm	**Working distance,** mm
+50	0.67 x 0.67	42
+100	1.1 x 1.1	71
+200	1.8 x 1.8	111
+300	2.2 x 2.2	136
-1000	5.3 x 5.3	333
-500	8.0 x 8.0	500

GTH-5-250-4 OPERATION SPECIFICATIONS

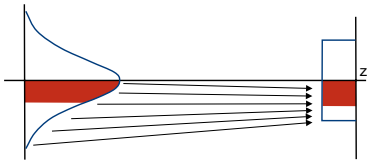
Recommended operation wavelength range	400-1500 nm
Input beam	TEM_{00}, diameter (1/e²): 5.0 ± 0.15 mm
Output beam	Top hat size at 250 mm working distance: 4 × 4 mm² (adjustable with additional lens)
Working distance	250 mm (adjustable with additional lens)
Beam energy distribution efficiency	> 95% of input energy within Top Hat profile
Beam homogenity	± 5 % (rel. to average intensity within top hat)
Lens diameter	12.0 +0.0/-0.1 mm
Thickness	4.0 ± 0.1 mm

Catalogue number	**Description**	**Price,** EUR
GTH-5-250-4	uncoated lens	565
GTH-5-250-4-VIS	VIS coated lens (400-700 nm (R<1% per face))	620
GTH-5-250-4-IR	IR coated lens (700-1300 nm (R<1% per face))	620

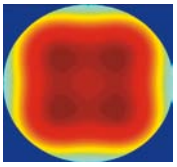
Other specific laser wavelengths are available on request.

GTH-5-250-4 OPERATION INSTRUCTIONS

Principles of Beam Shaper Operation and Lens Shape

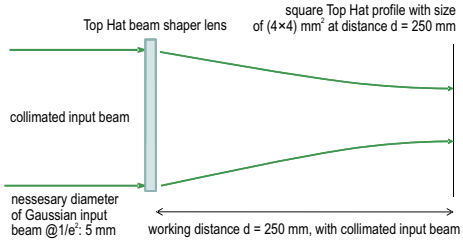


Energy of Gaussian input beam is re-distributed to a Top Hat beam profile by beam shaper lens (mapping).



Surface contour plot of beam shaper lens (free form optic).

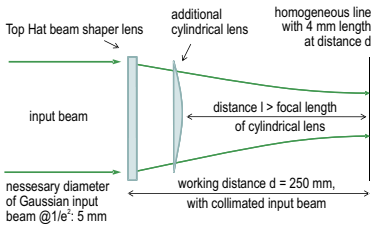
Optical Setup for Gauss-toTop Hat Beam Shaper Lens



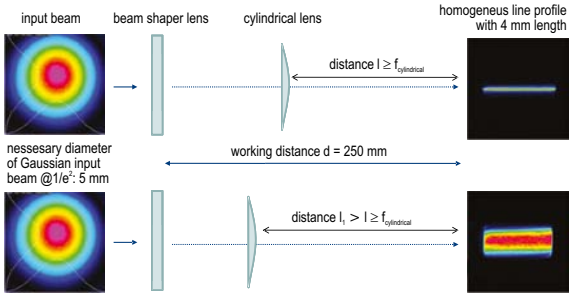
If a collimated Gaussian beam is used the Top Hat beam shaper lens delivers at the working distance d = 250 mm a square Top Hat beam profile with the size of (4×4) mm².

The Top Hat beam shaper lens works also for divergent and convergent Gaussian beams. Important: One has to consider that input beam diameter at beam shaper lens plane must be 5 mm @ 1/e². For divergent (or convergent) beams the size of Top Hat and working distance increase (or decrease).

Homogeneous Line Generation with Top Hat Beam Shapper Lens and Additional Cylindrical Lens

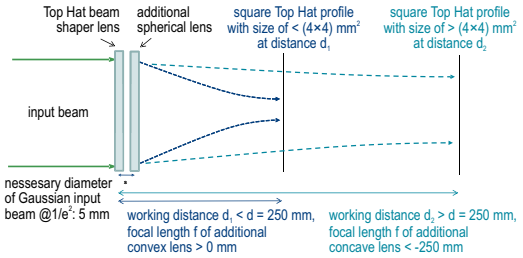


By introducing an additional cylindrical lens behind the Top Hat beam shaper lens (thereby one has to consider that the distance l between cylindrical lens and working plane must be bigger or same as focal length of cylindrical lens) it is possible to generate a line profile at working plane. Along the long axis the intensity profile is homogeneous. Along short axis, which is focused by cylindrical lens, the profile is near Gaussian.



By varying the distance l the width of line profile (short axis) can be changed from near diffraction limited size to several millimiters.

Adjustment of Square Top Hat Size by Additional Spherical Lens



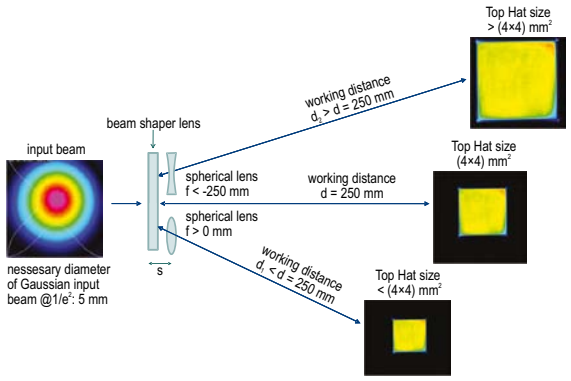
The working distance and the size of the Top Hat profile can be changed (same ratio) by an additional spherical lens. For a convex lens the size of the Top Hat profile and the working distance becomes smaller. For a concave lens the size of the Top Hat profile and the working distance becomes bigger.

The new working distance and the size of the Top Hat profile can be calculated:

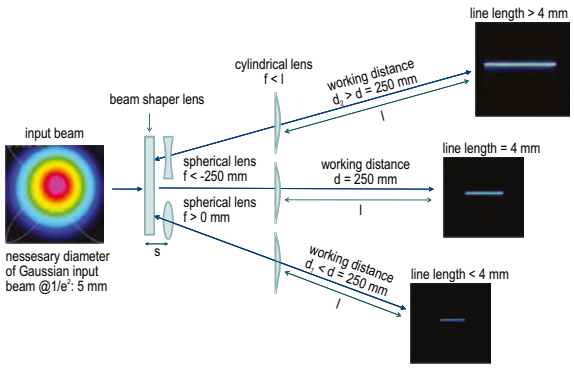
$$\text{Working distance} = \frac{250\,mm \cdot f}{250\,mm + f}$$

for focal length f>0 mm (additional convex lens) respectively focal length f<-250 mm (additional concave lens); s->0

$$\text{Square Top Hat Size} = \left(\frac{4mm \cdot \text{working distance}}{250\,mm}\right)^2 = \left(\frac{4mm \cdot f}{250\,mm + f}\right)^2$$



Adjustment of Length of Homogeneous Line by Additional Spherical Lens



GTH-4-2.2FA GAUSS-TO-TOP-HAT BEAM SHAPING LENS

Working distance of this lens is given by the focal length of an additional lens, which is always needed.

For instance if an additional lens f = 100 mm is used, Top Hat appears at 100 mm behind additional lens. So GTH-4-2.2FA could be easily put in front of objectives for example.

The distance between GTH-4-2.2FA and additional lens is not critical (up to several tens of centimeters).

The full fan angle of Top-Hat generation for GTH-4-2.2FA is 2.2 mrad. This leads to Top-Hat sizes:

Focal length, mm	**Top hat square size,** mm	**Working distance,** mm
+50	0.11 x 0.11	50
+100	0.22 x 0.22	100
+1000	2.2 x 2.2	1000
+2000	4.4 x 4.4	2000

GTH-4-2.2FA OPERATION SPECIFICATIONS

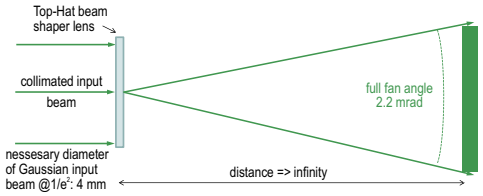
Recommended operation wavelength range	400-1550 nm
Input beam	TEM_{00}, diameter (1/e²): 4.0 ± 0.15 mm
Achievable Top Hat size	6x diffraction limited @ 1064 nm, 12x diffraction limited @ 532 nm
Full fan angle of Top-Hat generation	2.2 mrad
Beam energy distribution efficiency	> 95% of input energy within Top Hat profile
Beam homogenity	± 5 % (rel. to average intensity within Top Hat)
Lens diameter	12.0 +0.0/-0.1 mm
Lens thickness	4.0 ± 0.1 mm

Catalogue number	**Description**	**Price,** EUR
GTH-4-2.2FA	uncoated lens	565
GTH-4-2.2FA-VIS	VIS coated lens (400-700 nm (R<1% per face))	620
GTH-4-2.2FA-IR	IR coated lens (700-1300 nm (R<1% per face))	620

Other specific laser wavelengths are available on request.

GTH-4-2.2FA OPERATION INSTRUCTIONS

General function of Top-Hat beam shaper GTH-4-2.2FA



The Top-Hat beam shaper GTH-4-2.2FA is generating a square Top-Hat profile with a full fan angle of 2.2 mrad. To get best results it is necessary to use a Gaussian TEM_{00} input beam with a diameter of 4 mm @ 1/e².

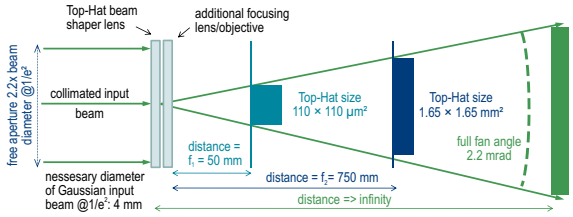
For all setups using GTH beam shaper the user has to consider that the free aperture along the total beam path has to be at least 2.2 (better 2.5) times bigger than the beam diameter @ 1/e².

Optical setup for Top-Hat beam shaper GTH-4-2.2FA

There are different possibilities to integrate the GTH-4-2.2 beam shaper into an optical setup.

1. Beam shaper directly in front of focusing optic/objective (Top Hat size >100 µm).

Top Hat size is determined by focal length (f) of focusing optic/objective and can be calculated as follows: $\frac{2.2}{1000} \cdot f$



By introducing the GTH-4-2.2FA into the beam path in front of a lens/objective the initial diffraction limited Gaussian spot will be transformed into a square homogeneous Top-Hat profile.

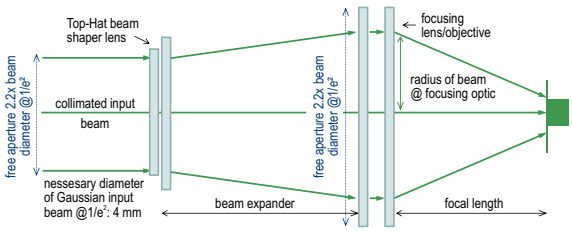
The necessary beam diameter at the position of GTH-4-2.2FA is 4 mm @ 1/e².

The resulting Top-Hat size is given by: $\frac{2.2}{1000} \cdot$ focal length, for example with f = 50 mm => 110 µm.

2. Beam shaper in front of beam expander (Top Hat size <100 µm)

Top Hat size is determined by numerical aperture (NA) of focused beam and can be calculated as follows:

$\approx \frac{4\ \mu m}{NA} \Rightarrow\approx$ 6x diffraction limited @ 1064 nm (12x @ 532 nm)



To achieve Top Hat sizes smaller than 100 µm it's recommended to introduce the GTH-4-2.2FA into the beam path in front of a beam expander. Initially the necessary input beam diameter of 4 mm @ 1/e² is passing the GTH. Afterwards the beam is expanded and focused on working plane. The initial diffraction limited Gaussian spot at focal plane will be transformed into a square homogeneous Top-Hat profile. The resulting Top-Hat size is given by:

$\approx \frac{4\ \mu m}{NA} \Rightarrow\approx$ 6x diffraction limited @ 1064 nm (12x @ 532 nm)

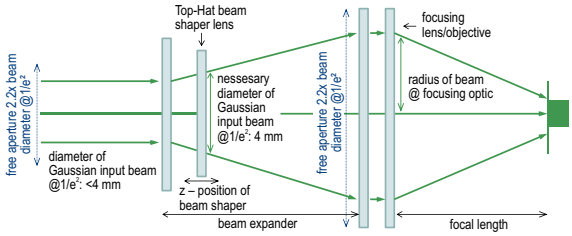
NA represents the numerical aperture of focused beam and is given by:

$$NA = \frac{\text{beam radius @ focusing optic}}{\text{focal length of focusing optic}}$$

3. Beam shaper within beam expander (Top Hat size <100 µm)

Top Hat size is determined by numerical aperture (NA) of focused beam and can be calculated as follows:

$$\approx \frac{4\ \mu m}{NA} \Rightarrow\approx \text{6x diffraction limited @ 1064 nm (12x @ 532 nm)}$$



A further and even more flexible possibility is to introduce GTH-4-2.2FA 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 GTH-4-2.2FA by shifting shaper along z-axis. It's just necessary to consider that the beam diameter at the position of GTH is 4 mm @ 1/e². The resulting Top-Hat size is given by:

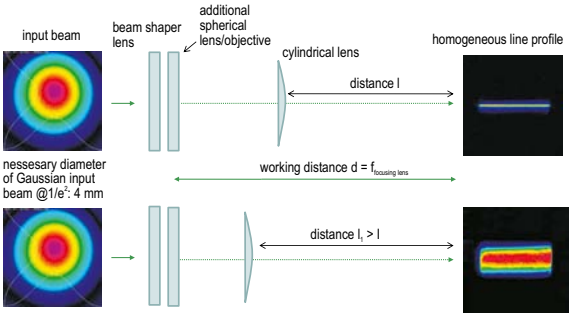
$$\approx \frac{4\ \mu m}{NA} \Rightarrow\approx \text{6x diffraction limited @ 1064 nm (12x @ 532 nm)}$$

NA represents the numerical aperture of focused beam and is given by:

$$NA = \frac{\text{beam radius @ focusing optic}}{\text{focal length of focusing optic}}$$

Homogeneous line generation with additional cylindrical lens

Line thickness fixed, near diffraction limited.



If an additional cylindrical lens is used, one can generate homogeneous line profiles. By varying the distance l the width of line profile (short axis) can be changed from near diffraction limited size to several millimeters. We recommend the use of a cylindrical lens with a focal length of f = 2.25 m.

GTH-3.6-1.75FA GAUSS-TO-TOP-HAT BEAM SHAPING LENS

Working distance of this lens is given by the focal length of an additional lens, which is always needed.

For instance if an additional lens f = 100 mm is used, Top Hat appears at 100 mm behind additional lens. So GTH-3.6-1.75FA could be easily put in front of objectives for example.

The distance between GTH-3.6-1.75FA and additional lens is not critical (up to several tens of centimeters).

The full fan angle of Top-Hat generation for GTH-3.6-1.75FA is 1.75 mrad. This leads to Top-Hat sizes:

Focal length, mm	**Top hat square size,** mm	**Working distance,** mm
+50	0.088 x 0.088	50
+100	0.175 x 0.175	100
+1000	1.75 x 1.75	1000

GTH-3.6-1.75FA OPERATION SPECIFICATIONS

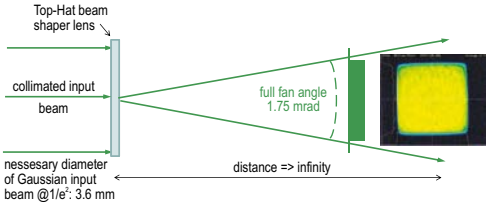
Recommended operation wavelength range	400-1550 nm
Necessary free aperture	always 2.2x beam diameter @ 1/e², along total beam path
Input beam	TEM_{00}, diameter (1/e²): 3.6 ± 0.15 mm
Achievable Top Hat size @ 1/e²	5x diffraction limited @ 1064 nm, 10x diffraction limited @ 532 nm
Full fan angle of Top-Hat generation	1.75 mrad
Beam energy distribution efficiency	> 95% of input energy within Top Hat profile
Beam homogenity	± 5 % (rel. to average intensity within Top Hat)
Lens diameter	12.0 +0.0/-0.1 mm
Lens thickness	2.0 ± 0.1 mm

Catalogue number	**Description**	**Price,** EUR
GTH-3.6-1.75FA	uncoated lens	565
GTH-3.6-1.75FA-VIS	VIS coated lens (400-700 nm (R<1% per face))	620
GTH-3.6-1.75FA-IR	IR coated lens (700-1300 nm (R<1% per face))	620

Other specific laser wavelengths are available on request.

GTH-3.6-1.75FA OPERATION INSTRUCTIONS

General function of Top-Hat beam shaper GTH-3.6-1.75FA



The Top-Hat beam shaper GTH-3.6-1.75FA is generating a square Top-Hat profile with a full fan angle of 1.75 mrad. To get the best results it is necessary to use a Gaussian TEM_{00} input beam with a diameter of 3.6 mm @ 1/e².

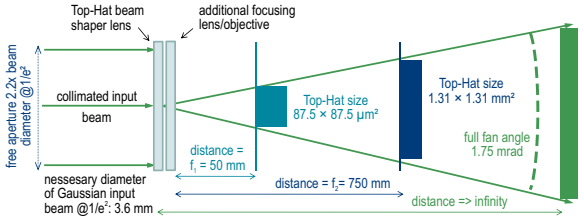
For all setups using GTH beam shaper the user has to consider that the free aperture along the total beam path has to be at least 2.2 (better 2.5) times bigger than the beam diameter @ 1/e².

Optical setup for Top-Hat beam shaper GTH-3.6-1.75FA

There are different possibilities to integrate the GTH-3.6-1.75FA beam shaper into an optical setup.

1. Beam shaper directly in front of focusing optic/objective (Top Hat size @ 1/e² > 90 µm).

Top Hat size is determined by focal length (f) of focusing optic/objective and can be calculated as follows: $\frac{1.75}{1000} \cdot f$



By introducing the GTH-3.6-1.75FA into the beam path in front of a lens/objective the initial diffraction limited Gaussian spot will be transformed into a square homogeneous Top-Hat profile.

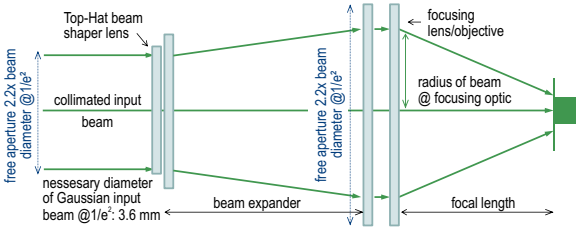
The necessary beam diameter at the position of GTH-3.6-1.75FA is 3.6 mm @ 1/e².

The resulting Top-Hat size is given by: $\frac{1.75}{1000}$ · focal length, for example with f = 50 mm => 87.5 µm.

2. Beam shaper in front of beam expander (Top Hat size @ 1/e² < 90 µm).

Top Hat size is determined by numerical aperture (NA) of focused beam and is given by:

$$\approx \frac{3.2\ \mu m}{NA} \Rightarrow\approx \text{ 5x diffraction limited @ 1064 nm (10x @ 532 nm)}$$



To achieve Top Hat sizes smaller than 90 µm it's recommended to introduce the GTH-3.6-1.75FA into the beam path in front of a beam expander. Initially the necessary input beam diameter of 3.6 mm @ 1/e² is passing the GTH. Afterwards the beam is expanded and focused on working plane. The initial diffraction limited Gaussian spot at focal plane will be transformed into a square homogeneous Top-Hat profile. The resulting Top-Hat size is given by:

$$\approx \frac{3.2\ \mu m}{NA} \Rightarrow\approx \text{ 5x diffraction limited @ 1064 nm (10x @ 532 nm)}$$

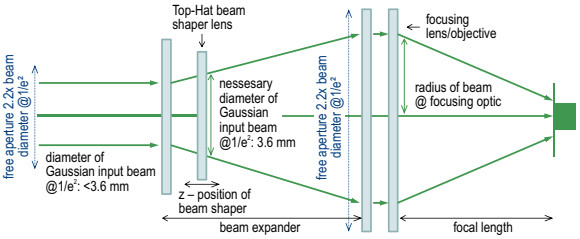
NA represents the numerical aperture of focused beam and is given by:

$$NA = \frac{\text{beam radius @ focusing optic}}{\text{focal length of focusing optic}}$$

3. Beam shaper within beam expander (Top Hat size @ 1/e² < 90 µm).

Top Hat size is determined by numerical aperture (NA) of focused beam and is given by:

$$\approx \frac{3.2\ \mu m}{NA} \Rightarrow\approx \text{ 5x diffraction limited @ 1064 nm (10x @ 532 nm)}$$



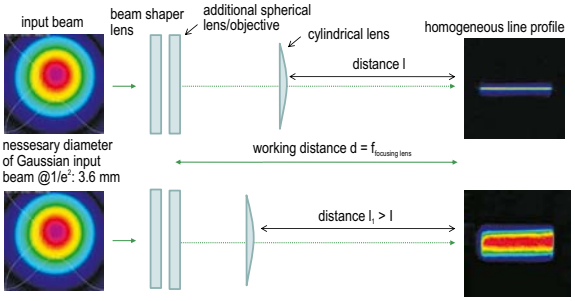
A further and even more flexible possibility is to introduce GTH-3.6-1.75FA into the beam path within a beam expander. The user has the possibility for an easy "fine tuning" of beam diameter at the position of GTH-3.6-1.75FA by shifting shaper along z-axis. It's just necessary to consider that the beam diameter at the position of GTH is 3.6 mm @ 1/e². The resulting Top-Hat size is given by:

$$\approx \frac{3.2\ \mu m}{NA} \Rightarrow\approx \text{ 5x diffraction limited @ 1064 nm (10x @ 532 nm)}$$

NA represents the numerical aperture of focused beam and is given by:

$$NA = \frac{\text{beam radius @ focusing optic}}{\text{focal length of focusing optic}}$$

Homogeneous line generation with additional cylindrical lens



If an additional cylindrical lens is used, one can generate homogeneous line profiles. By varying the distance l the width of line profile (short axis) can be changed from near diffraction limited size to several millimeters. We recommend the use of a cylindrical lens or lens system with a focal length of = 1.8 m.

FBS — TOP HAT BEAM SHAPING LENS FROM UVFS

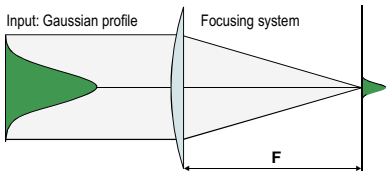
- **New Diffractive Beam Shaping Concept based on Fourier methods**
- **Transforming Gaussian TEM_{00} beam into square or round homogeneous Top-Hat profile**
- **Top Hat size is near diffraction limited and is given by: ~λ /NA**
- **Achievable Top Hat sizes: 1 µm – 200 µm**

SPECIFICATIONS

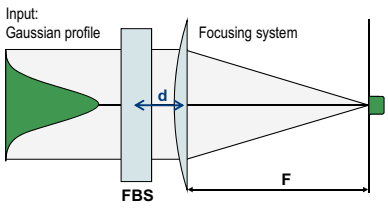
Material	fused silica	
Diameter	25.4 mm	tolerance ±0.1 mm
Input Beam	TEM_{00}, different models for diameter@1/e²: 2.0 ... 10.0 mm with 0.5 mm step	tolerance ±5%
Necessary Free Aperture	2.2x (or better 2.5x) beam diameter@1/e²	along total beam path
Top Hat Size	1.5x diffraction limited Gaussian spot	square form (round optional)
Homogenity	+/- 2.5%	rel. to average intensity within tophat
Wavelength	different models for: 1064 nm, 532 nm or 355 nm	others on request
Transmission	> 99%	AR/AR coating
Efficiency	> 90%	of input energy within tophat profile
Damage Threshold	4 J/cm² @ 532 nm, 10 ns	
Free Aperture	23 mm	

FBS OPERATION INSTRUCTIONS

FBS – Top-Hat Fundamental Beam Mode Shaper



Without FBS Beam Shaper: Gaussian-profile at focal plane



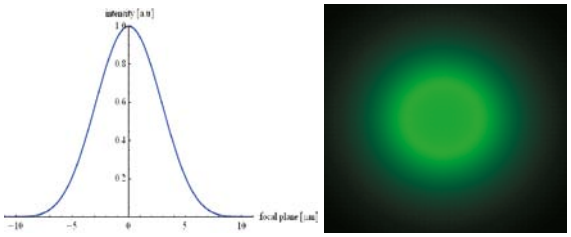
With FBS Beam Shaper: Top-Hat-profile at focal plane

– FBS works together with focusing system (FS)
– Top Hat size just depends on wavelength (λ) and numerical aperture (NA) of focused beam
– Distance d between FBS and FS up to several meters

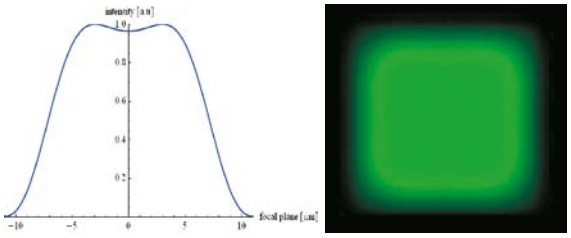
Intensity distribution at focal plane

Main FBS advantages:

– Smallest achievable Top-Hat size: ≈ always 1,5x of diffraction limited Gaussian-spot @ 1/e²
– Achievable Top Hat profiles: square or round
– Diffraction efficiency: > 95% of energy in Top Hat
– Homogeneity: modulation < ±2.5%
– Depth of focus: similar as for Gaussian beam
– Insensitive to misalignment, ellipticity and input diameter variation: ±5-10%



Without FBS shaper: diffraction limited Gaussian profile



With FBS shaper: near diffraction limited Top Hat profile

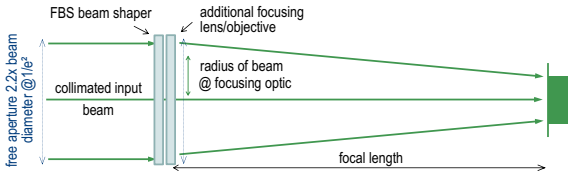
Optical setup for FBS Top-Hat beam shaper

Independent of optical setup the user has to consider that:

– The free aperture along the total beam path has to be at least 2.2x (better 2.5x) bigger than the beam diameter @ 1/ e²
– The Top Hat size is always given by: $\frac{\lambda}{NA}$
λ is the used wavelength;
NA is the numerical aperture of focused beam and is given by: $\frac{\text{beam radius @ focusing optic}}{\text{focal length of focusing optic}}$

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

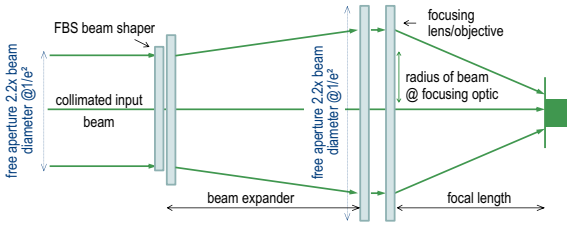


By introducing the FBS beam shaper into the beam path in front of a lens/objective the initial diffraction limited Gaussian spot will be transformed into a homogeneous Top-Hat profile.

When a Gaussian TEM_{00} input beam with a diameter of 5 mm@ 1/e² 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/e² and a focusing lens with f=160 mm is used, ones will get a homogeneous Top Hat profile with a diameter of 34 µm.

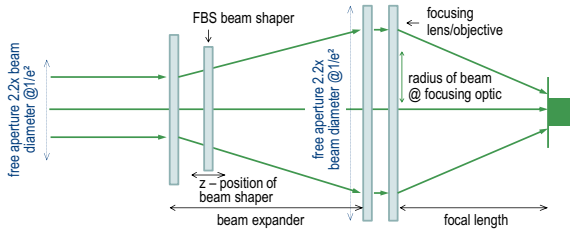
2. Beam shaper in front of a beam expander



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.

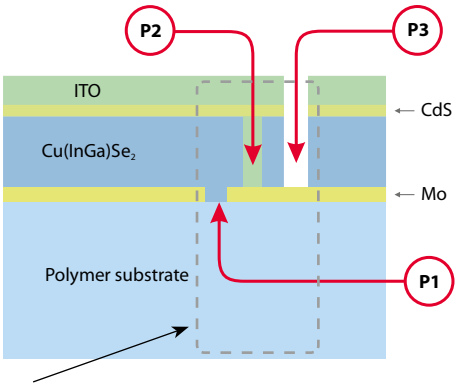
Example: A Gaussian beam with a diameter of 5 mm@1/e² illuminates the FBS beam shaper and is afterwards increased by a beam expander to a beam diameter of 8 mm. With an focusing optic with f=50 mm the user can generate a Top Hat with a diameter of 7 µm. The needed free aperture increases with the expanded 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



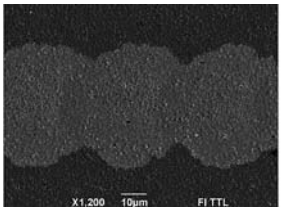
A further and even more flexible possibility is to introduce the FBS beam shaper into the beam path within a beam expander. The user has the possibility for an easy “fine tuning” of beam diameter at the position of FBS beam shaper by shifting shaper along z-axis.

Scribing of CIGS-solar cells

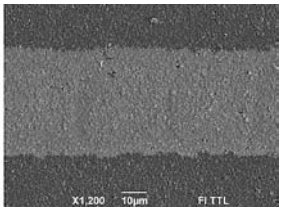


– Wasted area, reducing efficiency → need of smallest scribing lines
– Cut quality influence efficiency → need of small HAZ, no debris, smooth edges
– High scanning speed for high throughput → need of small pulse overlap

P1 – „Scribing“



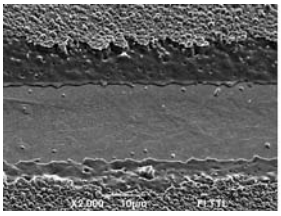
Gaussian Profile



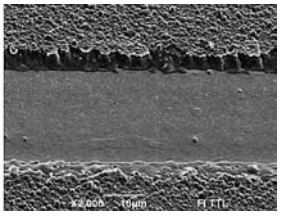
FBS-Top-Hat Profile
small overlap, smooth edges

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.

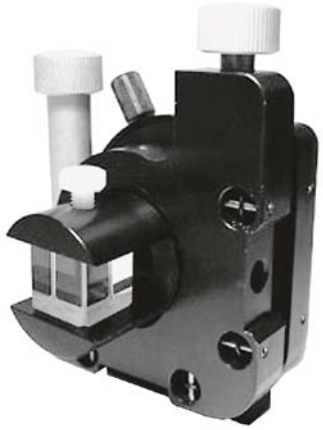
Raciukaitis et. al, JLMN-Vol. 6, No. 1, 2011

RECOMMENDED ACCESSORIES

Zoom Beam Expander
See page 6.3

Two Axes Translation Polarizer Holder 840-0240
See page 7.56

990-0060 CONTINUOUSLY VARIABLE ATTENUATOR / BEAMSPLITTER



- **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	T_s/T_p < 1:200
Clear aperture	11 mm

for Broadband Region

Catalogue number	Central wavelength, nm	LDT, J/cm²	Price, EUR
990-0060-11VIS	450-680	1 [1)]	1030
990-0060-11IR	700-1000	2 [2)]	1030

[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	T_s/T_p < 1:500
Clear aperture	11 mm

Catalogue number	Central wavelength, nm	LDT, J/cm² *	Price, EUR
990-0061-11	1064	15	710
990-0062-11	1030	15	710
990-0063-11	800	8	710
990-0064-11	532	6	710
990-0065-11	355	3	740

** LDT measured at designed wavelength, 10 Hz, 10 ns pulses.*

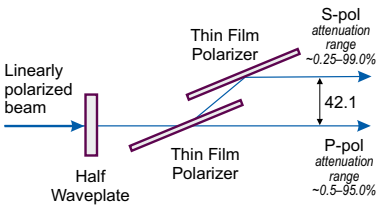
990-0070 VARIABLE ATTENUATORS FOR LINEARLY POLARIZED LASER BEAM

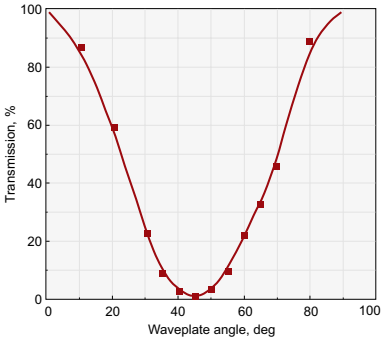
*Note: Movable base **820-0090**, Rod Holder **820-0050-02** and standard rod should be ordered seperately.*

- **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**

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 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

RELATED PRODUCTS

Beam dumps 990-0800, 990-0820

See page 6.21

For Nd:YAG Laser Applications

Catalogue number	Wavelength, nm	Price, EUR
990-0070-266H *	266	1020
990-0070-355	355	750
990-0070-532	532	650
990-0070-1064	1064	650

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

Catalogue number	Wavelength, nm	Price, EUR
990-0070-257	257	945
990-0070-266	266	945
990-0070-343	343	840
990-0070-400	400	740
990-0070-400B	390-410	890
990-0070-515	515	740
990-0070-515B	505-525	890
990-0070-800	800	740
990-0070-800B	780-820	890
990-0070-1030	1030	740
990-0070-1030B	1010-1050	890

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).

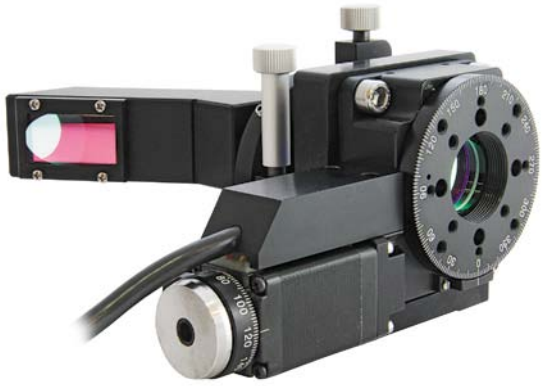
For High Power Femtosecond Laser Applications

Catalogue number	Wavelength, nm	Price, EUR
990-0070-257H	257	1020
990-0070-266H	266	1020
990-0070-343H	343	915
990-0070-400H	400	815
990-0070-400HB	390-410	965
990-0070-515H	515	815
990-0070-515HB	505-525	965
990-0070-800H	800	815
990-0070-800HB	780-820	965
990-0070-1030H	1030	815
990-0070-1030HB	1010-1050	965

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).

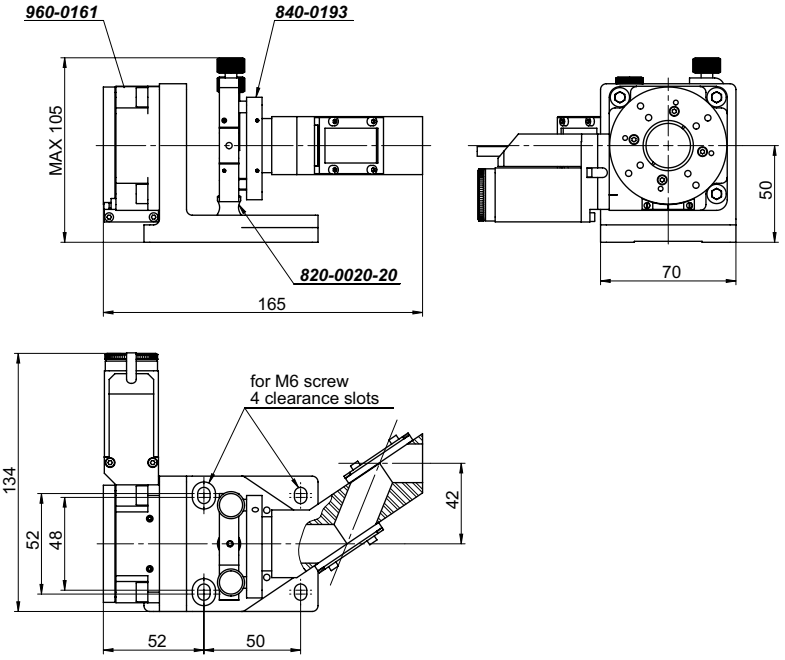
990-0070M

MOTORIZED VARIABLE ATTENUATOR FOR LINEARLY POLARIZED LASER BEAM



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 wave-plate. 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: PS12-2.5-4), please ad CP to code and 600 EUR to price.

Example:

990-0070-266M – motorized attenuator without controller and power supply.

Price – 1725 EUR

990-0070-266M+CP – motorized attenuator with controller and power supply.

Price – 2325 EUR

For Nd:YAG Laser Applications

Catalogue number	Wavelength, nm	Price, EUR
990-0070-266HM *	266	1800
990-0070-355M	355	1530
990-0070-532M	532	1430
990-0070-1064M	1064	1430

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

Catalogue number	Wavelength, nm	Price, EUR
990-0070-257M	266	1725
990-0070-266M	266	1725
990-0070-343M	343	1620
990-0070-400M	400	1520
990-0070-400BM	390-410	1670
990-0070-515M	515	1520
990-0070-515BM	505-525	1670
990-0070-800M	800	1520
990-0070-800BM	780-820	1670
990-0070-1030M	1030	1520
990-0070-1030BM	1010-1050	1670

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 Applications

Catalogue number	Wavelength, nm	Price, EUR
990-0070-257HM	266	1800
990-0070-266HM	266	1800
990-0070-343HM	343	1695
990-0070-400HM	400	1595
990-0070-400HBM	390-410	1745
990-0070-515HM	515	1595
990-0070-515HBM	505-525	1745
990-0070-800HM	800	1595
990-0070-800HBM	780-820	1745
990-0070-1030HM	1030	1595
990-0070-1030HBM	1010-1050	1745

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).

990-0070HBBi70

BROADBAND VARIABLE ATTENUATOR FOR FEMTOSECOND LASER PULSES

990-0070-800HBBi70

990-0070-800HBBi70M

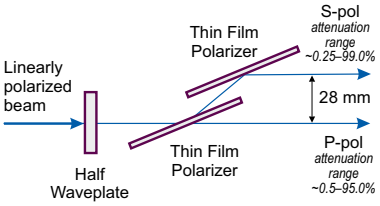
- **Divides laser beam into two parallel beams of manually adjustable intensity ratio**
- **Large dynamic range**
- **Transmitted beam shift ~ 2.6 mm**
- **High optical damage threshold**

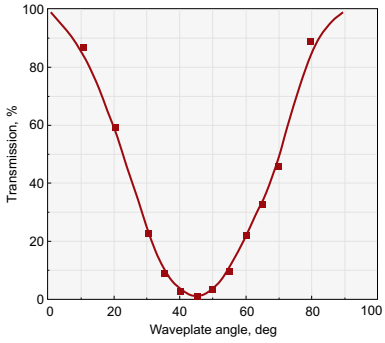
This variable attenuator/beamsplitter consists of a special design opto-mechanical adapter and a precision opto-mechanical holder 840-0197. Two thin film polarizers, operating at AOI=70° and reflecting s-polarized light while transmitting p-polarized light, are housed into the adapter. A quartz zero 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.

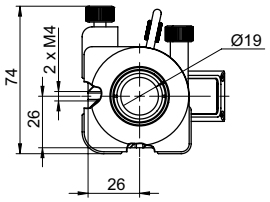
The 840-0197 holder allows to adjust angle of incidence of the thin film polarizers by ±2° and to achieve the maximum polarization contrast.

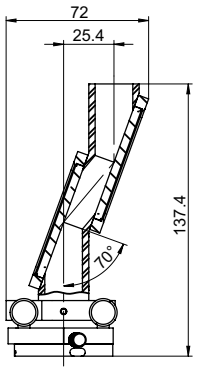




SPECIFICATIONS

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





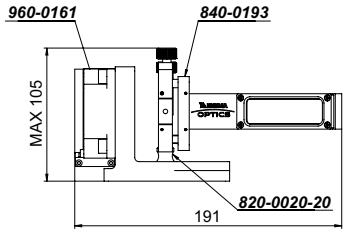
990-0070-800HBBi70

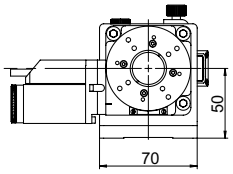
Manual attenuators

Catalogue number	Wavelength, nm	Price, EUR
990-0070-800HBBi70	750-850	1270
990-0070-1030HBBi70	980-1080	1270

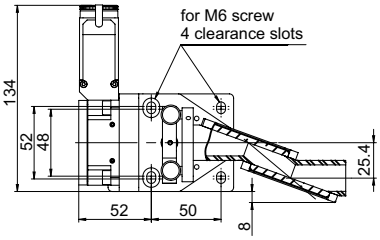
Motorized attenuators

Catalogue number	Wavelength, nm	Price, EUR
990-0070-800HBBi70M	750-850	2050
990-0070-1030HBBi70M	980-1080	2050





990-0070-800HBBi70M



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: PS12-2.5-4), please ad CP to code and 600 EUR to price.

Example:

990-0070-800HBBi70 – motorized attenuator without controller and power supply.

Price – 2050 EUR

990-0070-800HBBi70+CP – motorized attenuator with controller and power supply.

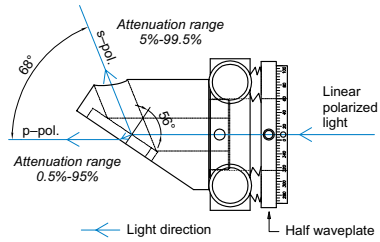
Price – 2650 EUR

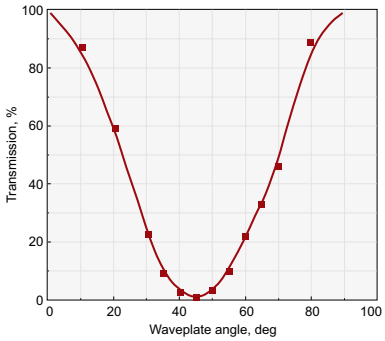
990-0071 VARIABLE ATTENUATORS FOR LINEARLY POLARIZED LASER BEAM

*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.





- **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**

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 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 Nd:YAG Laser Applications

Catalogue number	Wavelength, nm	Price, EUR
990-0071-266H *	266	690
990-0071-355	355	475
990-0071-532	532	445
990-0071-1064	1064	445

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

Catalogue number	Wavelength, nm	Price, EUR
990-0071-257	257	625
990-0071-266	266	625
990-0071-343	343	600
990-0071-400	400	550
990-0071-400B	390-410	650
990-0071-515	515	550
990-0071-515B	505-525	650
990-0071-800	800	550
990-0071-800B	780-820	650
990-0071-1030	1030	550
990-0071-1030B	1010-1050	650

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

Catalogue number	Wavelength, nm	Price, EUR
990-0071-257H	257	690
990-0071-266H	266	690
990-0071-343H	343	665
990-0071-400H	400	615
990-0071-400HB	390-410	715
990-0071-515H	515	615
990-0071-515HB	505-525	715
990-0071-800H	800	615
990-0071-800HB	780-820	715
990-0071-1030H	1030	615
990-0071-1030HB	1010-1050	715

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).

990-0071M

MOTORIZED VARIABLE ATTENUATOR FOR LINEARLY POLARIZED LASER BEAM

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.

- **New compact design!**

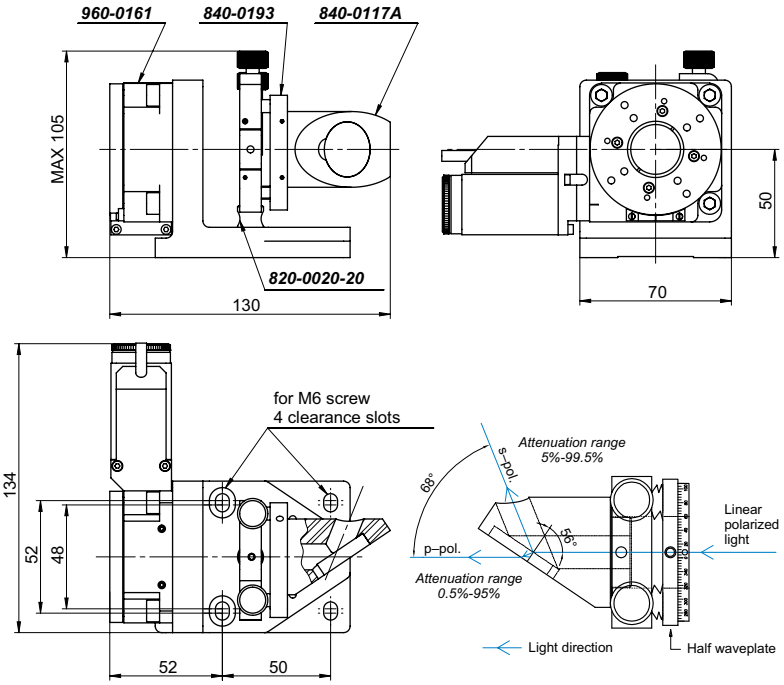
Ordering information

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: PS12-2.5-4), please ad CP to code and 600 EUR to price.

Example:

990-0071-266M – motorized attenuator without controller and power supply.
Price – 1405 EUR

990-0071-266M+CP – motorized attenuator with controller and power supply.
Price – 2005 EUR



For Nd:YAG Laser Applications

Catalogue number	Wavelength, nm	Price, EUR
990-0071-266HM *	266	1470
990-0071-355M	355	1260
990-0071-532M	532	1230
990-0071-1064M	1064	1230

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

Catalogue number	Wavelength, nm	Price, EUR
990-0071-266M	266	1405
990-0071-343M	343	1380
990-0071-400M	400	1330
990-0071-400BM	390-410	1430
990-0071-515M	515	1330
990-0071-515BM	505-525	1430
990-0071-800M	800	1330
990-0071-800BM	780-820	1430
990-0071-1030M	1030	1330
990-0071-1030BM	1010-1050	1430

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

Catalogue number	Wavelength, nm	Price, EUR
990-0071-266HM	266	1470
990-0071-343HM	343	1445
990-0071-400HM	400	1395
990-0071-400HBM	390-410	1495
990-0071-515HM	515	1395
990-0071-515HBM	505-525	1495
990-0071-800HM	800	1395
990-0071-800HBM	780-820	1495
990-0071-1030HM	1030	1395
990-0071-1030HBM	1010-1050	1495

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).

990-0072

VARIABLE ATTENUATOR FOR FEMTOSECOND LASER PULSES

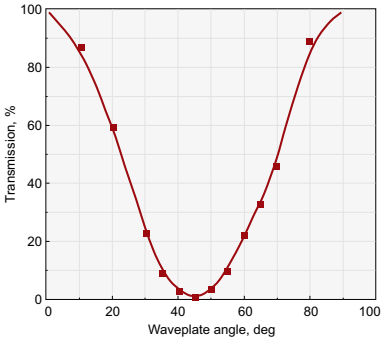
- **New compact design!**

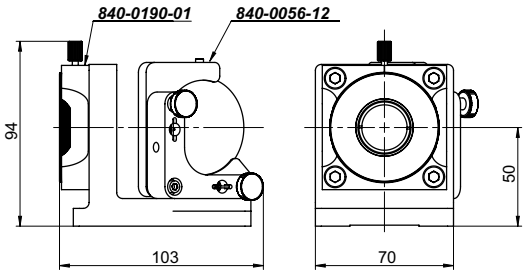
- **Divides laser beam into two beams of manually adjustable intensity ratio separated by 68° angle**
- **Large dynamic range**
- **Trasmitted beam shift ~1 mm**
- **High optical damage threshold**
- **Look online for motorized version 990-0072M**

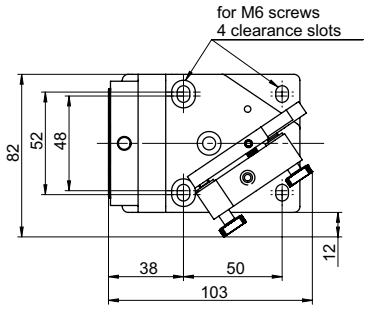
This variable attenuator/beamsplitter consists of Polarizer Holder 840-0190-01 and Kinematic Mirror/Beamsplitter Mount 840-0056-12. UVFS Thin Film Brewster type polarizer diameter 50.8 mm, which reflect s-polarized light while transmitting p-polarized light, is housed into Beamsplitter Mount 840-0056-12. 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.







*Check **www.eksmaoptics.com** for motorized version **990-0072M***

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 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 Nd:YAG Laser Applications

Catalogue number	Wavelength, nm	Price, EUR
990-0072-266H*	266	1085
990-0072-355	355	765
990-0072-532	532	735
990-0072-1064	1064	755

* *A quartz Zero Order Air-Spaced Half Waveplate clear aperture Ø22 mm is housed in rotating holder 840-0190-01.*

For Femtosecond Applications

Catalogue number	Wavelength, nm	Price, EUR
990-0072-266	266	950
990-0072-343	343	895
990-0072-400	400	865
990-0072-515	515	865
990-0072-800	800	880
990-0072-800B	780-820	980
990-0072-1030	1030	890
990-0072-1030B	1010-1050	980

For High Power Femtosecond Applications

Catalogue number	Wavelength, nm	Price, EUR
990-0072-266H	266	1085
990-0072-343H	343	1030
990-0072-400H	400	1000
990-0072-515H	515	1000
990-0072-800H	800	1015
990-0072-800HB	780-820	1115
990-0072-1030H	1030	1025
990-0072-1030HB	1010-1050	1115

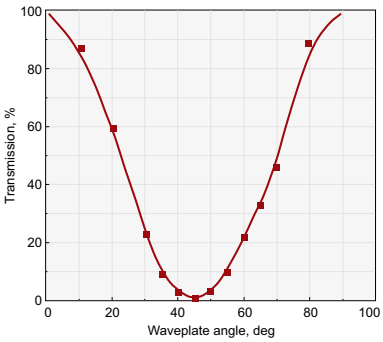
990-0073 VARIABLE ATTENUATOR FOR FEMTOSECOND AND Nd:YAG LASER PULSES

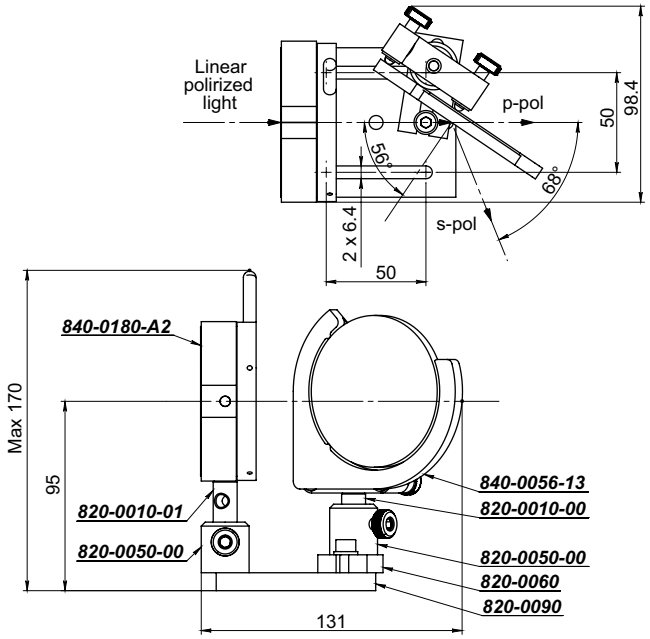
- **Divides laser beam into two beams of manually adjustable intensity ratio separated by 68° angle**
- **Large dynamic range**
- **Trasmitted beam shift ~1.4 mm**
- **High optical damage threshold**
- **Motorized version available on request**

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 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 Nd:YAG Laser Applications

Catalogue number	Wavelength, nm	Price, EUR
990-0073-266H*	266	1790
990-0073-355	355	1460
990-0073-532	532	1440
990-0073-1064	1064	1515

* *Zero Order Air-Spaced half waveplate is housed in rotating holder.*

For Femtosecond Applications

Catalogue number	Wavelength, nm	Price, EUR
990-0073-266	266	1690
990-0073-343	343	1560
990-0073-400	400	1540
990-0073-515	515	1540
990-0073-800	800	1560
990-0073-800B	780-820	1790
990-0073-1030	1030	1615
990-0073-1030B	1010-1050	1850

For High Power Femtosecond Applications

Catalogue number	Wavelength, nm	Price, EUR
990-0073-266H	266	1790
990-0073-343H	343	1660
990-0073-400H	400	1640
990-0073-515H	515	1640
990-0073-800H	800	1660
990-0073-800HB	780-820	1890
990-0073-1030H	1030	1715
990-0073-1030HB	1010-1050	1950

990-0400 FILTERS HOLDER WITH 90° FLIP

990-0415

990-0423

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.

Catalogue number	Acceptable filters number	Suitable filters diameter, mm	Clear aperture diameter, mm	Weight, kg	Price, EUR
990-0415	5	25.4	23	0.16	155
990-0415ND	5	25.4	23	0.19	250
990-0423	3	50.8	48	0.22	145

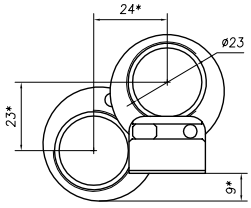
- **Allows stacking of 5 filters of Ø25,4 mm (1"), or 3 filters of Ø50,8 (2")**
- **Fast flipping in and out of beam path**
- **Available to be used in 90° position**
- **Has one M4, two M6 and two holes Ø 6.4mm for mounting on posts or table bases**
- **Large aperture allows to attenuate large diameter laser beam**
- **Black Anodized Aluminium and Brass screws**

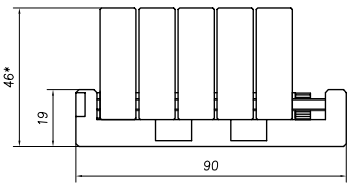
***990-0415** at 0° position*

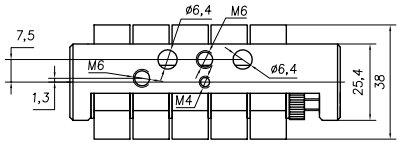
(Note: Solid base height extender 820-0210 should be ordered seperately)

***990-0423** at 0° position*

(Note: Solid base height extender 820-0210 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

990-0800 AIR-COOLED BEAM DUMP

990-0800

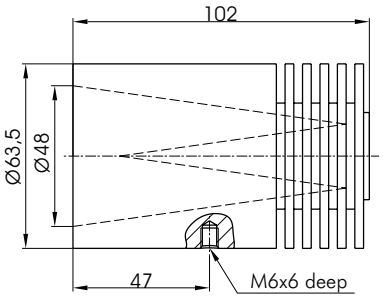
Beam Dump 990-0800 is designed to block CW or pulsed laser beams. It can be used on beams of up to 50 W in the wavelength range from 0.1 to 30 µm.

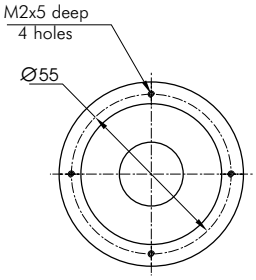
Due to the design of the beam dump, even if the non-reflective coating is damaged by high intensity pulses, there is no backward reflection.

SPECIFICATIONS

Wavelength range	0.1-30 µm
Max. Handling power	50 W
Max. Energy	2.5 J (20 Hz)
Acceptance aperture	48 mm (1.89")
Laser type	pulsed, CW

Code	Weight, kg	Price, EUR
990-0800	0.57	169





990-0820 WATER-COOLED BEAM DUMP

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.

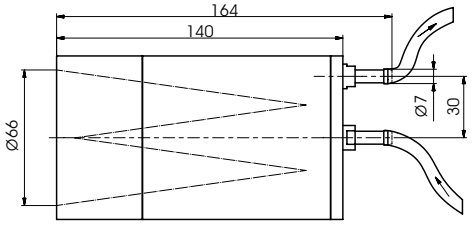
Even if the non-reflective coating is damaged by high intensity pulses, the beam is not reflected back into your optical scheme.

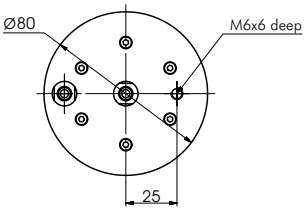
The dump mounts on M6 hole on its back.

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

Code	Weight, kg	Price, EUR
990-0820	1.2	239





Optics

Nonlinear and Laser Crystals

Pockels Cells and Drivers

Opto-Mechanics

Optical Systems

Nd:YAG Laserline Components

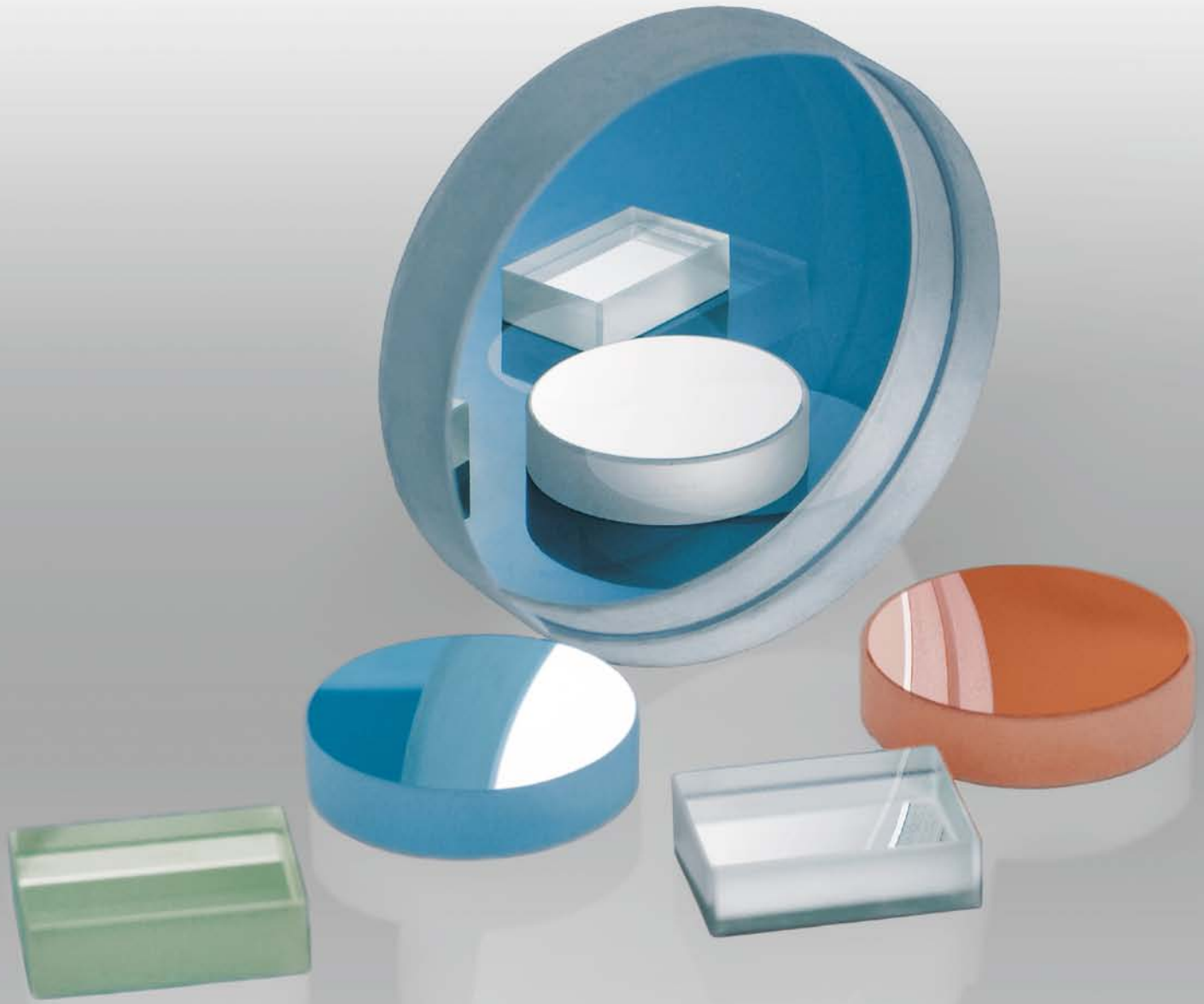
Femtoline Components

Ultrafast Pulse Picking Solutions

EKSMA OPTICS

A reliable partner for more than 30 years

for OEM and R&D customers



Optical Tables

*Honeycomb Table Tops **720 – 740***
online

*Honeycomb Breadboards **704 – 712***
online

*Aluminium Breadboards **715***
online

*Solid steel Breadboard **716***
online

*Pneumatic Vibration Isolation System **740***
online

*Pneumatic Vibration Isolation Workstation **740W***
online

*Pneumatic Vibration Isolation System **742***
online

*Optical Table Supports **765 • 766***
online

*Active Vibration Isolation System **770-5060***
online

*Active Vibration Isolation Workstation **778-5060***
online

*Active Vibration Isolation System **776-0200***
online

*Laboratory Rack Device **790***
online

*Table Connectors **791***
online

*Laser Shelves **792***
online

*Protective Screens **793***
online

*Instrument Shelves **794***
online

*Laminar Tabletop Workstation **750***
online

Brackets & Rails

*Narrow Aluminium Optical Rail **810-0001***
online

*Narrow Aluminium Rail Carriers **810-0002***
online

*Aluminium Optical Rails **810-0005***
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*Aluminium Rail Carriers **810-0007***
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*Steel Optical Rails **810-0010***
online

*Steel Rail Carriers **810-0020***
online

*Sliding Rail Carrier **810-0030***
online

*Multiple Mounting Plates **810-0035***
online

*Large Rods **810-0040; -0050***
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*Vertical Positioner **810-0060***
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*Large Rod Mounting Clamp **810-0061***
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*Large Rod Small Mounting Clamp (aluminium) **810-0062A***
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*Periscope on Silent Rods **810-0065***
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*Periscope on Large Rods **810-0067***
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*Large Table Base **810-0070***
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*Angle Brackets **810-0080; -0090***
online

*Angle Brackets **810-0100***
online

*Angle Brackets **810-0110***
online

Angle Brackets **810-0112**
online

Angle Brackets **810-0115**
online

Angle Brackets **810-0116**
online

Angle Brackets **810-0120**
online

Mini Angle Brackets **810-0130**
online

Angle Brackets **810-0140**
online

Angle Brackets **810-0145**
online

Angle Brackets **810-0146**
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Angle Brackets **810-0150**
online

Angle Brackets **810-0150-01**
online

Angle Brackets **810-0160**
online

Base Mounts & Accessories

Silent Rods **795-0010**
online

Thread Adapters **795-0016**
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Standard Rods **820-0010; -0020**
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Collar **820-0030**
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Rod Translators **820-0040**
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Translating Post Holder **820-0045**
online

Rod Holders **820-0050**
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Rod Holder with Base Adapter **820-0051**
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Fixed Pedestals **820-0055**
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Movable Base **820-0060**
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Movable Base **820-0070**
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Movable Base **820-0080**
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Movable Base **820-0090**
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Movable Base **820-0100**
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Table Bases **820-0110**
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Base Plates with eccentric clamp **820-0120**
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Table Clamp **820-0125**
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Base Plate with Rotary Clamp **820-0130**
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Universal Base Plates **820-0135**
online

Universal Base Plates **820-0136**
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Low-profile Magnetic Base **820-0140**
online

Compact Magnetic Bases **820-0150**
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Riser Blocks **820-0160; -0170**
online

Rod Clamp **820-0180**
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Rod Clamp **820-0190**
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Rod Clamp **820-0200**
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Solid Base Height Extenders **820-0210; -0220**
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Rod Holders Base Adapter **820-0225**
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Table Clamps **820-0230**
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Table Clamps **820-0240**
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Connecting Cones **820-0250; -0254**
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Hex key **820-0270**
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Self-Centering Lens/Optics Mounts ***830-0027-08***
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Large Adjustable Kinematic Optical Mount ***840-0005***
online

Precise Adjustable Kinematic Mount for Large Optics ***840-0005-05***
online

Large Optical Mount ***840-0006***
online

Self-centring Large Aperture Optical Mount ***840-0007***
online

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online

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online

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online

Gimbal Mount ***840-0096***
online

Round Optics Adapter ***840-0100-A1***
online

Miniature Clamp ***840-0100-A2***
online

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online

Prism and Polarizing Cube Adapters ***840-0100-A4***
online

Platform Adapter ***840-0100-A5***
online

Small Optical Mount of Side Drive ***840-0102-T***
online

Mirror Mounts of Side Regulation ***840-0110-T***
online

Round Optics Adapters ***840-0110-A1***
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Miniature Clamp ***840-0110-A2***
online

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840-0110-A5
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online

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840-0115
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840-0116
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online

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online

Beamsplitter / Mirror Mounts ***840-3120-B***
online

Mirror Optical Mount
840-4120-B
online

Objective Mount
840-0120-T
online

Beamsplitters / Optics Mount ***840-0130-T***
online

Universal Mirror Mount / Platform
840-0140-T
online

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online

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840-0197
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840-0210
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Kinematic Vertical Drive Optical Mount/Vertical Drive Optical Mount
840-0220; -0225
online

Kinematic Vertical Drive Optical Mount
840-0230
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840-0240
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Multi-Axis Tilt Platform
850-0010
online

Kinematic Bases
850-0020; -0022
online

Magnetic Kinematic Base ***850-0030***
online

Single Axis Tilt Stage
850-0040
online

Adjustable Laser / Laser Head Holder
850-0095
online

Adjustable Height Platform ***850-0200***
online

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Fine Closed Screw ***870-0030***
online

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online

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online

High-Resolution Micrometers ***870-0050***
online

Mini Micrometers ***870-0055***
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Compact Fine Screws ***870-0060***
online

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Motorized Mirror Mounts ***940-0050***
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Motorized Mirror / Beamsplitter Mount ***940-0060***
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Vacuum Compatible Motorized Vertical Drive Optical Mount with DC motor ***940-0080***
online

Motorized Flipper Mount ***940-0090***
online

Motorized Gimbal Mount ***940-0096***
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Motorized Vertical Translation Stage ***940-0200***
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Motorized Precision Vertical Positioner ***940-0218***
online

Motorized Vertical Lift Stage ***940-0220***
online

Narrow Motorized Translation Stage with Stepper Motor ***960-0050***
online

Narrow Motorized Translation Stage with Vacuum Compatible Stepper Motor ***960-0050V***
online

Narrow Motorized Translation Stages with DC Motors ***961-0050; 962-0050***
online

Narrow (width 30 mm) Motorized Translation Stages ***960-0060-01; -04***
online

Medium (width 50 mm) Motorized Translation Stages ***960-0060-06; -12***
online

Vacuum Compatible Motorized Stages ***960-0060V***
online

Motorized Translation Stage ***960-0065***
online

Motorized Translation Stage ***960-0080***
online

Motorized Translation Stage ***960-0090***
online

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Long-Travel Motorized Linear Stages ***960-0110***
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Long-Travel Motorized Linear Stages ***960-0115***
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online

Motorized Rotation Stages ***960-0140***
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Motorized Rotation Stages ***960-0150***
online

Motorized Rotation Stages with SM System ***960-0140SM***
online

Motorized Rotation Stages with SM System ***960-0150SM***
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Universal Motorized Rotation Stage ***960-0190***
online

Motorized Vertical Translation Stage ***960-0199***
online

Large Motorized Rotation Stage ***960-0250***
online

Narrow Motorized Translation Stage with DC Motor ***961-0060***
online

Narrow Motorized Translation Stage with Vacuum Compatible DC Motor ***961-0060V***
online

Motorized Screws ***970-0040***
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Motorized Actuator ***970-0050***
online

Compact Motorized Actuator ***970-0060***
online

Motorized Actuator ***970-0065***
online

Ultra-High Resolution Compact Motorized Actuator (DC Motor) ***970-0067***
online

Ultra-High Resolution Compact Motorized Actuator with Vacuum Compatible DC motor ***970-0067V***
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Motorized Fiber Coupling Stage ***970-0070***
online

Motorized Translation Stage ***970-0080***
online

Motorized Translation Stage ***970-0085***
online

Motorized Rotation and Tilt Stage ***970-0090***
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page 7.100

Optical Systems

EKSMA OPTICS

Beam Expanders

F-Theta Lenses

Variable Attenuators
for Linearly Polarized Laser Pulses

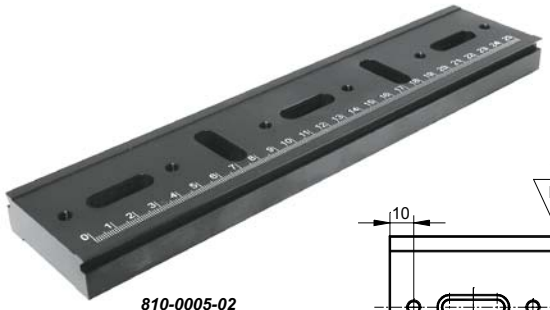
Gauss-to-Top Hat Beam Shaping lenses

Brackets & Rails

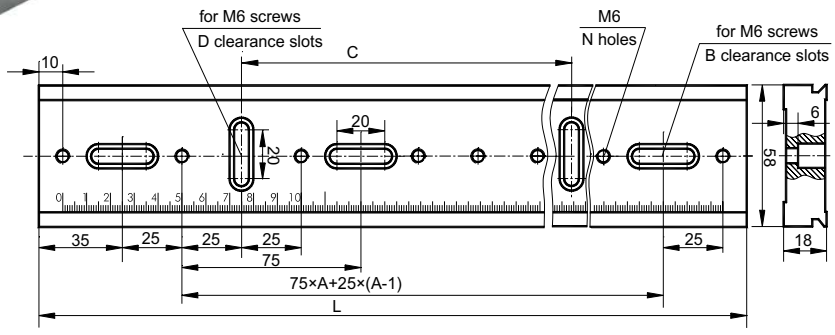
810-0005 ALUMINIUM OPTICAL RAILS

- Easy sliding and fixing
- Scale engraved
- Material: black anodized aluminium
- High stability

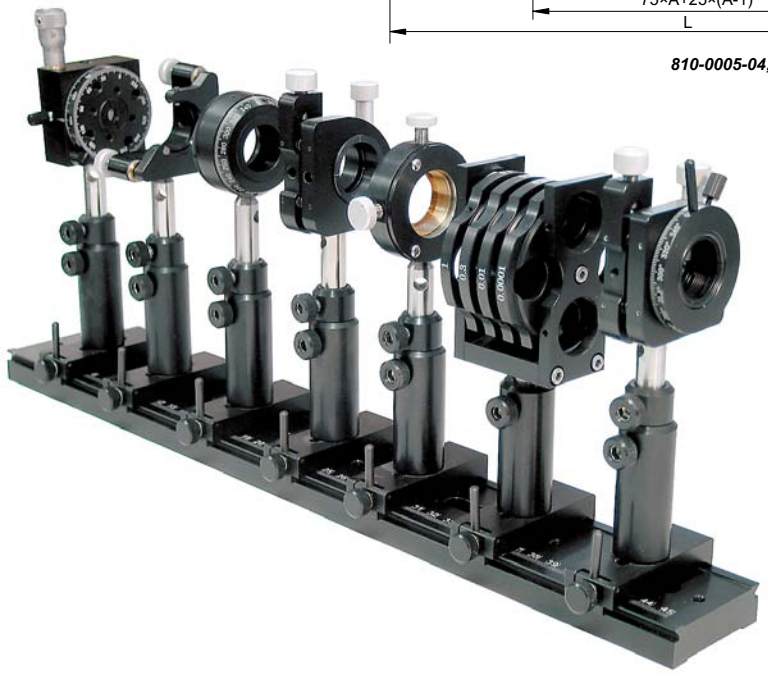
Code	Length, mm	A	N	B	D	C, mm	Weight, kg	Price, EUR
810-0005-01	150	–	3	2	1	–	0.36	64
810-0005-02	270	2	6	3	2	100	0.66	88
810-0005-04	470	4	12	5	2	300	1.16	109
810-0005-06	670	6	18	7	2	500	1.65	149
810-0005-08	800	7	22	8	2	600	2.00	225
810-0005-10	1000	9	28	10	2	800	2.40	295



810-0005-02



810-0005-04; 810-0005-06



For drawings of other Aluminium Optical Rail models please visit www.eksmaoptics.com

810-0007 ALUMINIUM RAIL CARRIERS

- **Two locking options: by integrated spring clip, and by a fixing screw**
- **Quick and easy sliding**
- **Material: black anodized aluminium**

Components are attached to the carriers by M6 screws from beneath or from the top through M6 mounting holes.

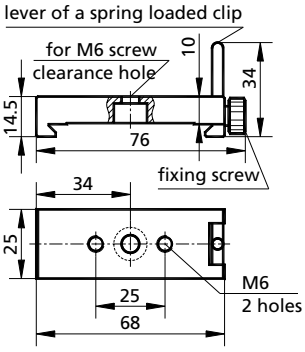
To release and to move, or to lift the carrier push the lever of the clip. To stop the carrier firmly, use the fixing screw. Rather than grinding against, and damaging the rail with its tip, the screw gently clamps to the rail the wide tenon of the clip.

The clip is preloaded by a spring. Its lever is removable (on a thread).

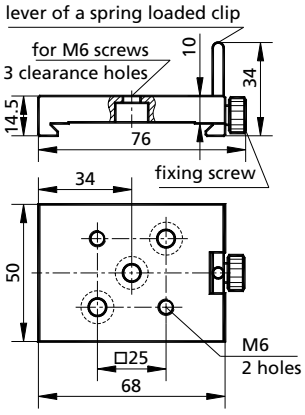
810-0007-06

810-0007-02

Code	Weight, kg	Price, EUR
810-0007-02	0.09	64
810-0007-06	0.05	57



810-0007-06



810-0007-02

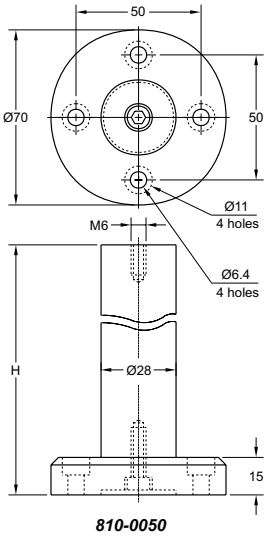
810-0040 • 810-0050 LARGE RODS

Large rod with rod base 810-0051

Large rod without rod base 810-0040

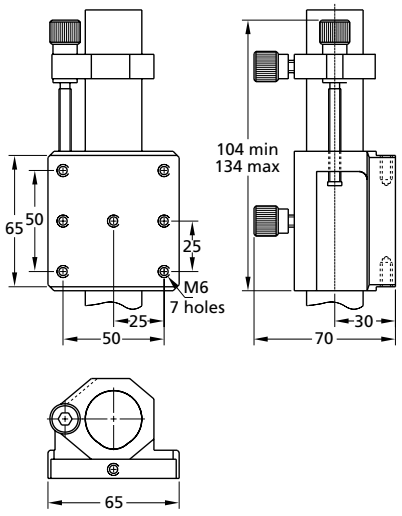
Code	Description	Height (H), mm	Weight, kg	Price, EUR
810-0040	Large Rod	300	1.42	31
810-0042	Large Rod	400	1.90	61
810-0050	Large Rod with black oxidized steel base	315	1.85	41
810-0051	Large Rod with stainless steel base	315	1.85	48
810-0052	Large Rod with black oxidized steel base	415	2.33	71
810-0053	Large Rod with stainless steel base	415	2.33	78

The main use of model 810-0040 precision grounded stainless steel rod is vertical positioner mounting. The 810-0050 is a large rod with a rod base. These rods could be stably mounted on any surface with M6 tapped holes on 25 mm centers.



810-0050

810-0060 VERTICAL POSITIONER



Mounting option:
*Large Rod with Rod Base **810-0051***
*Vertical Positioner **810-0060***
*Movable Base **820-0090***

Complementary Products

Code	Page
810-0050	7.10
810-0051	7.10
810-0060	7.11
810-0080	online
810-0090	online
820-0070	7.19
820-0090	7.19
840-0020	7.33
840-0115	7.41
092-0015	1.24

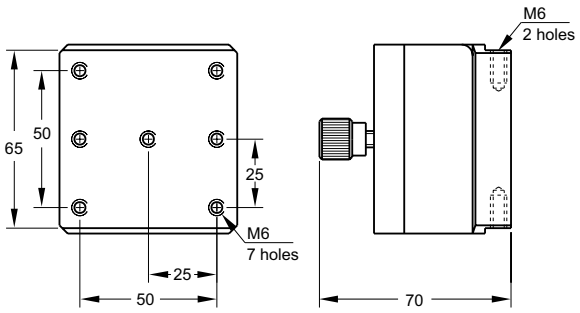
The 810-0060 positioner has one mounting surface with M6 tapped holes. It provides coarse and smooth vertical positioning of mounted components. Regulating screw thread is M6 × 0.5 mm. The 820-0090 base and the 810-0080, 810-0090 angle brackets can be fastened to the edge or to the mounting surface of positioner.
Finish: black oxidized steel.

Code	Weight, kg	Price, EUR
810-0060	1.00	61

Mounting option – Periscope:
*Large Rod with Rod Base **810-0050**,*
*Large Rod Mounting Clamp **810-0061**,*
*Movable Base **820-0090**,*
*Kinematic Mirror and Beamsplitter Mount **840-0020**,*
*Adapter for Mirror at 45° **840-0115** (2 pcs.),*
*Vertical Positioner **810-0060**,*
*Movable Base **820-0070** (2 pcs.),*
*Mirrors **092-0015***

Mounting option – Periscope:
*Large Rod with Rod Base **810-0050**,*
*Kinematic Mirror and Beamsplitter Mount **840-0020**,*
*Adapter for Mirror at 45° **840-0115** (2 pcs.),*
*Vertical Positioner **810-0060** (2 pcs.),*
*Movable Base **820-0070** (2 pcs.),*
*Mirrors **092-0015***

810-0061 LARGE ROD MOUNTING CLAMP



The Mounting Large Rod Clamp 810-0061 has one mounting surface with M6 holes. It provides coarse vertical positioning of mounted components along the large rod 810-0040 or 810-0050. 820-0090 and 820-0060 bases and 810-0080, 810-0090 angle brackets can be fastened to the edge or to the mounting surface of positioner.
Finish: black oxidized steel.

Code	Weight, kg	Price, EUR
810-0061	1.00	49

Complementary Products

Code	Page
810-0040	7.10
810-0050	7.10
810-0080	online
810-0090	online
820-0060	7.18
820-0090	7.19
860-0010 XYZ	7.57
860-0110	7.80

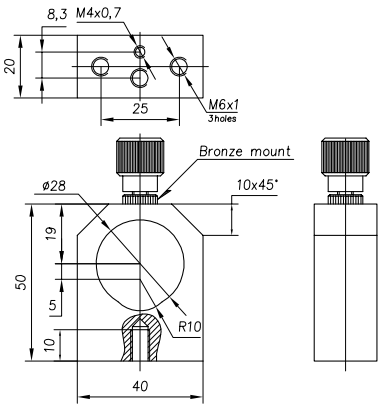
*Mounting option: Large Rod with Rod Base **810-0050**, Large Rod Mounting Clamp **810-0061**, Movable Base **820-0090**, Tilt/Rotation Stage **860-0110***

*Mounting option: Large Rod with Rod Base **810-0050**, Large Rod Mounting Clamp **810-0061**, Movable Base **820-0090**, Compact Translation Stages **860-0010** XYZ*

*Mounting option: Large Rod with Rod Base **810-0050**, Large Rod Mounting Clamp **810-0061** and Kinematic Mirror and Beamsplitter Mount **840-0020**, Movable Base **820-0060***

810-0062A LARGE ROD SMALL MOUNTING CLAMP (ALUMINIUM)

Large Rod Small Mounting Clamp 810-0062 has one mounting surface with 3 M6 holes and 1 M4 hole. It provides coarse vertical positioning of mounted components along the Large Rod 810-0040 or 810-0050. Optical mounts can be fastened using movable base 820-0060.
Material: black anodized aluminium.

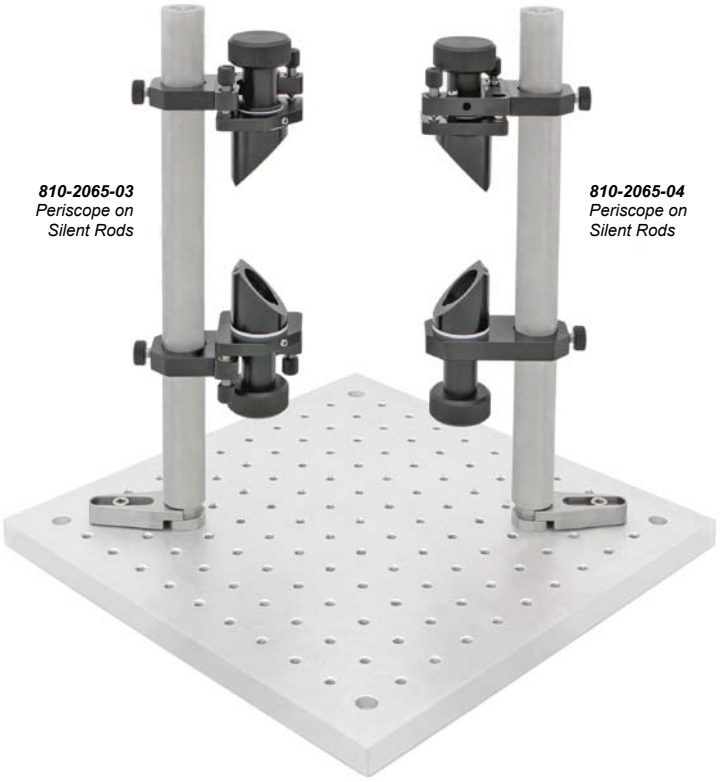


Code	Weight, kg	Price, EUR
810-0062A	0.07	22

810-0065 PERISCOPE ON SILENT RODS

- **Precise azimuth control**
- **Precise angles control**
- **1” optics mounts**
- **Stable and adjustable**

These research and industrial grade periscope assemblies are useful tools for changing beam path direction and elevation. Periscope uses a kinematic mount to create the most stable and flexible system available. While 810-2065-03 allows same functionality on top and bottom optics holders, the 810-2065-04 comes with adjustable top while bottom is rigid and offers rotation only. Optics rest against two contact lines formed at the interface and are firmly held by a plastic securing screw. Adapter easily accommodates any 1” optics.

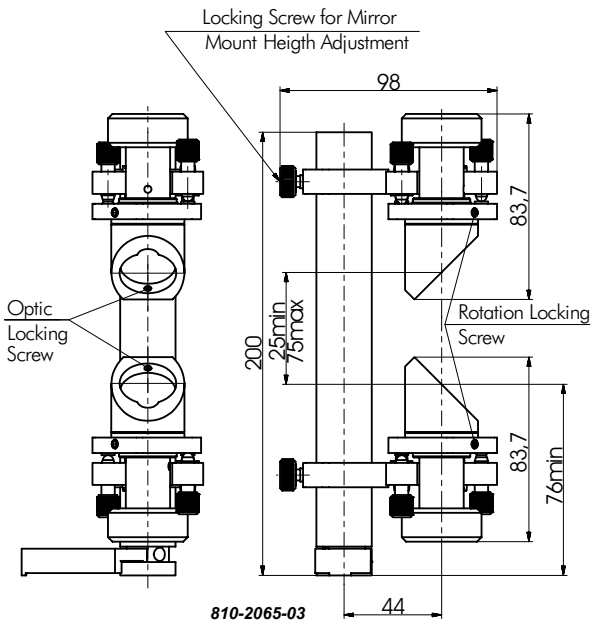


810-2065-03
Periscope on Silent Rods

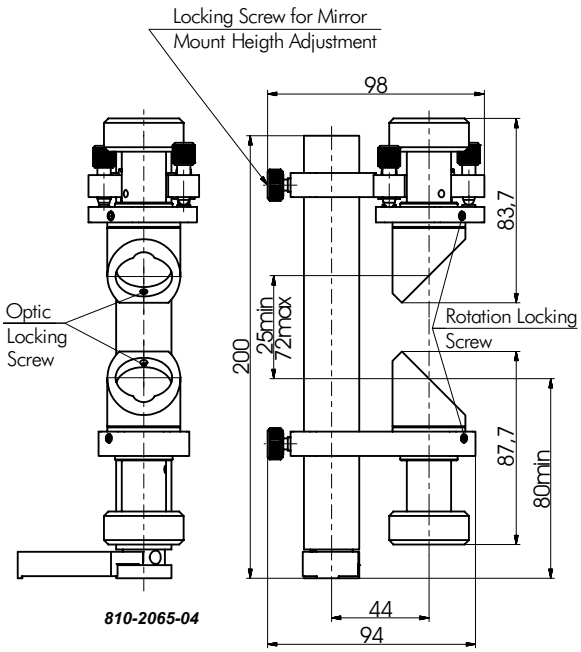
810-2065-04
Periscope on Silent Rods

SPECIFICATIONS

Optics Diameter	Ø1” (Ø25.4 mm)
Minimum Thickness of Optics	4.5 mm
Angular Adjustment Range	±4.5 °
Rotation	360 °



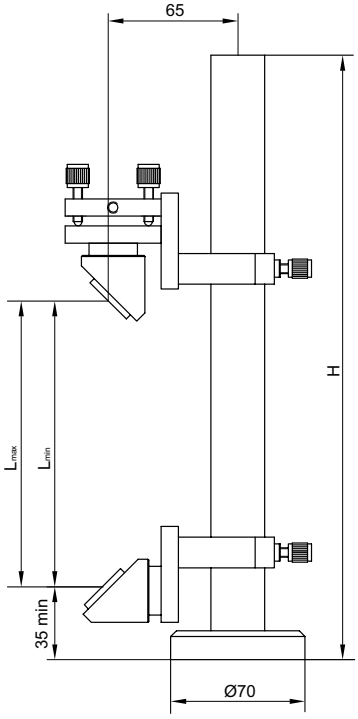
810-2065-03



810-2065-04

Code	Height, mm	Price, EUR
810-2065-03	200	259
810-2065-04	200	240

810-0067 PERISCOPE ON LARGE RODS



EKSMA OPTICS offers periscope assemblies on large rods that enable to easily adjust the height and change the direction of a laser beam. The periscope assembly consists of two adapters for mirrors at 45° 840-0115 where mounted optics face each other. Mounting Clamps 810-0062A allow to adjust the distance between mirrors for a position needed.

The assemblies are available with one or two kinematic mirror mounts that have an adjustment range of 9° and sensitivity of 3 arcsec. Other kinematic mirrors for periscope (for example 840-0033 with 3 adjustment screws) are available under request.

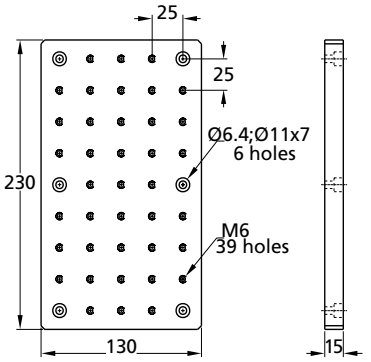
For periscope assemblies of height lower than 300 mm, please see Periscope on Silent Rods 810-0065.

Description	Code	Height (H), mm	Distance between mirrors (L_{min}…L_{max}), mm	Weight, kg	Price, EUR
Periscope on Large Rod with oxidized steel base	810-5067	315	35…250	2.25	210
Periscope on Large Rod with stainless steel base	810-5167	315	35…250	2.25	217
Periscope on Large Rod with black oxidized steel base	810-5267	415	35…350	2.73	240
Periscope on Large Rod with stainless steel base	810-5367	415	35…350	2.73	247
Periscope on Large Rod with oxidized steel base and two Kinematic Mirror Mounts	810-5066	315	35…250	2.34	275
Periscope on Large Rod with stainless steel base and two Kinematic Mirror Mounts	810-5166	315	35…250	2.34	282
Periscope on Large Rod with black oxidized steel base and two Kinematic Mirror Mounts	810-5266	415	35…350	2.82	305
Periscope on Large Rod with stainless steel base and two Kinematic Mirror Mounts	810-5366	415	35…350	2.82	312

Periscope assembly consists of:

- Large Rod with oxidized or stainless steel base, **810-0050**
- Two adapters for mirrors at 45°, **840-0115**
- Two Mounting Clamps, **810-0062A**
- Two Movable Bases, **820-0060**
- One or two Kinematic Mirror Mounts, **840-0032-80**

810-0070 LARGE TABLE BASE



The model 810-0070 Large Table Base could be used in the same way as standard table bases as well as could be mounted above the optical table (on large rods or on the side of the table). This allows to transfer subassemblies from main optical surface.
Finish: black oxidized steel.

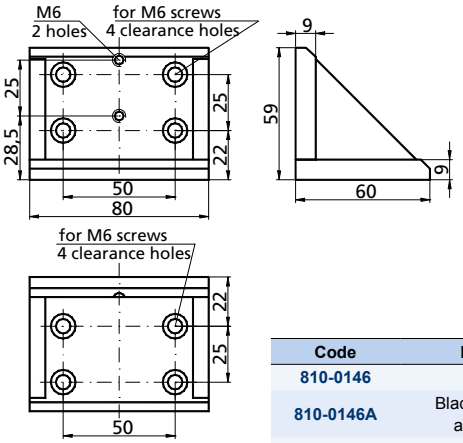
Code	Weight, kg	Price, EUR
810-0070	3.33	49

Complementary Products

Code	Page
810-0050	7.10

810-0146 ANGLE BRACKET

810-0146



810-0146SS

- **Steel, Stainless Steel or Black Anodized Aluminium**
- **Designed to be used with:**
  - **Stable Steel Translation Stages 860-0052**
  - **Stable Aluminium Translation Stages 860-0053**

Code	Material	Weight, kg	Price, EUR
810-0146	Steel	0.24	55
810-0146A	Black anodized aluminium	0.16	49
810-0146SS	Stainless steel	0.24	55

Complementary Products

Code	Page
860-0052	7.59
860-0053	7.60

860-0053 XYZ

860-0052-SS XYZ

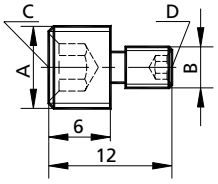
860-0052 XYZ

Base Mounts & Accessories

795-0016 THREAD ADAPTERS

Thread Adapters 795-0016 are used to connect components when precise orientation in plane is not required. Some adapters have different threads on ends. So, you can connect components with M4 and M6 threaded holes. Material: stainless steel.

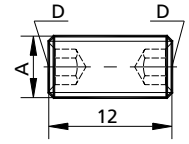
Metric/imperial thread adapters are available on request.



Model	A	B	C	D	Price, EUR
795-0016-43	M4	M3	2	1.5	2.25
795-0016-63	M6	M3	3	1.5	2.25
795-0016-64	M6	M4	3	2	1.5
795-0016-84	M8	M4	4	2	2.25
795-0016-81	8-32	1/4-20	2	3	2.25

Model	A	B	C	D	Price, EUR
795-0016-44	M4	–	–	2	1.5
795-0016-66	M6	–	–	3	1.5
795-0016-85	8-32	–	–	2	1.5
795-0016-11	1/4-20	–	–	3	1.5

C and D denote hex key sizes.



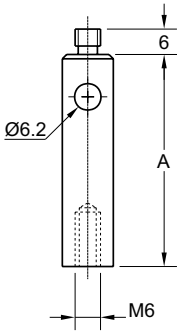
820-0010 • 820-0020 STANDARD RODS

820-0010

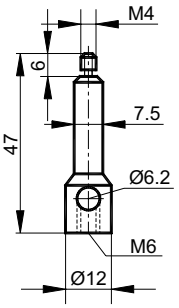
820-0010 stainless steel rods of 12 mm diameter have M6 male threads on the top and M6 tapped holes on the bottom. It allows to mount all accessories directly on the rod, or to fix the rod directly on movable bases, translators, or to connect the rods. Cross hole at the top of the rod is very convenient for rigid fastening.

820-0020-20

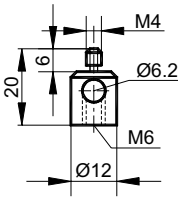
820-0020-00



820-0010



820-0020-00



820-0020-20

The rod 820-0020-00 is especially designed for Precision Mirror Mount (eg. 840-0060) as well as for other mounts with mounting holes M4.

Rod 820-0020 has M4 male thread for the top and M6 thread hole on the bottom.

Complementary Products

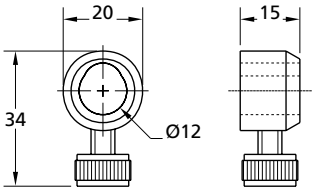
Code	Page
820-0040	7.17
820-0051	7.18
840-0060	online
820-0225	7.23

Code	Height, mm (A)	Weight, kg	Price, EUR
820-0010-00	25.4	0.02	4.4
820-0010-01	38.1	0.03	4.8
820-0010-02	50	0.04	5.2
820-0010-03	75	0.06	5.6
820-0010-04	100	0.08	6.0
820-0010-06	150	0.13	6.9
820-0010-08	200	0.18	7.9
820-0020-00	41	0.02	10.0
820-0020-20	14	0.01	6.0

820-0030 COLLAR

The 820-0030 collar allows to fix model 820-0010 standard rods at desirable height and to rotate the rod without changing height.

Finish: black anodized aluminium.



Code	Weight, kg	Price, EUR
820-0030	0.01	6.4

Complementary Products

Code	Page
820-0010	7.16

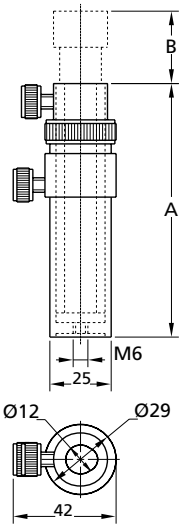
820-0040 ROD TRANSLATORS

820-0040-04 *820-0040-02*

The model 820-0040 Rod Translators provide stable mounting, vertical translation and fixing of model 820-0010 rods in place. One round turn of knurled collet produces 2 mm linear translation of rod with no rotation.

Both the rod and translator bore are double-bored to form two line contacts in the inner wall for rigid lock down. Coarse and precision adjustments are fixed by thumbscrews.

Finish: black oxidized steel.



Code	Height A, mm	Translation range B, mm	Weight, kg	Price, EUR
820-0040-02	67	16	0.22	41
820-0040-04	105	50	0.30	46

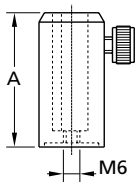
Complementary Products

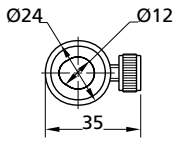
Code	Page
820-0010	7.16

820-0050 ROD HOLDERS

The model 820-0050 rod holders provide convenient and reliable model 820-0010 rod mounting and positioning at fixed height. To eliminate rod wobble, the inside diameter of rod holders is double-bored, providing two full-length contacts in the holder wall to support the rod along its entire length. Model 820-0050 holders can be mounted directly to a table by model 820-0260 screw as well as on bases, fixing by M6 bolts.

Finish: black anodized aluminium.





Code	Height A, mm	Weight, kg	Price, EUR
820-0050-00	25.4	0.02	10.0
820-0050-01	38.1	0.04	10.9
820-0050-02	50	0.05	11.8
820-0050-03	75	0.06	12.5
820-0050-04	80	0.07	12.7
820-0050-06	100	0.08	13.2
820-0050-08	150	0.11	17.3

Complementary Products

Code	Page
820-0010	7.16
820-0260	7.24

820-0051 ROD HOLDER WITH BASE ADAPTER

Complementary Products

Code	Page
820-0010	7.16
820-0125	7.20

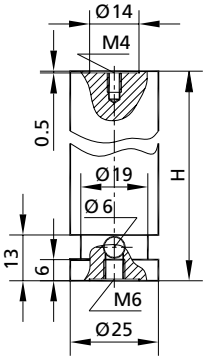
Rod holder with base adapter 820-0051 provides convenient mounting of the rod 820-0010 to an optical table using table clamp 820-0125. This combination ensures the the positioning and alignment of various optical mounts using our Standard Rods 820-0010.

Table clamp
820-0125

Code	Height A, mm	Weight, kg	Price, EUR
820-0051-00	38.1	0.06	16.0
820-0051-01	50.8	0.08	16.9
820-0051-02	62.7	0.09	17.8
820-0051-03	87.7	0.10	18.5
820-0051-04	92.7	0.11	18.7
820-0051-06	112.7	0.13	19.2
820-0051-08	162.7	0.16	23.3

820-0055 FIXED PEDESTALS

- **Solid (Ø25 mm) stainless steel rod**
- **Random positioning**
- **Exceptional stability**



Code	Height H, mm	Weight, kg	Price, EUR
820-0055-05	25	0.08	16
820-0055-10	50	0.17	18
820-0055-15	75	0.26	20
820-0055-20	100	0.36	22
820-0055-30	150	0.55	24
820-0055-40	200	0.72	28

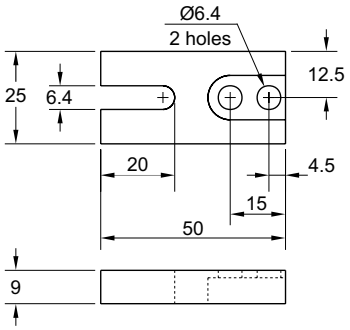
Complementary Products

Code	Page
795-0016	7.16
820-0125	7.20

820-0060 MOVABLE BASE

The 820-0060 movable base is especially convenient for close space situations. Its primary use is to position rods and small riser blocks.

Finish: anodized aluminium.

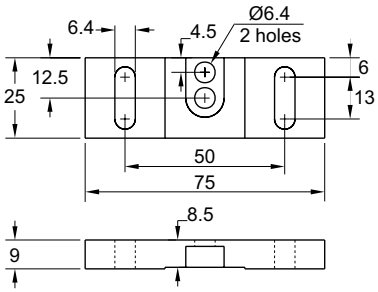


Code	Weight, kg	Price, EUR
820-0060	0.03	7.3

820-0070 MOVABLE BASE

The 820-0070 movable base has 13 mm translation range. It is useful for small rod holders and riser blocks mounting.
Finish: anodized aluminium.

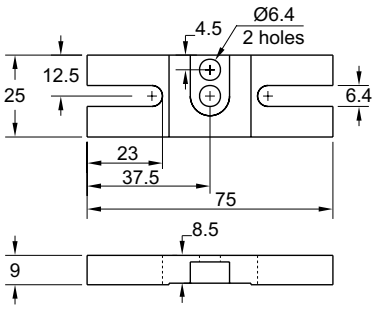
Code	Weight, kg	Price, EUR
820-0070	0.04	8.6



820-0080 MOVABLE BASE

The 820-0080 movable base provides translation of mounted rod holders, translators over 13 mm range with rigid lockdown.
Finish: anodized aluminium.

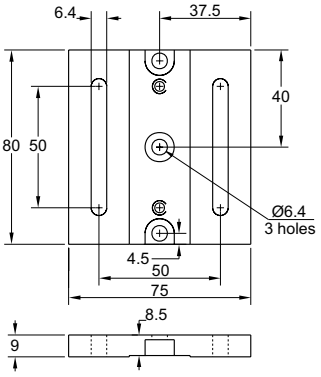
Code	Weight, kg	Price, EUR
820-0080	0.04	7.7



820-0090 MOVABLE BASE

The 820-0090 movable base provides 50 mm longitudinal translation of one or two mounted rod holders, translators or riser blocks.
Finish: black anodized aluminium.

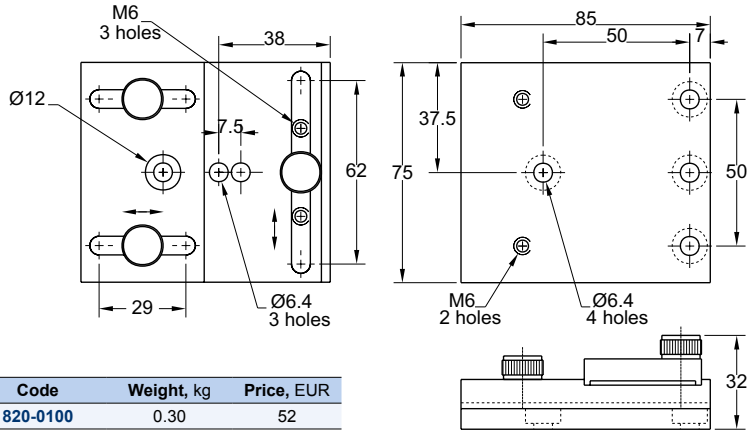
Code	Weight, kg	Price, EUR
820-0090	0.12	12.7



820-0100 MOVABLE BASE

The 820-0100 adjustable base provides separate X-Y adjustment. It is cost-effective solution of non-critical two axes positioning of rod holders, translators and riser blocks.
Finish: black anodized aluminium.

Code	Weight, kg	Price, EUR
820-0100	0.30	52



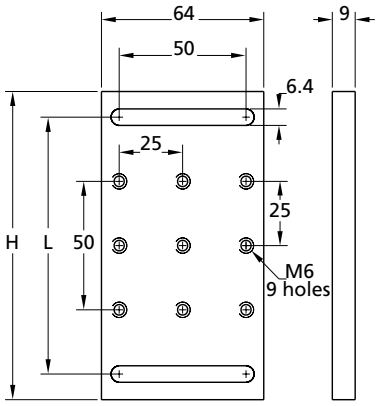
820-0110 TABLE BASES

820-0110-02

820-0110-04

The 820-0110-02 and 820-0110-04 standart table bases with 9 and 12 threaded M6 holes respectively allow positioning of all basemounted accessories with M6 tapped holes or male threads anywhere on a table fixing by M6 screws or 820-0230-02 and 820-0230-04 table clamps. Two slots, with 100 or 125 mm distance allow longtitudinal positioning along a line of holes in the table.

Finish: black oxidized steel.



820-0110-02

Code	H, mm	L, mm	Weight, kg	Price, EUR
820-0110-02	120	100	0.48	13.0
820-0110-04	145	125	0.57	16.4

Complementary Products

Code	Page
820-0230-02	7.23
820-0230-04	7.23

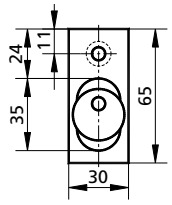
820-0120 BASE PLATES WITH ECCENTRIC CLAMP

820-0120-02 820-0120-06 820-0120-04

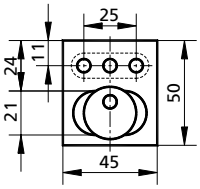
Bases 820-0120 are used to clamp posts and post holders in random positions.

Attach a post to the base using a M6 screw. Set the position. The base rotates around the clamp through 360° and translates within 10 mm. Fix the clamp with a M6 screw.

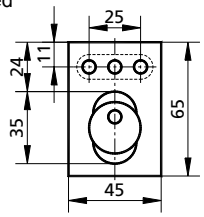
The base is made of black anodized aluminium.



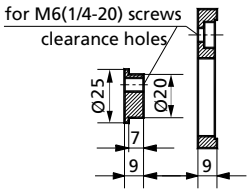
820-0120-02



820-0120-04



820-0120-06



side view of the bases

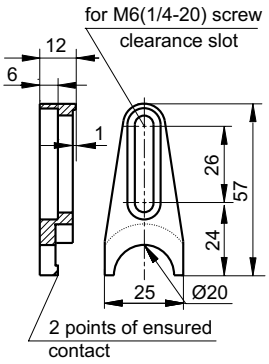
Code	Weight, kg	Price, EUR
820-0120-02	0.11	11
820-0120-04	0.12	12
820-0120-06	0.15	15

820-0125 TABLE CLAMP

820-0125 Table Clamp is used for convenient and fast mounting of 795-0010 rods, 820-0055 pedestals or 820-0051 Rod Holders with Base Adapter on optical tables or breadboards.

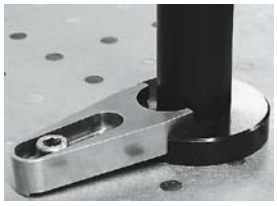
Material: stainless steel.

Code	Weight, kg	Price, EUR
820-0125	0.05	15

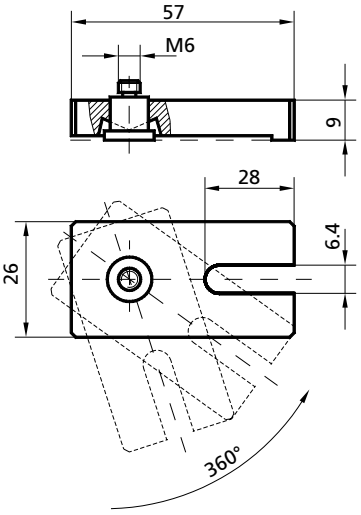


Complementary Products

Code	Page
795-0010	online
795-0016	7.16
820-0051	7.18
820-0055	7.18



820-0130 BASE PLATE WITH ROTARY CLAMP



Rotary Clamp 820-0130 is used to fasten components at random positions where they can not be fastened directly to the optical table.

Screw a post or post holder onto the clamp's knob. Then locate the component at the required position. While the knob is firmly attached to the component, it allows the plate to rotate freely. Position the plate's slot over a tapped hole and screw it down to clutch the knob. The component will remain stable.

Material: steel with chemical black finish.

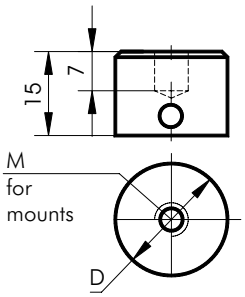
Code	Weight, kg	Price, EUR
820-0130	0.08	8

820-0150 COMPACT MAGNETIC BASES

820-0150-08

820-0150-02

Small components may be quickly positioned on ferromagnetic optical tables and breadboards or translation stages using Compact Magnetic Bases 820-0150.



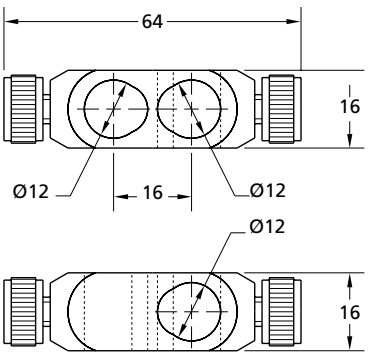
Code	D, mm	M	Holds load up to, kg	Weight, kg	Price, EUR
820-0150-02	19	M6	5	0.03	10
820-0150-04	19	M4	5	0.03	10
820-0150-06	27	M6	10	0.06	16
820-0150-08	27	M4	10	0.06	16

820-0180 ROD CLAMP

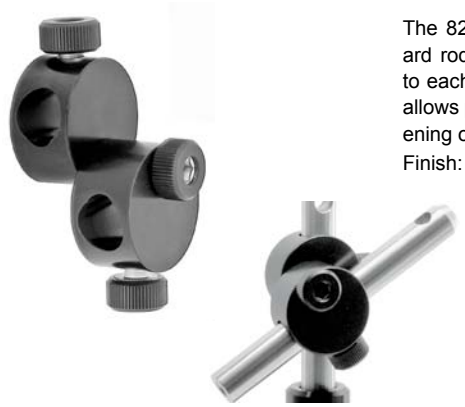
The 820-0180 clamp mounts two standard rods at right angle with respect to each other.

Finish: black anodized aluminium.

Code	Weight, kg	Price, EUR
820-0180	0.02	18

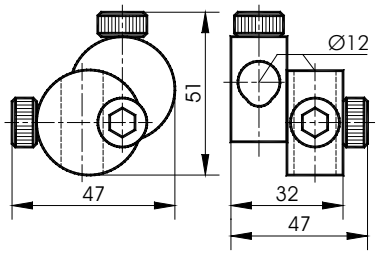


820-0190 ROD CLAMP



The 820-0190 clamp mounts two standard rods at desirable angle with respect to each other. The construction of clamp allows positioning of one rod without loosening of other.

Finish: black anodized aluminium.

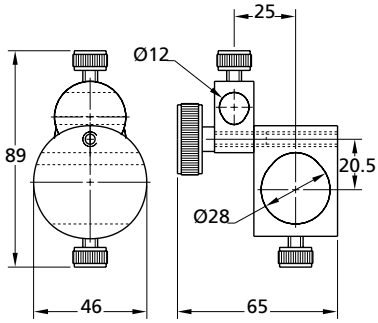


Code	Weight, kg	Price, EUR
820-0190	0.11	25

820-0200 ROD CLAMP

The 820-0200 clamp holds standard and large rods at desirable angle with respect to each other.

Finish: black anodized aluminium.



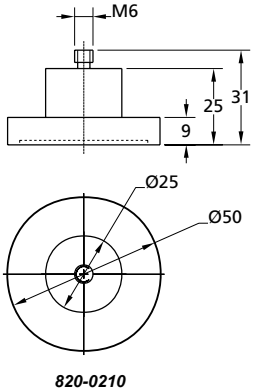
Code	Weight, kg	Price, EUR
820-0200	0.12	26

820-0210 • 820-0220 SOLID BASE HEIGHT EXTENDERS

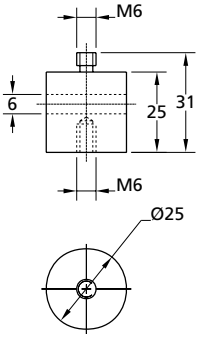
820-0210

820-0220

The 820-0210 solid base provides mounting of components at fixed optical axis height. It adds 25 mm height for every component to be mounted on. The 820-0220 height extender adds another 25 mm. After positioning solid base can be reliably fixed to a table with 820-0230-02 or 820-0230-04 clamps. Finish: black anodized aluminium.



820-0210



820-0220

Code	Weight, kg	Price, EUR
820-0210	0.06	10.5
820-0220	0.03	7.3

Complementary Products

Code	Page
820-0230	7.23

820-0225 ROD HOLDERS BASE ADAPTER

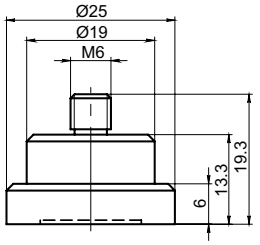
- **Designed to be used with Rod Holders 820-0050**

820-0225 Rod Holders Base Adapter can be fixed to 820-0050 Rod Holders transforming them to pedestal-style mount 820-0051 Rod Holders with Base Adapter or fixed to 820-0010 Standard Rod enabling them to be compatible with the 820-0125 Table Clamp.

Material: Stainless Steel.

Complementary Products

Code	Page
820-0010	7.16
820-0050	7.17
820-0125	7.20

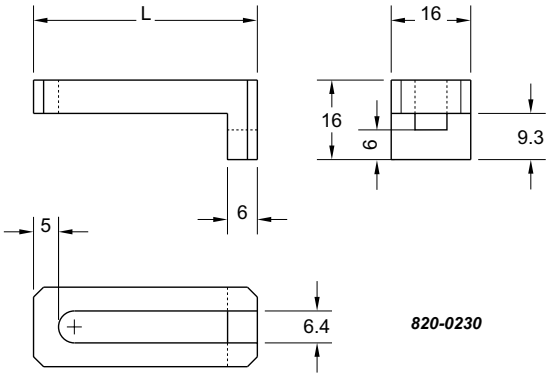


Code	Weight, kg	Price, EUR
820-0225	0.04	6

820-0230 TABLE CLAMPS

820-0230-02

820-0230-04



820-0230

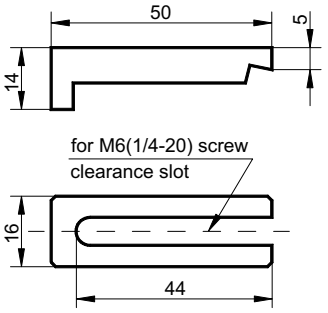
The 820-0230-02 and 820-0230-04 clamps provide fixing of movable bases and other components to a surface with M6 tapped holes. It is useful when direct mounting of components is not practical. Finish: black oxidized steel.

Code	L, mm	Weight, kg	Price, EUR
820-0230-02	45	0.026	6
820-0230-04	60	0.03	8

820-0240 TABLE CLAMP

Using Table Clamps 820-0240 you can position most base mounted components at any angle on the table and not to be limited by mounting hole pattern of the optical table. For using clamps the device is positioned so that the slot of the clamp is over the base and a screw can be inserted into a tapped hole. Tightening this screw can generate sufficient force for most mounting applications.

Material: steel with chemical black finish.

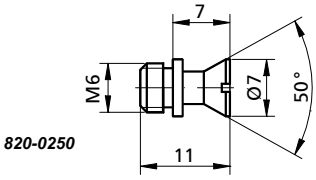


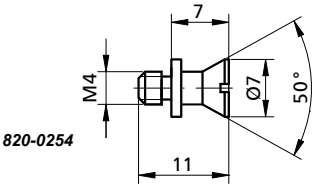
Code	Weight, kg	Price, EUR
820-0240	0.03	10

820-0250 • 820-0254 CONNECTING CONES

Connecting Cones are particularly useful for connecting elements when specific orientation plane is required, e.g. Narrow Translation Stages 860-0060-02 (860-0060-04) joined for X-Y-Z motion. Connecting cone is made of black finished steel and has M6 (M4) thread at one end and 50° cone in another. A component is fastened to the cone using an additional fastening screw.

Code	Thread	Weight, kg	Price, EUR
820-0250	M6	0.01	4.5
820-0254	M4	0.01	4.5



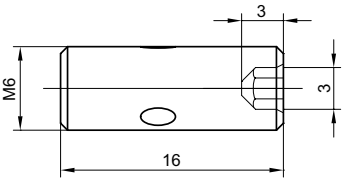


820-0270 HEX KEY

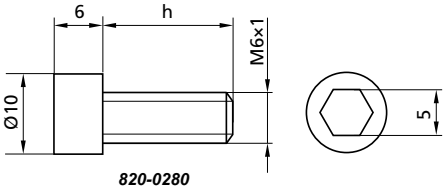
820-0260 • 820-0280 SCREWS

The “L” shaped 820-0270 hex key is very convenient in all mounting situations. The 820-0260 screw is very useful for mounting of rods, rod holders, large rod 810-0040 directly to the table top or where M6-M6 connection is required.
M6-M4 adapters are also available.

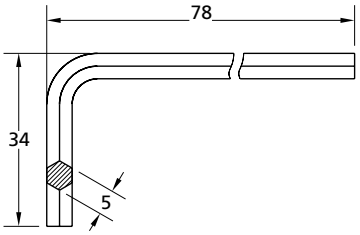
Code	Weight, kg	Price, EUR
820-0260	0.005	0.73
820-0270	0.020	0.73



820-0260



820-0280



820-0270

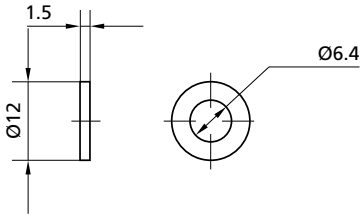
These hex socket head cap screws are available in different lengths.

Code	Length h, mm	Package	Price, EUR
820-0280-01	10	10 pcs	0.8
820-0280-02	16	10 pcs	0.9
820-0280-03	20	10 pcs	1
820-0280-04	25	10 pcs	1.1
820-0280-05	30	10 pcs	1.2
820-0280-06	45	10 pcs	1.3
820-0280-07	50	10 pcs	1.4

820-0290 WASHER

A Washer is made of black finished steel and is used for protecting of surfaces from scratches and provides more stable tightening.

Code	Package	Price, EUR
820-0290	10 pcs	0.3

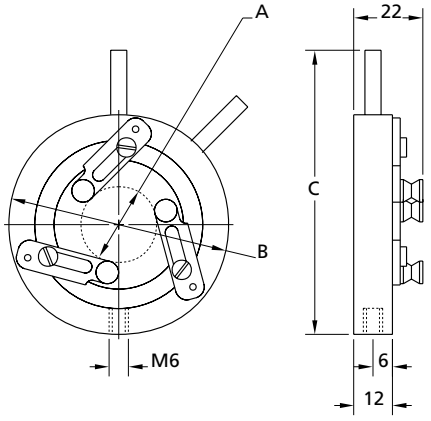


Optical Mounts

830-0010 • 830-0020 SELF-CENTRING LENS MOUNTS

830-0020

830-0010



The model 830-0010 and model 830-0020 self-centring lens mounts reliably centre and safely hold round optics and cylindrical components. Holding by three rods with V-groove tips provide easy and secure optics accommodation with high relocation repeatability.

Model 830-0010 and 830-0020 mounts may be attached to series 820-0010 standard rods and then with series 820-0050 rod holders or series 820-0040 rod translators be located on the table. Alternatively, sets of riser blocks and movable bases provide a selection of convenient, various axes height and direct location to table.

Model 830-0010 accommodates optics up to 40 mm and model 830-0020 up to 60 mm in diameter.

Finish: black anodized aluminium.

Code	Amin, mm	Amax, mm	B, mm	C, mm	Weight, kg	Price, EUR
830-0010	8	40	68	88	0.10	91
830-0020	8	60	88	108	0.13	95

Complementary Products

Code	Page
820-0010	7.16
820-0040	7.17
820-0050	7.17
820-0160	online

830-0025 SELF-CENTERING LENS/OPTICS MOUNTS

830-0025-04 *830-0025-02* *830-0025-40*

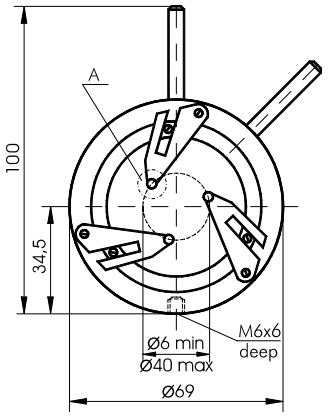
- **Automatically centers and holds optics**
- **Easy insertion and removal of optics**
- **3 M4 holes for fixing to flat object**
- **Reverse operation on request**
- **Can be motorized**
- **40 mm, 4” and 2” optics mount**

Self-Centering Lens/Optics Mounts reliably centres and securely holds round optics and cylindrical objects. This device is particularly valuable when lenses of different diameters are being used interchangeably, as repeated centering at constant height is necessary.

When released the three arms grip the lens, automatically centering the lens within the holder. Unlike other models, 830-0025 gripping mechanism controlled by pressing vertical piston down the socket. Because of such design mount can be easily motorized.

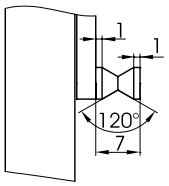
The mount can be modified on request for reverse operation – mount is closing while pushing vertical piston down. This way mount can be used to hold rings and hollow cylinders from inside.

Code	Description	Weight, kg	Price, EUR
830-0025-40	for 40 mm optics	0.07	75
830-0025-02	for 2” (50.8 mm) optics	0.19	99
830-0025-04	for 4” (101.6 mm) optics	0.38	140



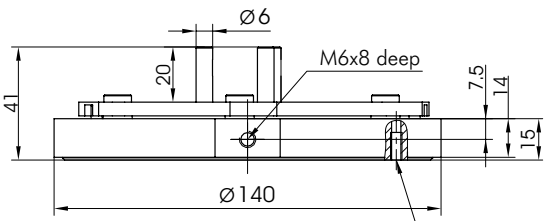
830-0025-40

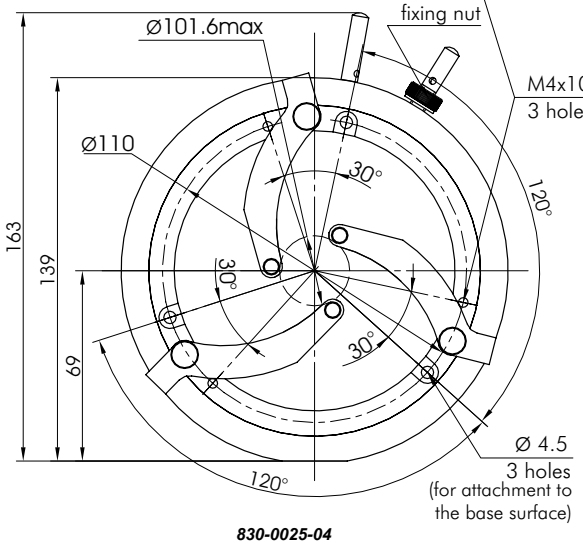
View A



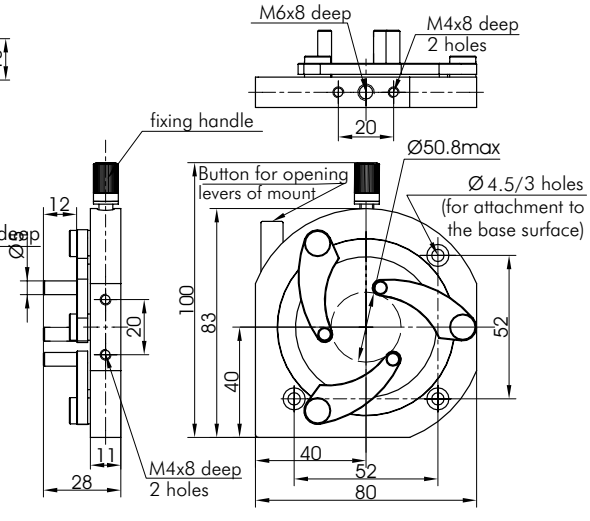
Complementary Products

Code	Page
820-0010	7.16





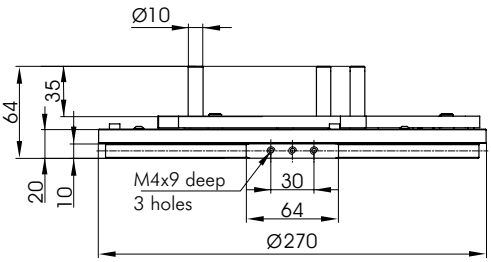
830-0025-04



830-0025-02

830-0027 SELF-CENTERING LENS/OPTICS MOUNTS

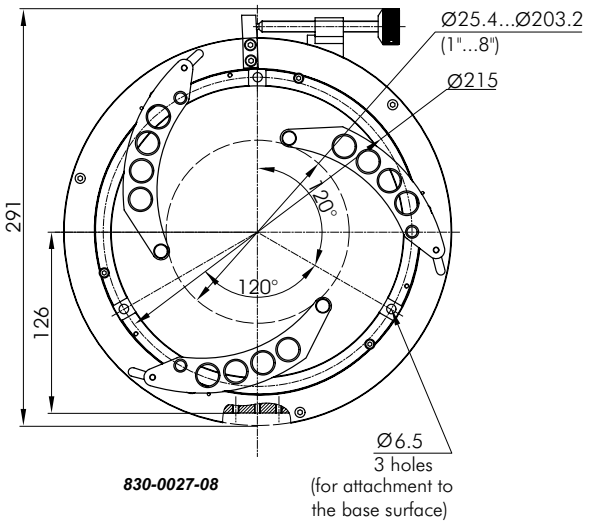
Self-Centering Optics Mount 830-0027 reliably centres and securely holds round optics and cylindrical objects. This device is particularly valuable when lenses of different diameters are being used interchangeably and repeated centering at constant height is necessary. The Self-Centering Optics Mount 830-0027-08 accommodates optics up to 8 inch (203.2 mm); 830-0027-12 – up to 12 inch (305 mm) and is oversized to provide easy finger access for inserting and removing optics. Optical elements are fixed and centered at the same time by adjusting driving screw at the top of the device. Heavy optical components are secured by wedged rods.



- **For optics up to 8” or up to 12” in diameter**
- **Adjustable range from 1” (25.0 mm) to 8” (203 mm)**
- **3 mounting holes Ø6.5 mm are made for mounting to flat object**
- **Reverse operation – holding hollow objects from inside**
- **Made of black anodized aluminium and black oxidation steel**

Catalogue number	Description	Weight, kg	Price, EUR
830-0027-08	8”; without base plate	1.8	365
830-0027-08B	8”; with a base plate	1.85	400
830-0027-12	12”; without base plate	7.35	2155
830-0027-12B	12”; with a base plate	7.55	2190

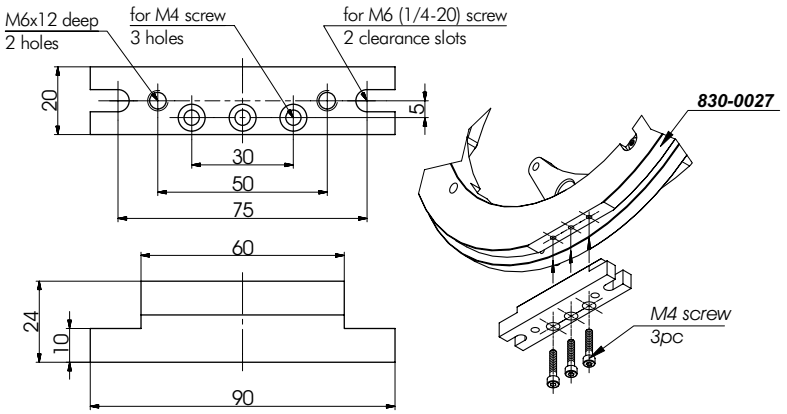
For Vacuum Compatible Self-Centering Optics Mount of 8” or Self-Centering Mount of 12” datasheets please visit www.eksmaoptics.com



830-0027-08

Base plate for 830-0027-08

Our recommended Base Plate is used to fix 830-0027 to optical table or other suitable bases. Mounting base plates of different shapes can be manufactured under customer request. Default package does not include Base Plate and it must be ordered separately.



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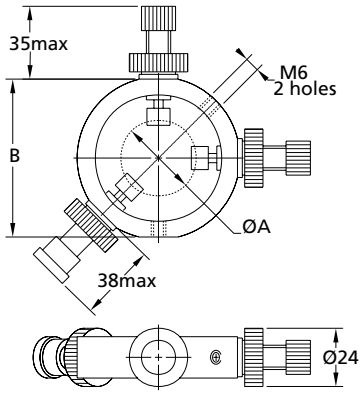
830-0030 ADJUSTABLE LENS MOUNTS

The 830-0030 series adjustable lens mounts provide convenient, precise optics centering and repeatable removal and replacing. Lenses are positioned and locked in place by three rigid shaft assemblies with V-groove tips. Each individually adjustable shaft incorporates a sliding sleeve for rough positioning and diameter setting and collet fix sleeve in place. A thumbscrews at the end of two orthogonal sleeves then provide fine X-Y position adjustment within 3 mm range.
Mounting holes on the support ring provide easy attachment to all mounting elements.
Finish: black anodized aluminium.



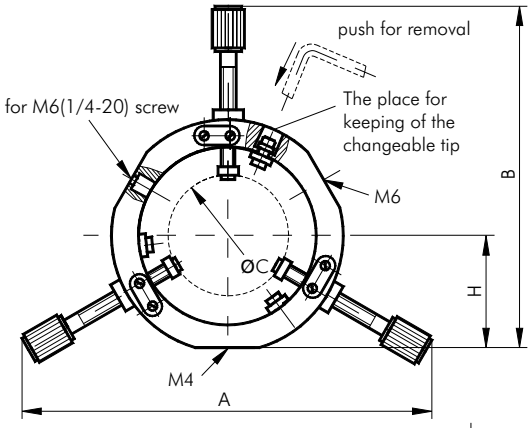
Code	Amin, mm	Amax, mm	B, mm	Weight, kg	Price, EUR
830-0030-02	20	45	65	0.21	107
830-0030-04	40	65	85	0.23	114
830-0030-06	60	85	105	0.25	121

Complementary Products

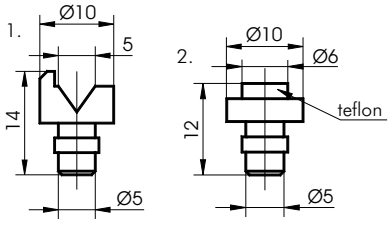
Code	Page
820-0010	7.16

830-0035 UNIVERSAL ADJUSTABLE LENS/OPTICS MOUNTS

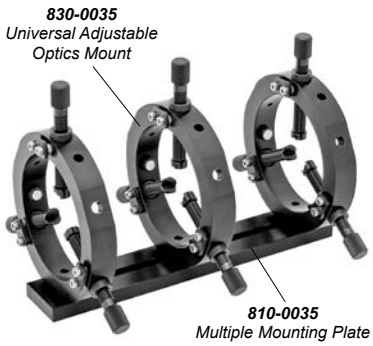
- **Holding of cylindrical objects of various diameters**
- **Three mounting options**
- **Convenient storage of tips which are not used at the moment**
- **Quick coarse positioning and diameter setting possibility**
- **Made of black anodized aluminium**



Changeable tips



Continued 830-0035



Complementary Products

Code	Page
810-0035	online

Universal Adjustable Lens/Optics Mounts 830-0035-04 and 830-0035-02 are used to accommodate any round objects of any thickness, like lenses, mirrors or lasers. Three support shafts of holder are assembled with non-rotating V-groove aluminium universal interchangeable tips for lenses mirrors, etc. While not in use the new non-abrasive flat teflon face aluminium tips for lasers are kept in special holes on aluminium support ring. Long objects like cylindrical laser heads can be held with two chucks.

Each individual adjustable shaft of holder incorporates threaded thumbscrew, sliding sleeve and fixation tool for rough positioning and diameter setting. It is enough to give only a twist thumbscrew of the shaft to provide a fine adjustment travel.

Three various mounting holes M4, M6, and Ø6.4 provides various and easy attachment possibilities to the Tables, Breadboards and Rod Holder system.

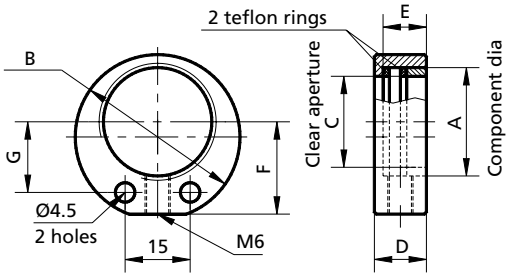
Code	A, mm	B, mm	C, mm	H, mm	Weight, kg	Price, EUR
830-0035-04	164-210	158-185	38-103	65.7	0.30	152
830-0035-02	134-164	124-141	10-66	49.1	0.25	99

830-0037 OPTICAL COMPONENT MOUNTS

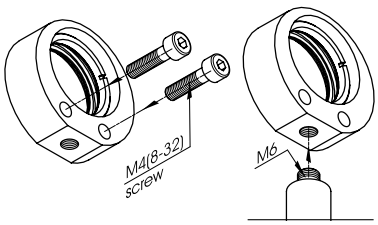
Optical Component Mounts 830-0037 can be used to hold round and thin optical elements of standard sizes. Mounts vary in dimensions so as to support diameters from 10 to 50 mm (0.5” to 2”). Original design allows to decrease the mount’s dimensions and weight.

Mounting holes: one M6 and two Ø4.5 mm.

Material: black aluminium.



Code	A	B	C	D	E	F	G	Weight, kg	Price, EUR
830-0037-10	12.7 (0.5”)	26	8	12	10	13.5	8.5	0.01	15
830-0037-20	20	33	17	12	10	18.8	13.8	0.02	18
830-0037-25	25.4 (1”)	38	23	12	10	21.3	16.3	0.02	17
830-0037-40	40	53	37	18	16	28.8	23.8	0.04	22
830-0037-50	50.8 (2”)	65	48	18	16	34.8	29.8	0.05	24
830-0037-75	75	89	72	18	16	46.5	42	0.06	44



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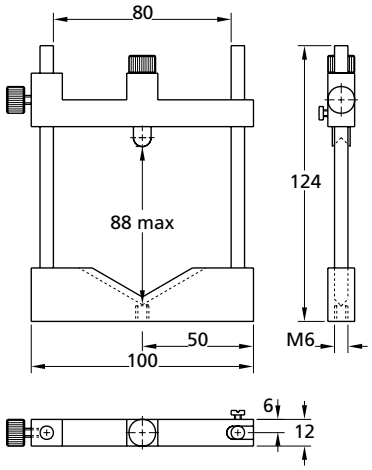
830-0040 VARIABLE LENS HOLDER

Model 830-0040 Variable Lens Holder is designed to hold optics from 15 mm to 78 mm in diameter. The top spring-loaded clamp holds optics of any configuration within V-shaped mounting base. The kinematic clamp height fixing is convenient when optics is removed and replaced.

Model 830-0040 holder is useful for thin lenses holding.

Finish: black oxidized steel.

Code	Weight, kg	Price, EUR
830-0040	0.36	48



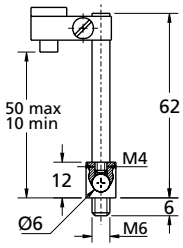
830-0050 OPTICS CLAMP

The 830-0050 clamp is especially convenient for fast optical elements clamping on bases, translators, rotators and other surfaces with M6 and M4 tapped holes.

Rod material: Stainless steel.

Clamp finish: black anodized aluminium

Code	Price, EUR
830-0050	19

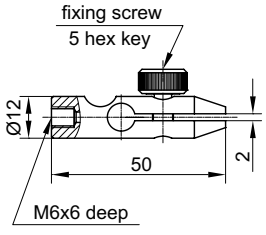


830-0055 PLATE CLAMP

Plate Clamp 830-0055 holds thin lightweight plates, like filters, transparencies, resolution targets and razor blades used in knife edge experiments.

These black anodized aluminium finished steel Clamps may be directly screwed for example to the mounting stud of a Mounting Post or to a Base Plate with Rotary Clamp 820-0130.

Code	Weight, kg	Price, EUR
830-0055	0.04	9



830-0060A 830-0070A FILTER HOLDERS

830-0060A

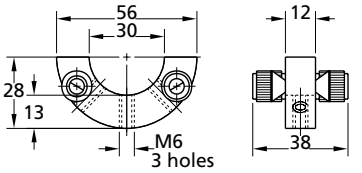
830-0070A

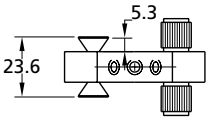
Model 830-0060A and 830-0070A Filter Holders are designed to locate plate optics with maximum clear aperture. Each plate is held separately to prevent scratching and is registered by dovetailed pins for easy relocation. Holders are useful for quick adjustment of combination of coloured or natural density filters.

Model 830-0060A holder holds up to two, while model 830-0070A up to five optics plates with dimensions 40×40 mm (max 80×80 mm) or Ø40 mm (max Ø80 mm) and thickness up to 4.5 mm in vertical position.

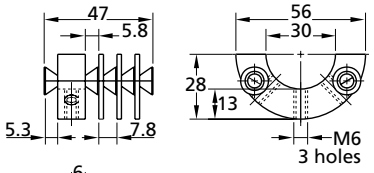
Finish: black anodized aluminium.

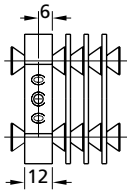
Code	Weight, kg	Price, EUR
830-0060A	0.09	20
830-0070A	0.12	22





830-0060A



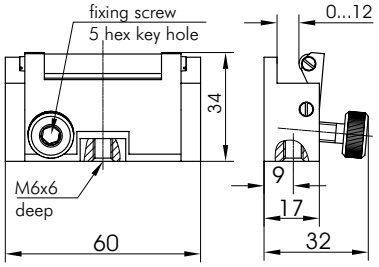


830-0070A

830-0075 UNIVERSAL PLATE HOLDER

Universal Plate Holder 830-0075 holds long and thick components, and can fix elements from 0 to 12 mm in width. M6 hole for mounting on posts provided in base.

Code	Weight, kg	Price, EUR
830-0075	0.07	53



830-0100 • 830-0101 830-0110 • 830-0111 RECTANGULAR OPTICS HOLDER

830-0110 ***830-0100***

Rectangular optics holders 830-0100 and 830-0110 provide easy and safe mounting of rectangular optics.

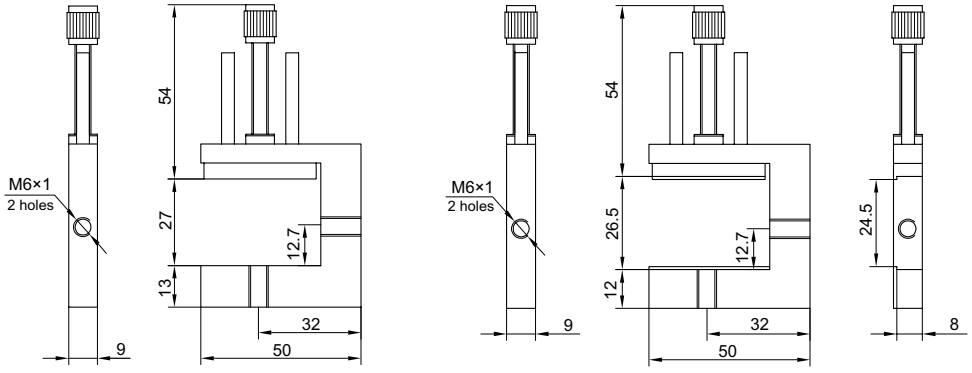
- Guiding pins ensure correct and reliable positioning of optical components
- M6 holes on two sides allow horizontal or vertical mounting

830-0101, 830-0111 have additional 1 mm raised edge for optics to stop against. Ideal for mounting rectangular windows and plano-concave cylindrical lenses.

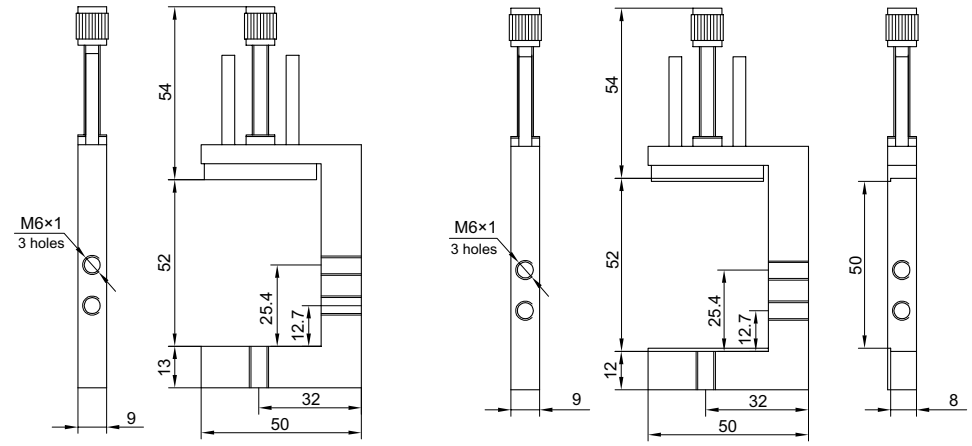
You may put lens flat side on raised edges and lock with fixing bolt.

Finish: Black anodized aliuminium.

830-0110 *and* ***830-0100*** *with lenses*



830-0100 ***830-0101***



830-0110 ***830-0111***

Code	Suitable for optics height, mm	Weight, kg	Price, EUR
830-0100	0–26	0.05	28
830-0101	2–26	0.05	29
830-0110	24.5–51	0.06	29
830-0111	26.5–51	0.06	30

Optical Positioners

840-0010 • 840-0020 840-0030 KINEMATIC MIRROR AND BEAMSPLITTER MOUNTS (STEEL)

840-0010

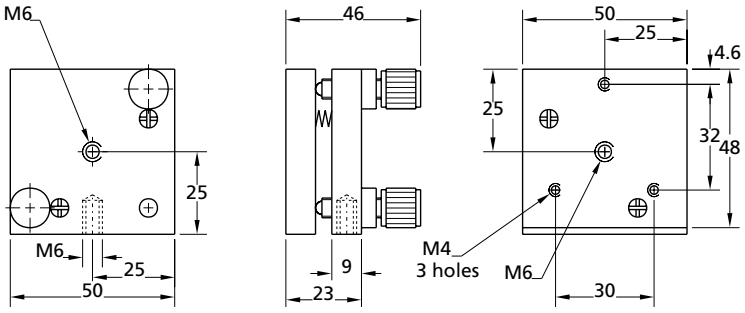
840-0010-04

The compact model 840-0010 mirror, model 840-0020 and 840-0030 mirror/beamsplitter mounts provide fine and smooth angular alignment of mounted elements. They are designed for stable orientation of mirrors, beamsplitters, prisms and other optical components.

Models 840-0020 and 840-0030 offer gentle, 3-point (plastic type pads and plastic ended screw for fixation) support of 22-26 mm dia optics.

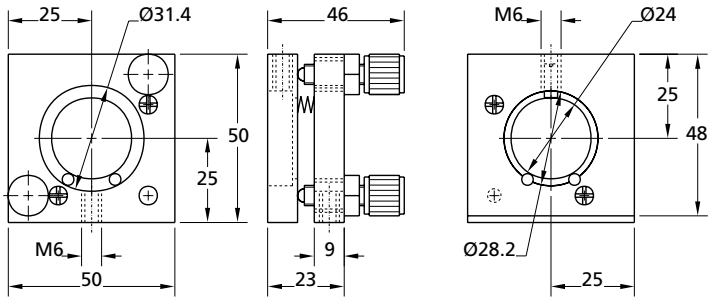
Mirrors can be directly bonded to the model 840-0010 mount.

Alternatively, model 840-0010 mount could be used as precision kinematic tilt stage which is mounted on series 820-0010 standard rods in series 820-0050 rod holders or series 820-0040 rod translators.



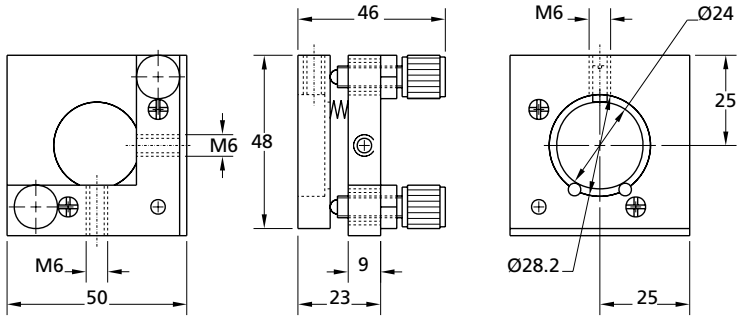
840-0010

840-0020



840-0020

840-0030-02



840-0030

Model 840-0010, 840-0020 and 840-0030 mounts could be attached to the table using a number of fixed-height riser blocks and movable bases as well. These provide the most stable, rigid mounting possible.

Mounts provide ±6° range of orthogonal adjustments with 8 arc-seconds resolution.

Model 840-0030 mount provides maximum clear aperture for beamsplitter applications at not-normal incidence angles.

Models 840-0010, 840-0020, 840-0030 are completed with steel screws M6×0.5 mm and brass collar with an outer thread M10×1 mm for mounting.

Additionally, model 840-0010-02, model 840-0020-02 and model 840-0030-02 mounts are completed with model 870-0010 precise screws.

840-0010-04, 840-0020-04 and 840-0030-04 options come with model 870-0020 micrometer screws with reading marks.

Finish: black oxidized steel.

*Mounting option: Kinematic Mirror and Beamsplitter Mount **840-0020**, Glan Laser Polarizing Prism in **M2P** mount, Solid Base Height Extender **820-0210***

*Mounting option: Movable Base **820-0080**, Rod Holder **820-0050-04**, Standard Rod **820-0010-02**, Kinematic Mirror and Beamsplitter Mount **840-0020** and Adapter for Beamsplitter at 45° **840-0116***

Code	Weight, kg	Price, EUR
840-0010	0.36	56
840-0010-02	0.42	108
840-0010-04	0.42	118
840-0020	0.26	63
840-0020-02	0.32	115
840-0020-04	0.32	125
840-0030	0.22	67
840-0030-02	0.28	119
840-0030-04	0.28	129

Complementary Products

Code	Page
820-0010	7.16
820-0050	7.17
820-0060	7.18
820-0080	7.19
820-0210	7.22

Code	Page
840-0020	7.33
840-0116	7.41
870-0010	online
870-0020	online

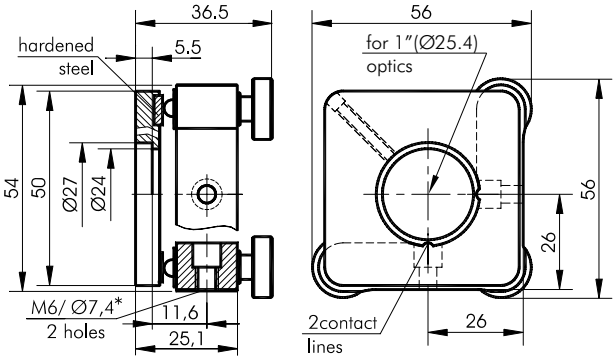
*Mounting option: Movable Base **820-0080**, Rod Holder **820-0050-04**, Standard Rod **820-0010-02**, Kinematic Mirror Mount **840-0010** and Optics Clamp **830-0050***

*Mounting option: Movable Base **820-0060**, Riser Block **820-0170-02** and Kinematic Mirror Mount **840-0010***

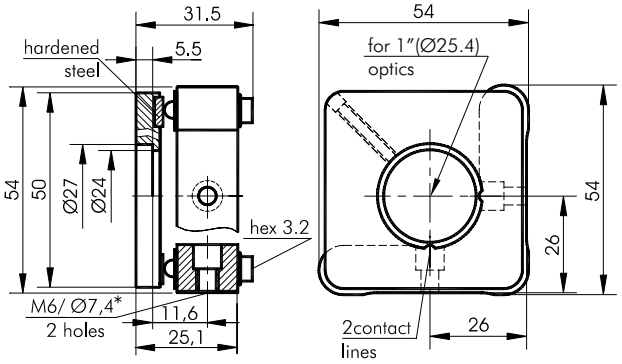
840-0032
840-0033
KINEMATIC MIRROR, BEAMSPLITTER MOUNTS (ALUMINIUM)

840-0033-80

840-0032-80



840-0033-80** comes with three Adjustment Screws **870-0080



840-0033-90** comes with three Adjustment Screws **870-0090

- **Precise and handy adjustment, angular in two orthogonal planes, and linear**
- **Stable vertical mounting**
- **Adjustment range of 9° or 5 mm**
- **Sensitivity of 3 arcsec or 1 µm**
- **Weight 0.09 kg**
- **Available motorized version 940-0060**
- **Available 2 inch version**

Kinematic Mirror/Beamsplitter Mounts 840-0032 and 840-0033 are designed for precise alignment of various optical elements to desired angular and linear orientation.

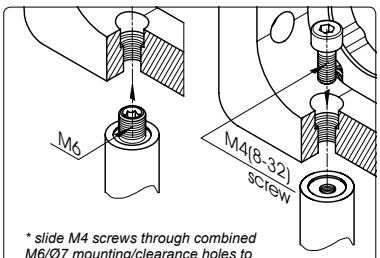
Models with 2 or 3 screws are available. The base of the mount has holes Ø8.7 mm for driving screws of your choice (see section 870). As a standard, we fit Fine Screws 870-0080 or 870-0090. Each screw has a hardened steel ball tip.

The mounts have a one inch mounting hole with Ø24 mm clear aperture.

840-0032, 840-0033 may be mounted on one side or another, e.g. to swap left/right hand side of access to the drive relative to the beam. It mounts to an M6 screw or directly to mounting posts on their M6 tips. Put a M4 screw through the combined Ø7/M6 hole to fasten the mount to units with M4 holes.

Material: Aliuminium.

Finish: Black anodized (by default) or any other color on request.



** slide M4 screws through combined M6/Ø7 mounting/clearance holes to mount the unit immediately to M4 holes, or mount the unit directly on any M6 tip.*

Code	Description	Price, EUR
840-0032-80	2 screws	65
840-0032-90	2 hex screws	59
840-0033-80	3 screws	75
840-0033-90	3 hex screws	72

Complementary Products

Code	Page
870-0080	online
870-0090	online
940-0060	7.89

PRECISION AND HIGH STABILITY L-SHAPED STEEL OPTICAL MOUNTS

- **Special flat spring for improved stability, versatility and durability**
- **Kinematics, orthogonal angular adjustments**
- **Tilt/tip 9° range with 5 arcsec sensitivity**
- **Left or right hand mounting**
- **Vertical and horizontal mounting**

Highly Stable Precision L-shaped Optical Mounts are designed on the basis of two-angle adjustment mount, and are made of steel with black chemical finishing. Special figure spring is used in these mounts for two purposes:

- It provides pre-loading against the tips of two precise driving screws for elimination of backlash.
- It ensures the absence of the roll coordinate.

The Highly Stable Precision L-shaped Optical Mounts have two M10×1 threaded mounting holes for mounting of the actuators. M6 tapped holes on the sides provide a wide variety of mounting configurations, either horizontal or vertical. A special L-shaped design of the mounts provides maximum clear aperture.

840-0036 STABLE STEEL MIRROR/BEAMSPLITTER MOUNTS

- **Special flat spring for improved stability versatility and durability**
- **Suitable for 1”, 2”, 3”, 4”, 6” optics**
- **6° range**
- **Kinematics, orthogonal angular adjustments**
- **Left or right hand mountable**
- **Vertical and horizontal mounting**

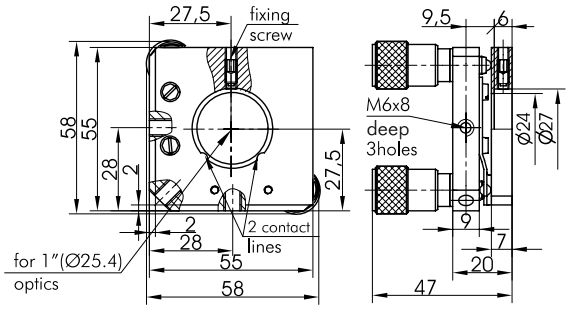
Special holders with two Teflon dowel pads and Teflon fixing screw. The mount is ideal for precision adjustment of 1” (25,4 mm), 2” (50.8 mm), 3” (76.2 mm), 4” (101.6 mm) or 6” (152.4) mirrors or beamsplitters.

The mount comes with 870-0030 screw as a standard. You may choose different screws. If you order the mount with alternative screws, please specify this in order, by appending the screw code name to the mount code.

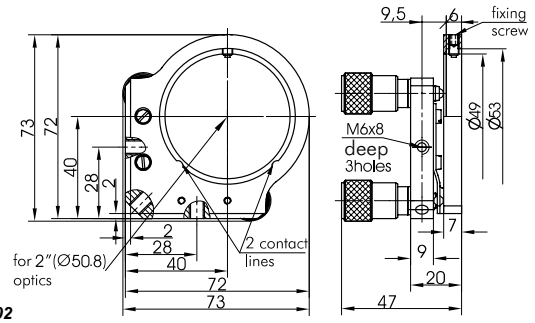
Models for 1”,2” and 3” optics made entirely of black anodized steel (back and front plates). Models for 4” and 6” optics use front plate made of black anodized aluminium.

	840-0036-01	840-0036-02	840-0036-03	840-0036-04	840-0036-06
Optics diameter	1” (25.4 mm)	2” (50.8 mm)	3” (76.2 MM)	4” (101.6 mm)	6” (152.4 mm)
Mechanism	kinematic				
Drive type	knob				
Adjustments	Θx, Θy				
Special features	center mount				
Angular range	8°	8°	6°	5°	4°
Sensitivity 0.5 mm fine thread	6 arcsec	6 arcsec	5 arcsec	4 arcsec	3 arcsec
Sensitivity 0.25 mm fine thread	3.4 arcsec	3.4 arcsec	2.3 arcsec	1.8 arcsec	1.5 arcsec
Material	Steel	Steel	Steel	Steel	Base - steel, front - aluminium
Mounting thread	M6 (3 holes)	M6 (3 holes)	M6 (5 holes)	M6 (4 holes)	M6 (6 holes)
Mounting	post, baseplate				
Optic Thickness	universal				
Optical axis height	27.5 mm	40 mm	53 mm	65 mm	96 mm
Adjustment screw	870-0030 (0.5 mm fine thread)				
Mounting thread for fine screw [1]	M10×1				
Weight, kg	0.07	0.18	0.44	1.04	1.4
Price, EUR	89	114	147	177	266

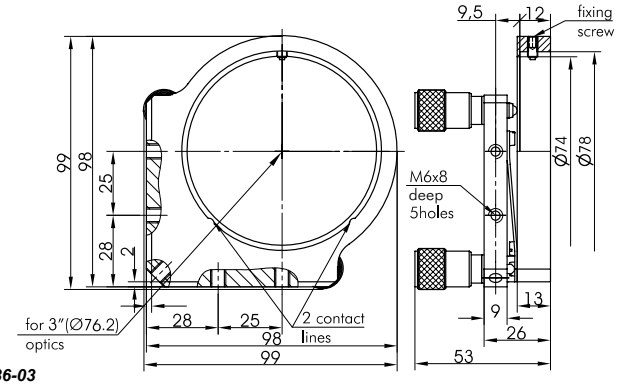
[1] Micrometer can be replaced with fine screw.



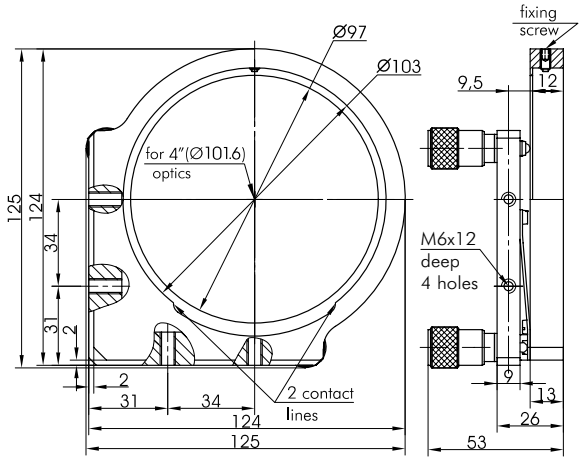
840-0036-01



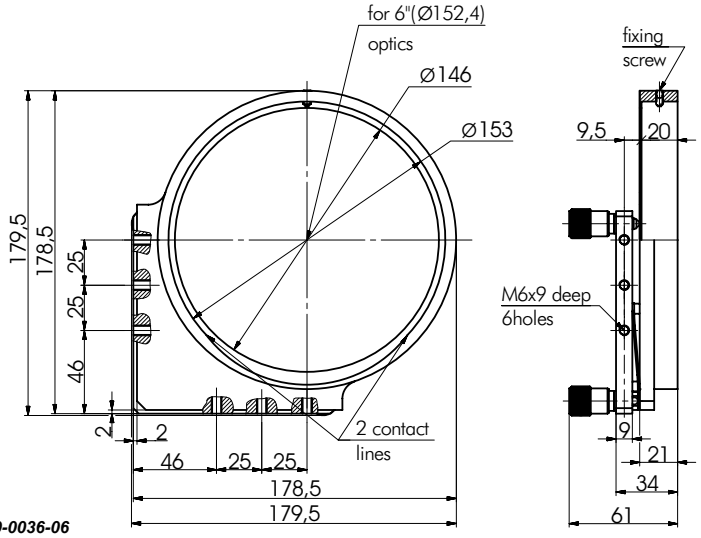
840-0036-02



840-0036-03



840-0036-04



840-0036-06

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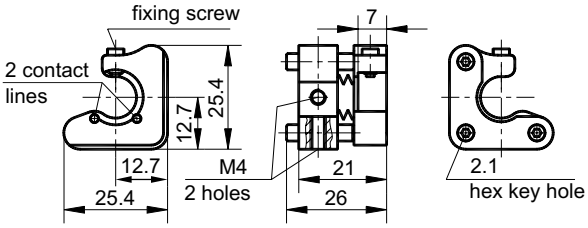
840-0054 MINIATURE KINEMATIC MIRROR / BEAMSPLITTER MOUNT

- For Ø12.7 mm optics (0.5 inch)
- Kinematic
- Clear edge design
- Hex key drive
- Tilt/tip range 14°
- Sensitivity 8 arcsec
- Material: black anodized aluminium
- Weight 0.03 kg
- Mirror version available



Code	Type	Accepts optics, mm	Clear aperture, mm	Price, EUR
840-0054		Ø12.7 (0.5 inch)	Ø10.2	60
840-0054-02	Mirror version	Ø12.7 (0.5 inch)	Ø10.2	60

Note: Mirror version is a right hand version of the standard model

840-0056 KINEMATIC MIRROR / BEAMSPLITTER MOUNTS

- 1", 2", 3" optics mounts
- Tilt range 9° (about two axes)
- Travel range 4 mm
- Sensitivity of 3 arcsec and 1 µm
- Mounting on either of 2 sides
- Two models: round and square aperture
- Kinematic
- Clear edge design
- A screw pulses via seat of hardened stainless steel
- "Mirror" version available
- Material: black anodized aluminium
- Available motorized version 940-0060

840-0056-11

840-0056-22

Kinematic Mirror / Beamsplitter Mounts 840-0056 are used for precise angular and linear alignment of optical elements.

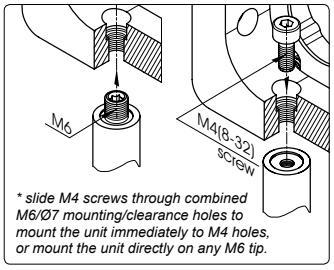
We provide two types of kinematic mirror/beamsplitter mounts: for round optical elements (840-0056-11; 840-0056-12; 840-0056-13) and for square optical elements (840-0056-21; 840-0056-22; 840-0056-23).

840-0056 has a resting flange to stop the optics. One fixing screw (two in "square" mounts) secures the optics against 2 contact lines, which make 2 contact points. To prevent damage to the optics, the tip of the fixing screw is made of plastic.

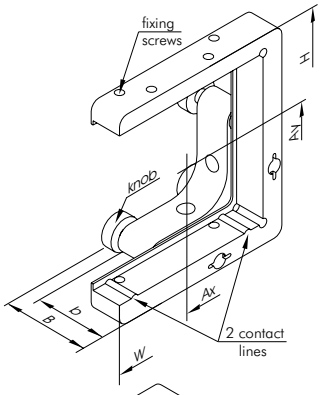
Square mounts 840-0056-20 additionally have 4 fixing screws for thin optics. They have conic tips to work as wedges to clutch a thin plate of optics to the resting flange. For thick optics square mounts have 2 screws rather than one.

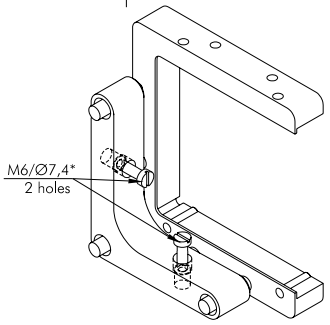
A platform is preloaded by two strong coil springs, ensuring tight kinematic fit. A thick base adds to stability. This allows to eliminate part of the mount, keeping clear one edge of the optics. Useful in schemes where beams go very close to each other.

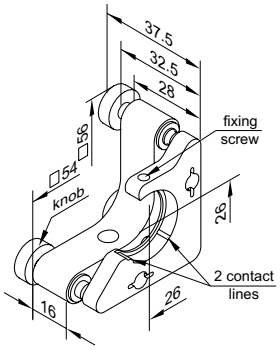
As standard, mounts come with screws 870-0080. See section 870 for the alternative screws. You may order the mounts with 2 or 3 adjustment screws. The prices are given of kinematic mirror/beamsplitter mounts with 3 driving screws.



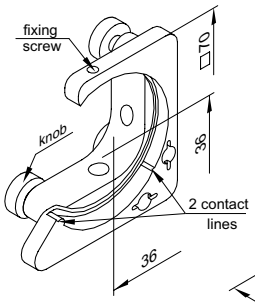
** slide M4 screws through combined M6/Ø7 mounting/clearance holes to mount the unit immediately to M4 holes, or mount the unit directly on any M6 tip.*



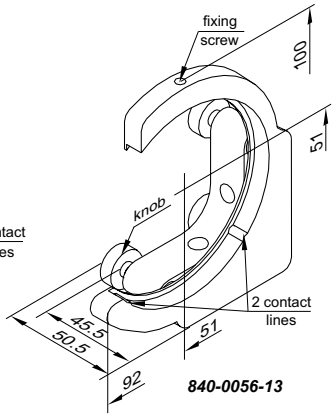




840-0056-11



840-0056-12



840-0056-13

Code	Description	Price, EUR
840-0056-11	for 1" optics	75
840-0056-12	for 2" optics	115
840-0056-13	for 3" optics	166

Code	H, mm	W, mm	B, mm	b, mm	Ax, mm	Ay, mm	Price, EUR
840-0056-21	56	56	37.5	32.5	26	26	87
840-0056-22	72.5	64	37.5	32.5	37.4	38.2	129
840-0056-23	102.5	92.5	50.5	45.5	53.6	55.4	182

840-0057 MOUNTS WITH HARD SEATS

- **Original stabilized L-shaped flat spring**
- **1" and 2" optics mounts**
- **Precise (sensitivity of 3 arcsec and 1 μm)**
- **Stable, with hard steel or sapphire seats under adjustment screws**
- **Tilt range of 5° in two orthogonal planes**
- **Travel range 4 mm**
- **Vertical mounting on either of two sides**
- **"Mirror" versions available**
- **Material: black anodized aluminium**

840-0057-13SH

840-0057-23S

840-0057-12SHM

Mounts 840-0057 have 1" (840-0057-1) or 2" (840-0057-2) mounting hole. A fixing screw secures the optics against 2 contact lines, which make 2 contact points. To prevent damage to the optics, the tip of the fixing screw is made of plastic.

On one side the edge of the optics stays clear. So you can use the optics close to the edge in schemes where beams are very closely situated to one another.

You may order mounts with 2 and 3 adjustment screws.

Each screw has a hardened steel ball tip. It pushes the aluminium platform against a hard seat. This results in increased durability, stability, and fine motion.

M6/Ø7.4 mounting/clearance holes are centered against the center of the mounted optics.

The platform has an original L-shaped flat spring. It performs two functions: preloading the platform, and reducing its drift. The high tension spring and the thick base of the unit increase its stability. This allowed to eliminate a part of the mount, keeping clear one side of the optics.

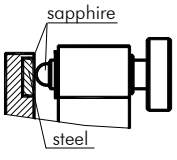
Code	840-0057-12 840-0057-13	840-0057-22 840-0057-23
Tilt/tip range	5°	5°
Sensitivity	5(3) arcsec	5(3) arcsec
Travel range	4 mm	4 mm
Sensitivity	1(0.5) μm	1(0.5) μm
Optics diameter	≤ Ø25.4 mm	≤ Ø50.8 mm
Clear aperture	24 mm	45 mm

Code	Optics size	Screws	Weight, kg	Price, EUR
840-0057-12	1"	2	0.09	67
840-0057-13	1"	3	0.10	75
840-0057-22	2"	2	0.14	99
840-0057-23	2"	3	0.15	115

Examples of codes	Screws
840-0057-13S	3
840-0057-12S	2
840-0057-22SH	2 hex
840-0057-13SPH	3 hex

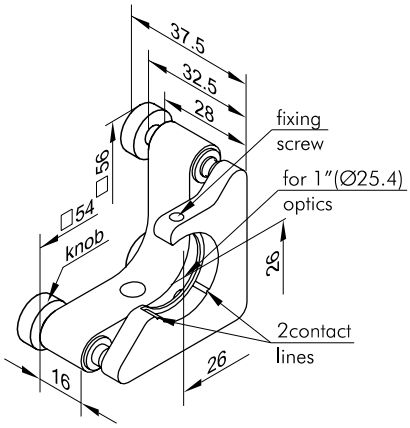
"S" – a screw pushes via a seat of hardened stainless steel
"SP" – a screw pushes via a seat of sapphire
"M" – "Mirror" version
"H" – hex screws. Removable hex knobs are available separately.

840-0057-SP

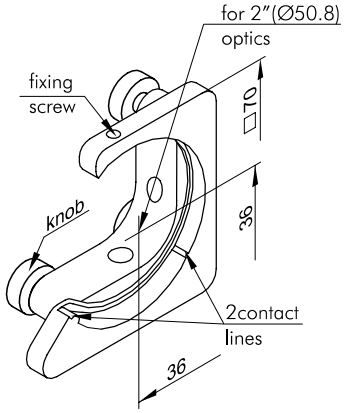


840-0057-S

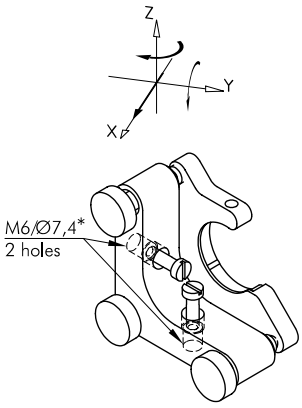
A screw pushes via a seat of hardened stainless steel or sapphire.



840-0057-13S
uses three Fine Screws 870-0080 (with knobs). 840-0057-13SH uses three Fine Screws 870-0080 (without knobs) to reduce risk of tampering (hex key included).



840-0057-23S
uses three Fine Screws 870-0080 (with knobs). 840-0057-23SH uses three Fine Screws 870-0080 to reduce risk of tampering (hex key included).

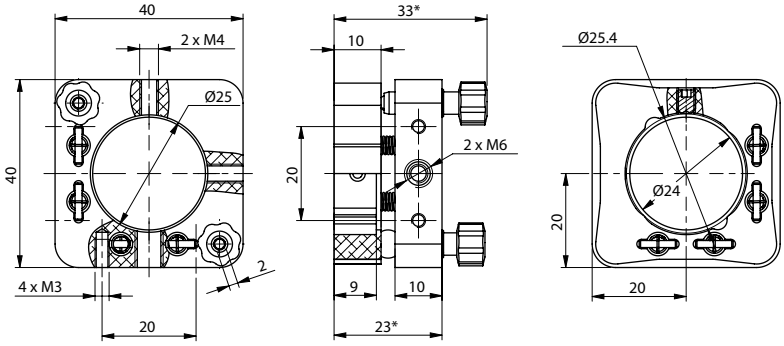


** slide M4(8-32) screws through combined M6/Ø7.4 mounting/clearance holes to mount the unit immediately to M4(8-32) holes, or mount the unit directly on any M6 tip*

840-0058-01 COMPACT KINEMATIC MIRROR / WINDOW MOUNT

Compact Kinematic Mirror/Window Mount 840-0058-01 is designed for precise angular alignment of optical elements. It is suitable for first surface mirrors, rear mirrors, output couplers and windows.

840-0058-01 has a resting flange to stop the optics. One fixing screw secures the optics against two hard rests, which make two contact points. To prevent damage to the optics, the tip of the fixing screw is made of plastic. The platform is preloaded by four strong springs, ensuring tight kinematic fit. Compact design (outer size just 40×40mm) is an advantage where the space is tight. Three types of holes (M6, M4 and M3) on the edge of the mount make it universal when choosing suitable rod or post.



- **1" optics mount – fits Ø25.4 mm and Ø25.0 mm optics of ≥5 mm thickness**
- **Tilt range about two axis – ±5°**
- **Sensitivity – 3 arcsec**
- **Mounting: M6, M4, M3 fixing holes on either of two sides**
- **Hexagon socket head cap screws – 2 mm hex key can be used for alignment**
- **Material: black anodized aluminum**

Code	Equipment	Weight, kg	Price, EUR
840-0058-01	Empty mount for optics Ø25.4 mm	0.05	59
082-2840-i0-45M58	Mount 840-0058-01 with UVFS flat mirror HR>99% @ 280-400 nm, AOI = 0-45 deg	0.06	152
082-4075-i0-45M58	Mount 840-0058-01 with UVFS flat mirror HR>99% @ 400-750 nm, AOI = 0-45 deg	0.06	140
082-7511-i0-45M58	Mount 840-0058-01 with UVFS flat mirror HR>99% @ 750-1100 nm, AOI = 0-45 deg	0.06	143
092-1010M58	Mount 840-0058-01 with UVFS flat UV Enhanced Aluminium coated mirror R_{ave}>85% @ 210-400 nm, AOI = 0-45 deg	0.06	120
092-0015M58	Mount 840-0058-01 with BK7 flat Protected Aluminium coated mirror R_{ave}>86% @ 300 nm - IR, AOI = 0-45 deg	0.06	77
092-0025M58	Mount 840-0058-01 with BK7 flat Protected Silver coated mirror R_{ave}>96% @ 400 nm - IR, AOI = 0-45 deg	0.06	95
092-0030M58	Mount 840-0058-01 with BK7 flat Protected Gold coated mirror R_{ave}>98% @ 900 nm - IR, AOI = 0-45 deg	0.06	98

840-0115 • 840-0116 ADAPTER FOR MIRROR AND BEAMSPLITTER AT 45º

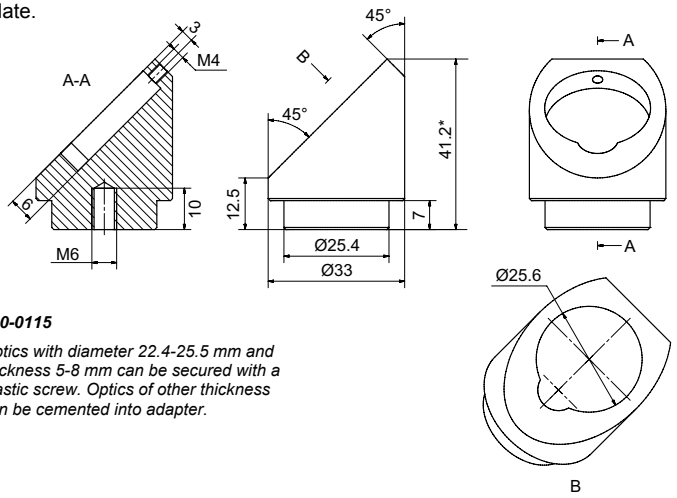
- **Suitable for dichroic mirrors and beamsplitters operating at AOI 45°**

With the help of this Adapter optics is firmly held by a plastic securing screw and it rests against two contact lines formed at the interface. Adapter easily accommodates any optical mount designed for 1'' optics or can be attached to any mount using a baseplate.

For fine adjustment adapter can be mounted into kinematic mirror mount 840-0020. Such combination provides 6° range of orthogonal adjustments with 8 arc-seconds resolution.

840-0115

Suitable for high reflection mirrors operating at AOI 45°

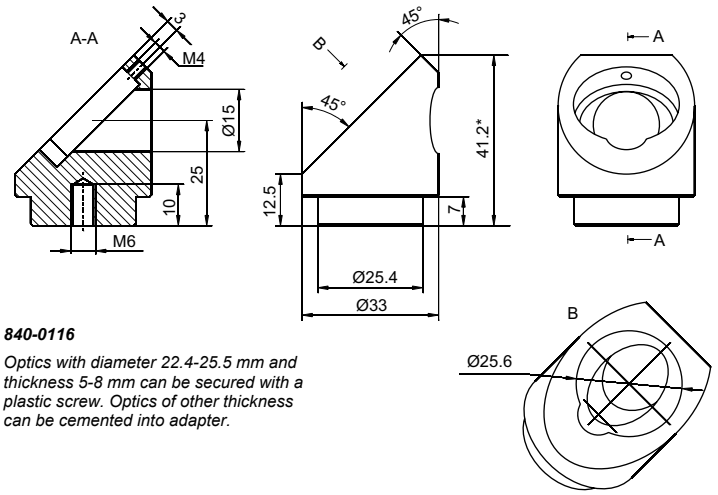


840-0115

Optics with diameter 22.4-25.5 mm and thickness 5-8 mm can be secured with a plastic screw. Optics of other thickness can be cemented into adapter.

840-0116S

Suitable for dichroic mirrors and beamsplitters operating at AOI 45°

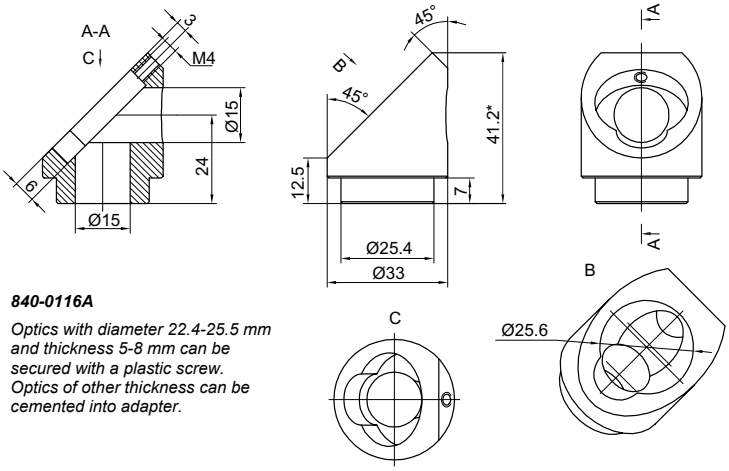


840-0116

Optics with diameter 22.4-25.5 mm and thickness 5-8 mm can be secured with a plastic screw. Optics of other thickness can be cemented into adapter.

840-0116A

Suitable for dichroic mirrors, beamsplitters and beam combiners operating at AOI 45°



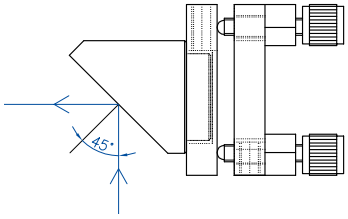
840-0116A

Optics with diameter 22.4-25.5 mm and thickness 5-8 mm can be secured with a plastic screw. Optics of other thickness can be cemented into adapter.

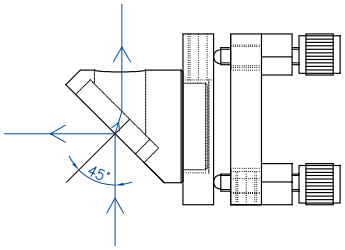
Code	Item	Finish	Weight, kg	Price, EUR
840-0115	adapter for mirror at 45°	black anodized aluminium	0.05	25
840-0116	adapter for beamsplitter at 45°	black anodized aluminium	0.05	25
840-0116A	adapter for beamsplitter at 45° with additional aperture	black anodized aluminium	0.05	26
840-0116S	adapter for beamsplitter at 45°	black oxidized steel	0.13	35

Light directions using one of adapters. *View from top*

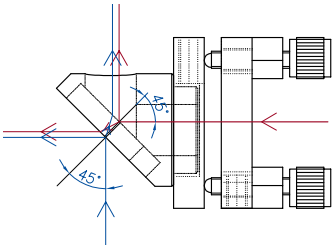
840-0115
with mirror



Light directions using 840-0115 adapter



Light directions using 840-0116 adapter



Light directions using 840-0116A adapter

Complementary Products

Code	Page
820-0010	7.16
820-0050	7.17
820-0070	7.19
820-0080	7.19
840-0020	7.33

Mounting option:
*Movable base **820-0080**, rod holder **820-0050-04**, standard rod **820-0010-02**, kinematic mirror and beamsplitter mount **840-0020** and adapter for beamsplitter at 45° **840-0116**.*

Mounting Option:
*Adapter for Beamsplitter **840-0116A**, Kinematic Mirror/Beamsplitter Mount **840-0056**, Rod Holder **820-0050-04**, Standard Rod **820-0010-02**, Movable Base **820-0070**.*

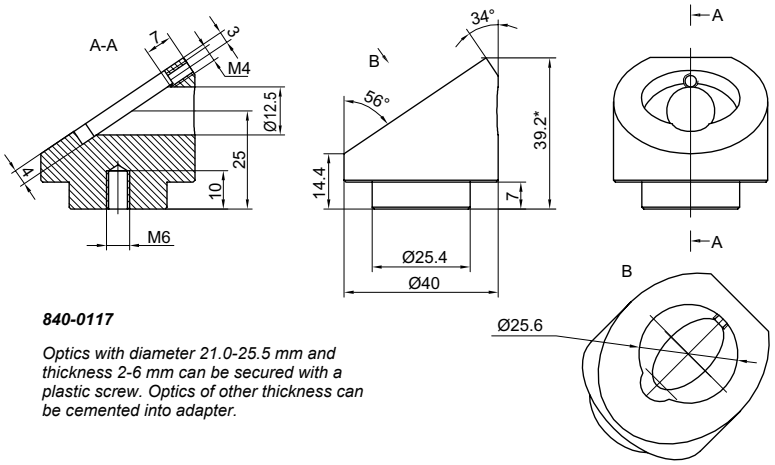
840-0117 • 840-0118 ADAPTERS FOR POLARIZER AT 56°

- **Suitable for thin film laser polarizers at 56°**

Optics is firmly held by a plastic securing screw and it rests against two contact lines formed at the interface. Adapter easily accommodates any optical mount designed for 1'' optics or can be attached to any mount using a baseplate.

For fine adjustment adapter can be mounted into kinematic mirror mount 840-0020. Such combination provides 6° range of orthogonal adjustments with 8 arc-seconds resolution.

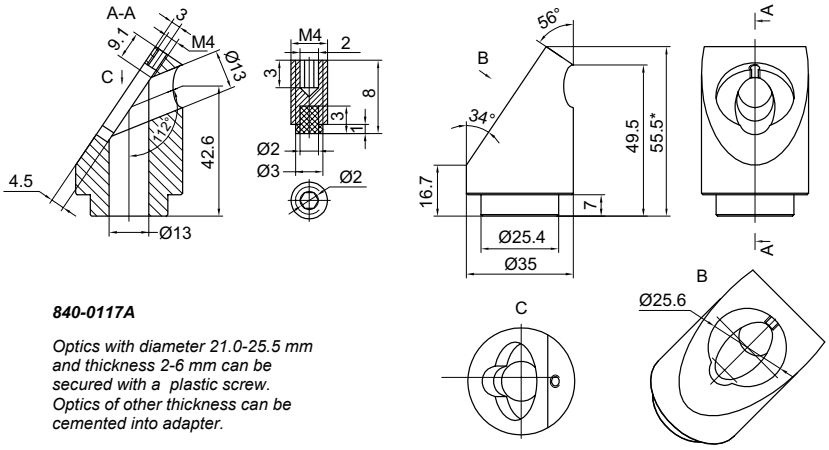
840-0117



840-0117

Optics with diameter 21.0-25.5 mm and thickness 2-6 mm can be secured with a plastic screw. Optics of other thickness can be cemented into adapter.

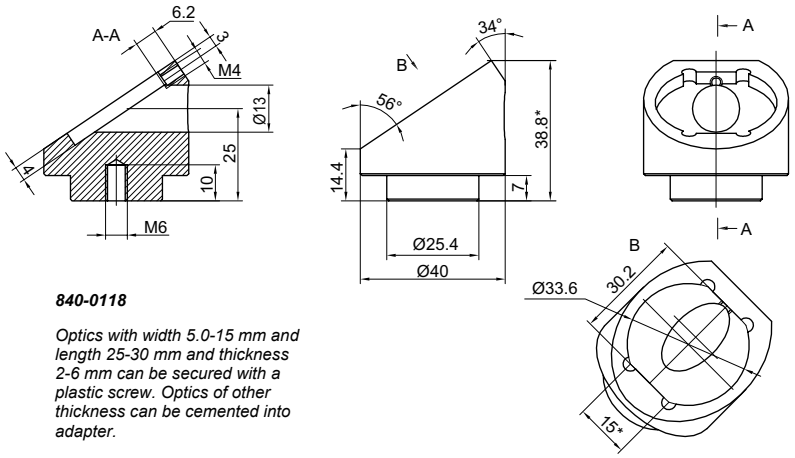
840-0117A



840-0117A

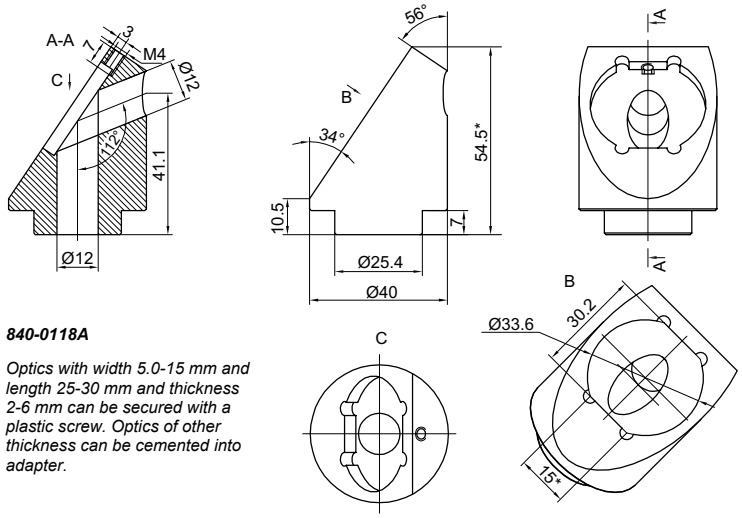
Optics with diameter 21.0-25.5 mm and thickness 2-6 mm can be secured with a plastic screw. Optics of other thickness can be cemented into adapter.

840-0118



840-0118

Optics with width 5.0-15 mm and length 25-30 mm and thickness 2-6 mm can be secured with a plastic screw. Optics of other thickness can be cemented into adapter.



840-0118A

Optics with width 5.0-15 mm and length 25-30 mm and thickness 2-6 mm can be secured with a plastic screw. Optics of other thickness can be cemented into adapter.

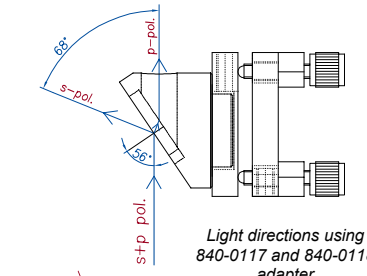
Mounting option:
Adapter for Round Polarizer 840-0117,
Kinematic mirror and beamsplitter mount 840-0020,
Standard rod 820-0010-02,
Collar 820-0030,
Rod translator 820-0040-02,
Movable base 820-0060.

Mounting option:
Adapter for Round Polarizer 840-0117A,
Kinematic Mirror and Beamsplitter Mount 840-0020,
Solid Base Height Extender 820-0210.

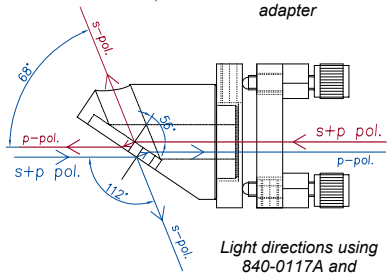
Code	Item	Finish	Weight, kg	Price, EUR
840-0117	adapter for round polarizer at 56°	black anodized aluminium	0.05	27
840-0117A	adapter for round polarizer at 56° with additional aperture	black anodized aluminium	0.09	28
840-0117-2	adapter for round polarizer at 56°. For optics of Ø50.8 mm	black anodized aluminium	0.22	39
840-0118	adapter for rectangular polarizer at 56°	black anodized aluminium	0.05	28
840-0118A	adapter for rectangular polarizer at 56° with additional aperture	black anodized aluminium	0.09	29

Mounting Option:
Adapter for Round Polarizer 840-0117,
Mirror/Beamsplitter Mount 840-0056,
Rod Holder 820-0050-04,
Standard Rod 820-0010-02,
Movable Base 820-0070.

Light directions using one of adapters. *View from top*



Light directions using 840-0117 and 840-0118 adapter



Light directions using 840-0117A and 840-0118A adapter

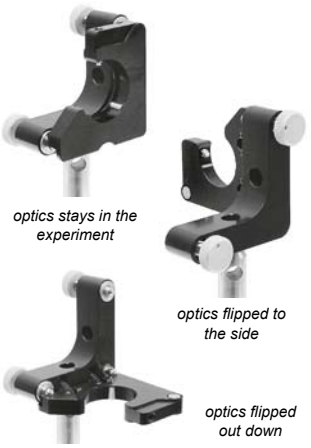
Complementary Products

Code	Page
820-0010-02	7.16
820-0030	7.17
820-0040-02	7.17
820-0050	7.17
820-0060	7.18
820-0070	7.19
820-0210	7.22
840-0020	7.33
840-0199	7.53

840-0155 FLIPPING MIRROR / BEAMSPLITTER MOUNT

840-0155-01
(left hand version)

840-0155-01M
(right hand "Mirror" version)



- **Flips optics in and out of the experiment**
- **Kinematic design**
- **Precise and handy angular adjustment in two orthogonal planes**
- **Stable vertical mounting**
- **Made of black anodized aluminium**
- **Mirror version available**

Use the Flipping Mount 840-0155 to place optics in and out of the optical scheme. Flip the platform out and back again – it sits on the adjustment screws in a repeated position. Precise alignment of various optical elements to desired angles is done by 2 adjustment screws.

3 seats form 3 kinematic points for definite position of the platform. The seats are made of hardened steel. This increases the service life, as they counter the hardened steel tips of adjustment screws and pivot balls.

Mount 840-0155 has a 1" mounting hole with Ø24 mm clear aperture. A fixing screw secures the optics against 2 contact lines, which make 2 contact points. To prevent damage to the optics, the tip of the fixing screw is made of plastic. On one side the edge of the optics stays clear. So you can use the optics close to the edge in schemes where you work with a beam very closely situated to another beam.

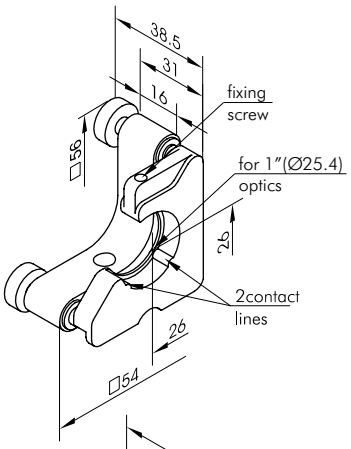
Ultra-Fine Adjustment Screws 870-0080 come as standard (one screw has its tips modified to form a kinematic point).

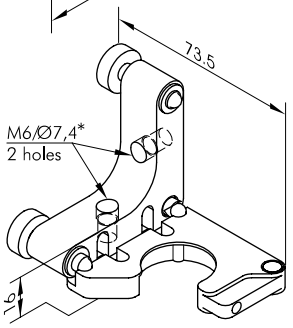
Depending on which side you mount the unit, flip the platform either vertically or horizontally. By flipping out vertically, the optics goes beneath the common level of the optical scheme. Still one leg of the base, with a adjustment screw on it, stays up. Yet this would not obstruct the optical path, as it would not when the optics was flipped in. Legs protruding upwards ease access to the adjustment screws, with less risk of obscuring the beam. There is no need to design the legs extended down, so as to clear the space totally.

SPECIFICATIONS

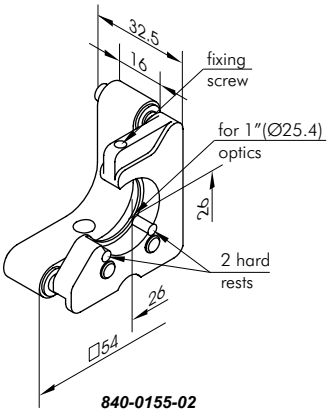
Fine screw thread	M6×0.25
Optics diameter	1"
Clear aperture	24 mm
Repeatability	20 µrad
Adjustment range	8°
Sensitivity	3 arcsec
Weight	0.09 kg

Code	Price, EUR
840-0155-01	135
840-0155-01M	135
840-0155-02	127
840-0155-02M	127





840-0155-01
uses Ultra-Fine Screws 870-0080 (with knobs) through combined M6/Ø7 mounting holes



840-0155-02
uses Fine Hex Adjustment Screws (without knobs), hex key included

840-0155-04 FLIPPING MIRROR / BEAMSPLITTER MOUNT

840-0155-04

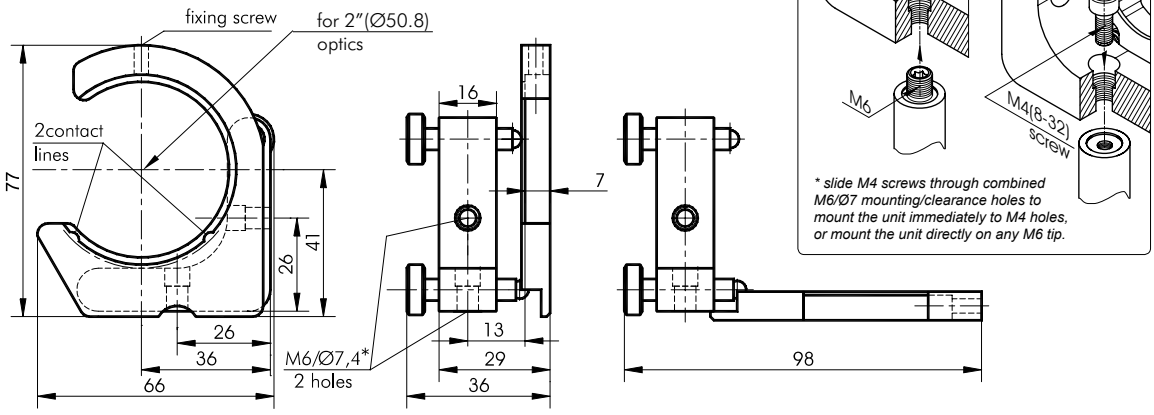
- Flip optics in and out of the optical scheme
- Kinematic design
- Maximum optics thickness 7 mm
- Clear edge design
- Hex key drive optional
- Material: black anodized aluminium
- Mirror version available

840-0155-05

SPECIFICATIONS

Fine screw thread	M6×0.25
Optics diameter	50.8 mm (2")
Clear aperture	49 mm
Repeatability	20 µrad
Tilt/tip range	8°
Sensitivity	3 arcsec

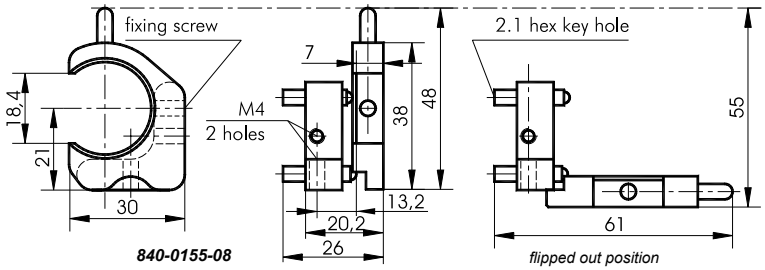
Code	Description	Price, EUR
840-0155-04	for Ø50.8 mm optics; screws with knobs	155
840-0155-05	for Ø50.8 mm optics; with hex screws	147



840-0155-06 840-0155-07 840-0155-08 840-0155-09 MINIATURE FLIPPING MIRROR / BEAMSPLITTER MOUNT

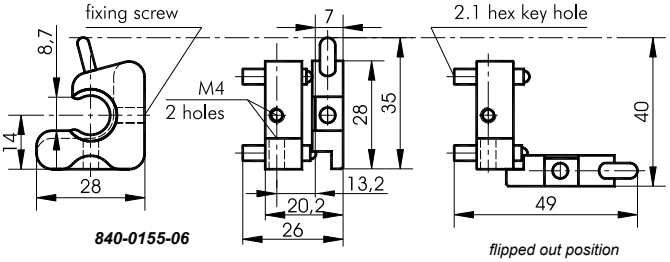
- Flip optics in and out of the optical scheme
- Repeatability 20 µrad
- Tilt/tip range 9°
- Sensitivity 8 arcsec
- For Ø12.7 and Ø25.4 mm (0.5" and 1") optics
- Clear edge design suits schemes where beam passes close to optics' edge
- Kinematic design
- High stability
- Hex key drive
- Material: black anodized aluminium
- Weight 0.02 kg
- "Mirror" versions available

840-0155-08



840-0155-08

840-0155-06

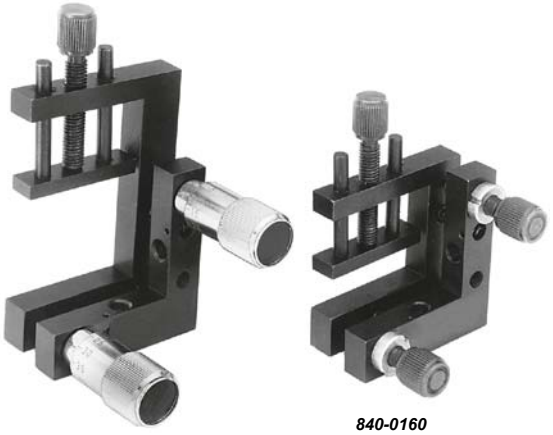


840-0155-06 flipped out position

Model	Type	Accepts optics	Clear aperture, mm	Price, EUR
840-0155-06		Ø12.7 mm (0.5 inch)	Ø10.2	99
840-0155-07	Mirror version	Ø12.7 mm (0.5 inch)	Ø10.2	99
840-0155-08		Ø25.4 mm (1 inch)	Ø24	104
840-0155-09	Mirror version	Ø25.4 mm (1 inch)	Ø24	104

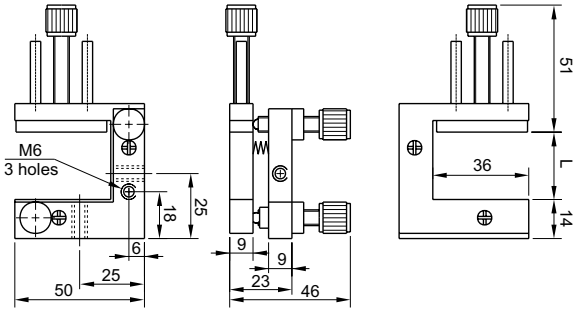
Note: *Mirror version is a right hand version of the standard.*

840-0160 840-0170 PRISM HOLDERS



840-0170-04

840-0160



840-0160

Prism holders 840-0160 and 840-0170 provide easy and safe mounting of prism type optics. Precision kinematic adjustment around two orthogonal axes ranges within ±6°.

The screw position locks ensure right and reliable optical components position fixing.

Precise screws provide 8 arcsec adjustment resolution. The model 840-0160 accepts optics 0–26 mm of height.

The model 840-0170 accepts 24.5–51 mm height optics. Additionally models 840-0160-02 and 840-0170-02 are completed with model 870-0010 precise screws. 840-00160-04 and 840-0170-04 options come with model 870-0020 micrometer screws with reading marks.

The models 840-0160 and 840-0170 are completed with steel screws M6×0.5 mm and brass collar with an outer thread M10×1 mm.

Finish: black oxidized steel.

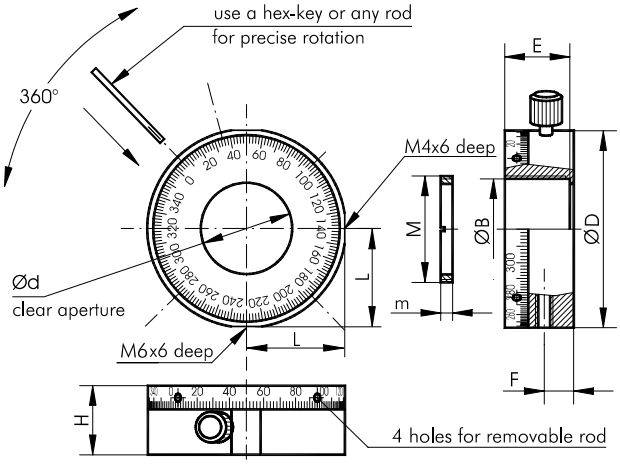
Complementary Products

Code	Page
870-0010	online
870-0020	online
870-0071	online

Code	Optics L height, mm	Adjustment screw	Weight, kg	Price, EUR
840-0160	0÷26	870-0071	0.22	63
840-0160-02	0÷26	870-0010	0.28	115
840-0160-04	0÷26	870-0020	0.28	125
840-0170	24.5÷51	870-0071	0.24	65
840-0170-02	24.5÷51	870-0010	0.30	117
840-0170-04	24.5÷51	870-0020	0.30	127

840-0180 POLARIZER HOLDERS

840-0180-A1 840-0180-A2 840-0180-A3



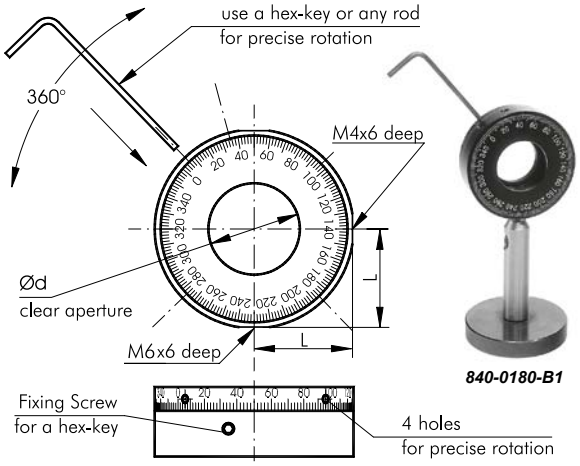
840-0180-A1, 840-0180-A2

- **For Ø1", Ø2" and Ø3" optics**
- **Accepts optics up to 13 mm thick**
- **Continuous 360° rotation with 2° scale gradation**
- **Lockable**
- **Roller bearings design**
- **2 graduation scales that may be useful in little space applications**
- **M6 and M4 threaded holes for mounting on posts or bases**
- **Material: black anodized aluminum**

Polarizer Holders 840-0180-A are ideal for positioning rotation sensitive optics such as polarizers or waveplates. Holders are offered for optics of 1", 2" or 3" diameter. Optics is placed inside central aperture, where it is securely held in place by a threaded retaining ring. The position is indicated on two 360° angular scales, with gradation of 2°. Where space doesn't allow to read one scale, you always will be able to view another.

The base of a holder has M6 and M4 threaded holes for mounting on posts or bases.

840-0180-A has a removable rod to rotate the platform by any of its 4 holes.



840-0180-B1

840-0180-B1, 840-0180-B2

Polarizer Holders 840-0180-B are the same as 840-0180-A, except that their fixing screw is tightened with a hex-key (included), and it does not stand out from the surface.

Like in 840-0180-A, the platform is rotated by any rod or the same hex key.

The holders are made of black anodized aluminium.

Code	D, mm	E, mm	H,mm	B, mm	d, mm	L, mm	M, mm	F, mm	m, mm	Weight, kg	Price, EUR
840-0180-A1	51	16.5	17.5	25.5	23	25	M27×1	7.5	2.5	0.08	69
840-0180-B1	51	16.5	17.5	25.5	23	25	M27×1	7.5	2.5	0.08	69
840-0180-A2	82	19	20	51.5	48	40.5	M53×1	9.5	2.5	0.18	138
840-0180-B2	82	19	20	51.5	48	40.5	M53×1	9.5	2.5	0.17	138
840-0180-A3	115	24.5	26.5	76.9	72	57	M78×1	12	3.5	0.46	210
840-0180-B3	115	24.5	26.5	76.9	72	57	M78×1	12	3.5	0.46	210

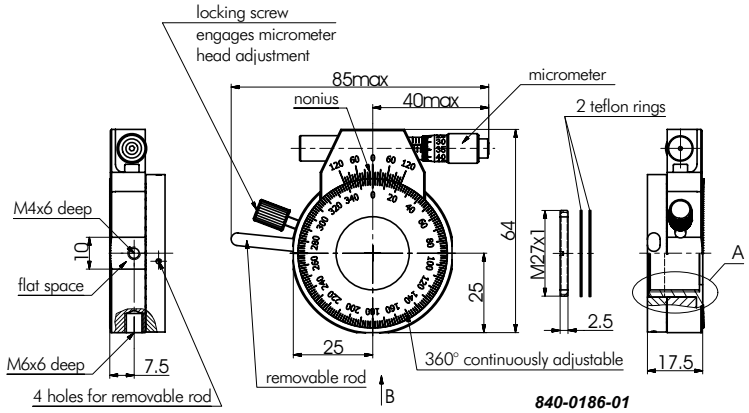
840-0186 HIGH PRECISION ROTATION POLARIZER, WAVEPLATE MOUNT

840-0186-01

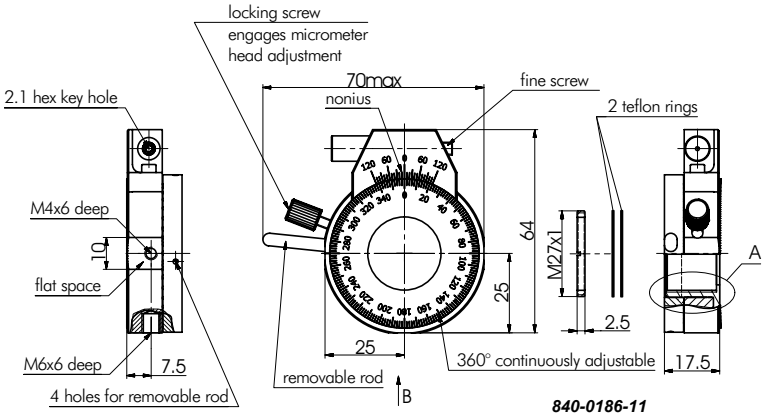
840-0186-11

High Precision Rotation Mount 840-0186 is ideal for positioning rotation sensitive optics such as polarizers or waveplates. The most common requirement for polarizers is to rotate them about their optical axis. Mounts accept optics of 1" in diameter. Optics are placed inside central aperture, where it is securely held in place by a threaded retaining ring. The position is indicated on 360° angular scale with gradation of 2°. Once mount is fixed in desired position it can be fine ajusted within 5° range with 1 arcmin accuracy. Micrometer screw 870-0055 is used, which can be optionally replaced with 870-0095 fine hex adjustment screw. The base and side of the polarizer holder has M6 threaded holes for mounting on posts or bases. Surface around mounting holes is flattened so the mount stays rigid once fixed on a mounting post or any other flat base. 840-0186 has a removable rod to rotate the platform by any of its 4 holes.

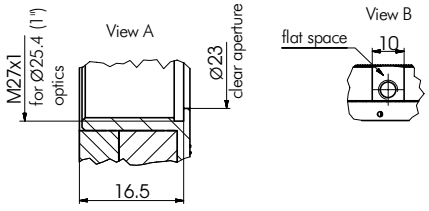
- **360° Continuous rotation**
- **Sensitivity 1 arcmin**
- **Compact design with roller bearings**
- **Direct read 2° graduations on main dial**
- **When locked, micrometer driven ±5° of fine rotation**
- **Ideal for 1" polarization optics**
- **One retaining ring included**
- **Optics thickness (max): 13 mm**



840-0186-01



840-0186-11



Code	Description	Price, EUR
840-0186-01	for 1" optics. With micrometer 870-0055	215
840-0186-11	for 1" optics. Fine hex adjustment screw	185

840-0190 POLARIZER HOLDER

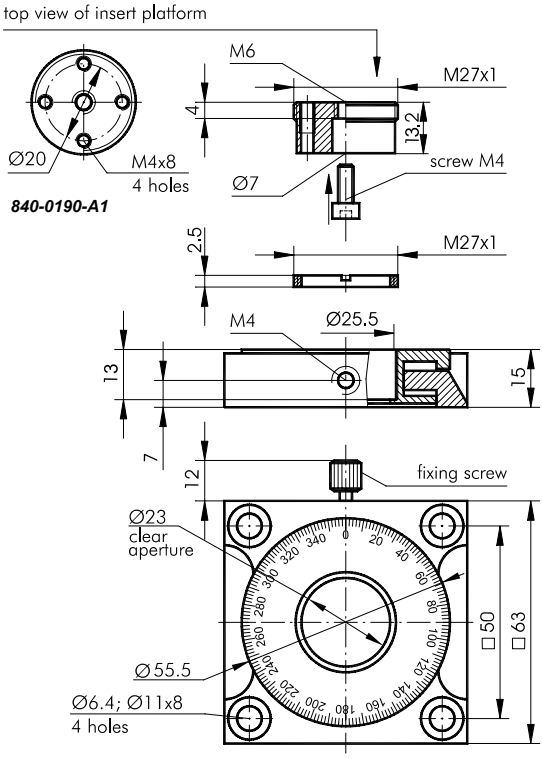
- **For Ø1” optics**
- **Can be used as an optical mount and rotation stage**
- **Accepts optics up to 9 mm thick**
- **Continuous 360° rotation with 2° scale gradation**
- **Lockable**
- **Roller bearings design**
- **Material: black anodized aluminum**

Base of 840-0190 has beveled sides for fingers to rotate the platform by its knurled edge.

840-0190 Polarizer Holder can be transfomed into a rotation stage with a complementary insert platform 840-0190-A1, which should be ordered separately.

The platform has a pattern of M4 holes and a central Ø7-to-M6 hole for mounting of components. If you need to fasten a unit with a M4 mounting hole to the central hole, you can slip an M4 screw through this Ø7-to-M6 combined hole.

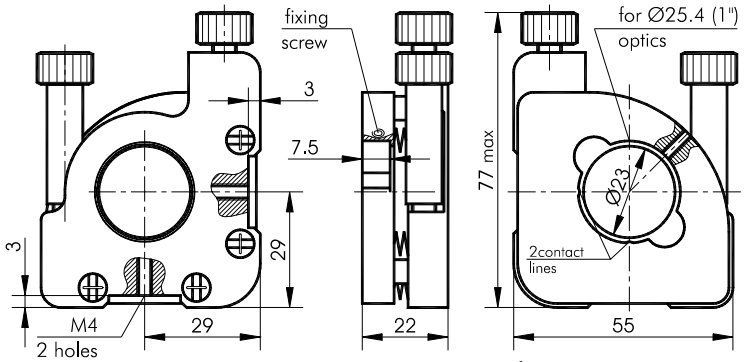
Code	Weight, kg	Price, EUR
840-0190-01	0.12	78
840-0190-A1	-	6

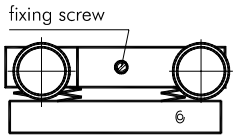


Mounting option:
*Polarizer Holder, **840-0190***
*Insert Platform, **840-0190-A1***
*Standard Rod, **820-0010***
*Rod Holder, **820-0050***
*Flipping Mirror / Beamsplitter Mount, **840-0155-01***

Mounting option:
*Polarizer Holder, **840-0190***
*Insert Platform, **840-0190-A1***
*Standard Rod, **820-0010***
*Rod Holder, **820-0050***
*Polarizer Holder, **840-0185***

840-0192 KINEMATIC DOUBLE OPTICAL MOUNT OF SIDE DRIVE





- **For Ø25.4 mm (1 inch) optics, thickness ≤10.5 mm**
- **Clear aperture 23 mm**
- **Kinematic design**
- **Dimensions most compact among 1 inch optics mounts**
- **Tilt/tip range ±2°**
- **Sensitivity 3 arcsec**
- **Both tilt and tip controlled from aside the optical path**
- **Ideal for dense optical schemes**
- **Fine adjustment screws with 0.25 mm pitch**
- **Hardened seats under adjustment screws**
- **Fine screw thread: M6×0.25 mm**
- **Accepts two pieces of optics: on the platform (adjustable), and on the base (not adjustable)**

To prevent damage to the optics the fixing screws have plastic tip.

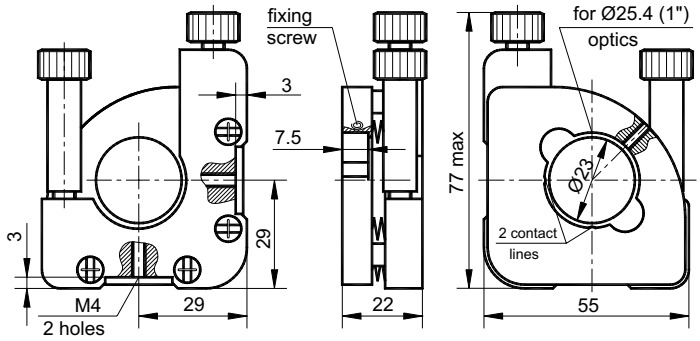
front and rear view – the base has an aperture for the second optics (not adjustable)

Code	Weight, kg	Price, EUR
840-0192	0.1	90

840-0193 KINEMATIC OPTICAL MOUNT OF SIDE DRIVE

- **For Ø25.4 mm (1 inch) optics, thickness ≤10.5 mm**
- **Clear aperture 23 mm**
- **Kinematic design**
- **Dimensions most compact among 1 inch optics mounts**
- **Tilt/tip range ±2°**
- **Sensitivity 3 arcsec**

- **Fine Screw Thread M6×0.25 mm**
- **Both tilt and tip controlled from aside the optical path**
- **Ideal for dense optical schemes**
- **Fine adjustment screws with 0.25 mm pitch**
- **Hardened seats under adjustment screws**



To prevent damage to the optics the fixing screw has a plastic tip.

Code	Weight, kg	Price, EUR
840-0193	0.12	87

EKSMA OPTICS • Tel.: +370 5 272 99 00 • Fax: +370 5 272 92 99 • info@eksmaoptics.com • www.eksmaoptics.com

840-0195 ADJUSTABLE POLARIZER HOLDER OF SIDE DRIVE

- **Dimensions most compact among 1” optics mounts**
- **Both tilt and tip are controlled from aside the optical path**
- **Original stabilized L-shaped flat spring**
- **Fine adjustment screws with 0.25 mm pitch**
- **Hardened inserts under adjusters**
- **Accepts optics 25.4 mm (1”) in diameter**
- **Accepts optics upto 10.5 mm thick**
- **Tilt/tip travel range ±2°**
- **Roller bearings**
- **Lockable**
- **Continuous 360° rotation**
- **Horizontal and vertical mounting**
- **Mounting holes M4 on three sides**

Adjustable Polarizer Holder 840-0195 is a 1 inch polarizer with an integrated adjustment of tilt and tip about two orthogonal axes within ±2°. The design is the slimmest ever.

The polarizer platform is graduated in 2° on a 360° angular scale. The platform has a removable rod by which you rotate it continuously the whole 360°, without obscuring the aperture. You can use the rod on any of the 4 holes on the perimeter.

The holder accepts Ø25.4 mm optics. Optics is stopped by a rest-flange, and is secured by a threaded retaining ring with Ø23mm clear aperture. A tightening key for the retaining ring is available on request.

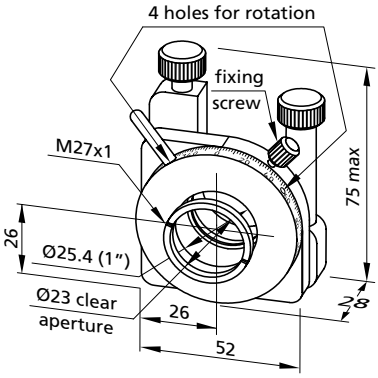
Tilt and tip is done by two stainless steel fine adjustment screws with pitch of 0.25 mm. The screws push rolling balls against hardened seats, ensuring smooth operation and sensitivity of 3 arcsec.

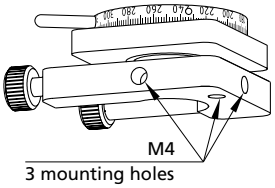
Large knobs ease the strain on your fingers. Both screws protrude from the top side, allowing easy access in dense schemes.

For tilting, the platform is preloaded against the base with L-shaped flat spring of our original design which renders great stability and eliminates induced polarization.

Three M4 tapped holes on the sides of the base and on its back allow horizontal or vertical mounting. The holder easily mounts on posts and bases.

Material: black anodized aluminium. L-shaped spring is made of high quality stainless spring steel.





3 mounting holes allow different mounting orientations, e.g. as a rotation stage.

SPECIFICATIONS

Fine screw thread	M6×0.25 mm
Tilt/tip range	±2°
Sensitivity	3 arcsec
Rotation range	360°
Scale gradation	2°
Optics accepted	
diameter	≤ Ø25.4 mm
thickness	≤ 10.5 mm
Clear aperture	23 mm
Weight	0.13 kg

Mounting option:
*Aluminium Optical Rails, **810-0005***
*Standard Rods, **820-0010***
*Rod Holders, **820-0050***

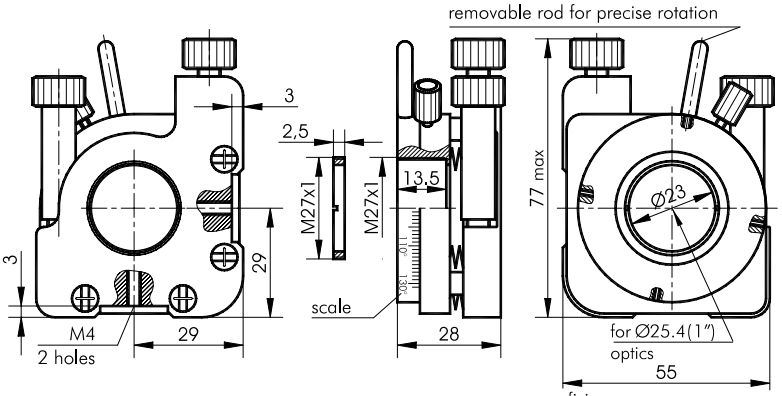
Code	Price, EUR
840-0195	155

Complementary Products

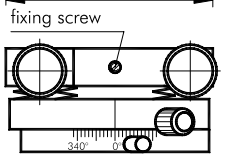
Code	Page
810-0005	7.9
820-0010	7.16
820-0050	7.17

840-0197 OPTICAL MOUNT OF SIDE DRIVE WITH ADJUSTABLE POLARIZER HOLDER

back view
the base has an aperture for the second optics (not adjustable)



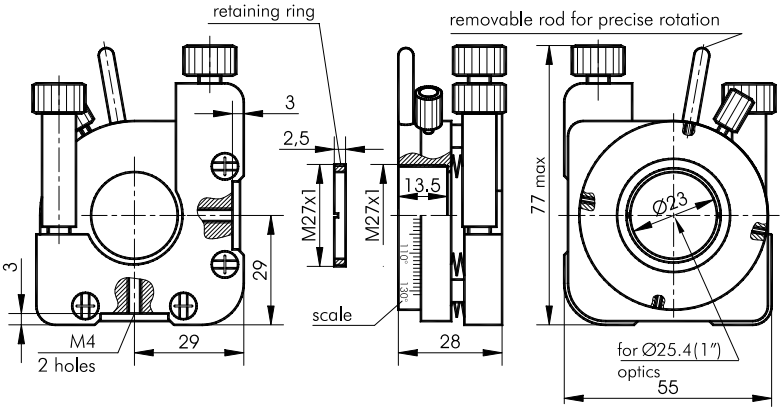
- For Ø25.4 mm (1 inch) optics
- Clear aperture 23 mm
- Kinematic design
- Dimensions most compact among 1 inch optics mounts
- Tilt/tip range ±2°
- Sensitivity 3 arcsec
- Both tilt and tip controlled from aside the optical path
- Ideal for dense optical schemes
- Fine adjustment screws with 0.25 mm pitch
- Hardened seats under adjustment screws
- Rotation range 360°
- Scale gradation 2°
- Accepts two pieces of optics: - on the platform (adjustable), - and on the base (not adjustable)



The screw for fixing optics in the base has a plastic tip. A retaining ring M27×1 to fix the optics is included. A tightening key for the retaining ring is available on request.

Code	Weight, kg	Price, EUR
840-0197	0.13	169

840-0199 KINEMATIC ADJUSTABLE POLARIZER HOLDER OF SIDE DRIVE



- For Ø25.4 mm (1 inch) optics
- Clear aperture 23 mm
- Kinematic design
- Dimensions most compact among 1 inch optics mounts
- Tilt/tip range ±2°
- Sensitivity 3 arcsec
- Both tilt and tip controlled from aside the optical path
- Ideal for dense optical schemes
- Fine adjustment screws with 0.25 mm pitch
- Hardened seats under adjustment screws
- Rotation range 360°
- Scale gradation 2°

This kinematic mount accepts crystal housings of Ø25.4 mm and thickness up to 10.5 mm. The housing is stopped by a rest-flange inside the central aperture of the platform, and is secured by a threaded retaining ring.

The rotation position (X axis) is indicated on 360° angular scale with a gradation of 2°. The rotation platform has a removable rod that allows continuous 360° rotation without obscuring the aperture.

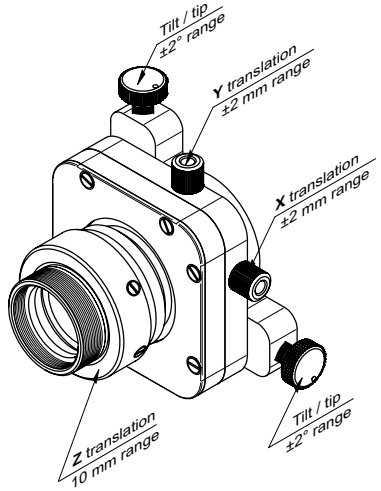
Angular adjustment range of tilt/tip (Z, Y axes) is ±2.5°. Two high resolution stainless steel vertical-drive screws with a pitch of 0.25 mm and "wedge and ball" mechanism ensure smooth and precise angular tilt/tip adjustment with 3 arc sec sensitivity. For tilting, the platform it is preloaded against the base with high quality springs.

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.

Code	Weight, kg	Price, EUR
840-0199	0.12	165

840-0210 FIVE AXES KINEMATIC OPTICAL MOUNT



Five-axes mounts are considered as a combination of:

- side drive kinematic optical mount (840-0192 / 840-0193),
- Y-Z translation optical mount (990-0050),
- optical zoom option.

Five-axes optical mount 840-0210 consists of:

- top side regulation two-axes kinematic mirror mount with two screws (thread pitch 250 µm (100 TPI));
- two-axes translation stage with 2 mm travel range driven by two screws (thread pitch 250 µm (100 TPI));
- zoom providing 100 mm travel range.

840-0210 holds 1 inch optics. The adapters may be purchased to mount optics of different diameters. Five-Axes Optical Mounts have M4 holes on the bottom to accommodate different mounting systems directly or through tread adapters.

Vacuum compatible model of the mount can be provided on request.

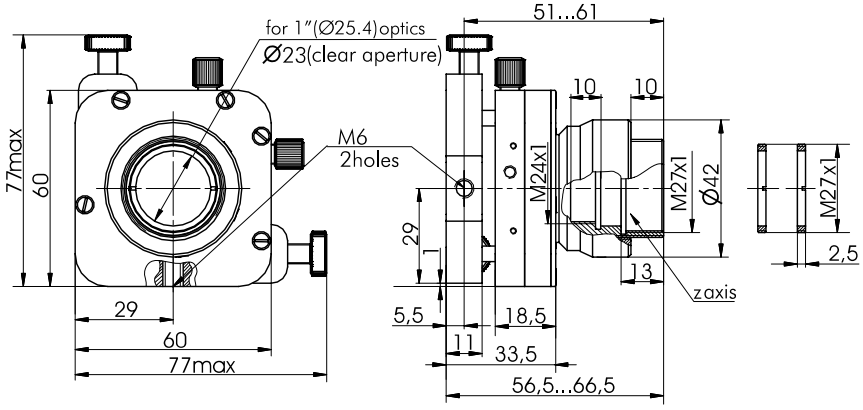
SPECIFICATIONS

Fine screw thread	M6×0.25 mm
Optics diameter	Ø25.4 mm
Tilt/tip range	±2°
	screw thread pitch 250 µm (100TPI)
Sensitivity	3 arcsec
XY translation range	±2 mm
	screw thread pitch 250 µm (100TPI)
Sensitivity for XY translation	1 µm
Sensitivity for Z translation	1 µm
Z translation range	10 mm
Material	aluminium
Finishing: 840-0210	black anodized
840-0210-10	vacuum compatible
Weight	0.28 kg

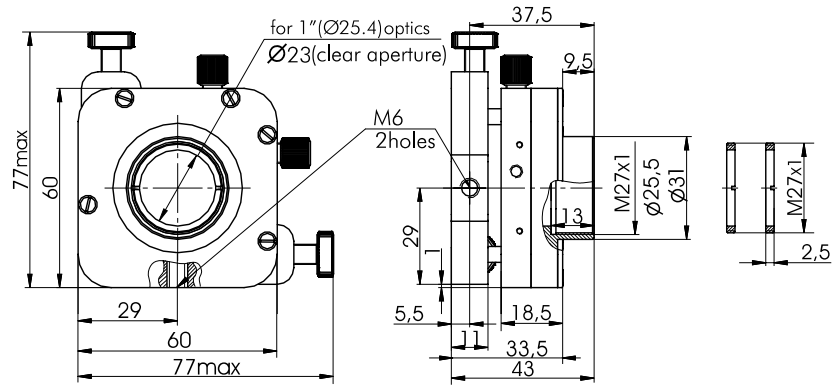
Complementary Products

Code	Page
840-0192	7.51
840-0193	7.51
990-0050	online

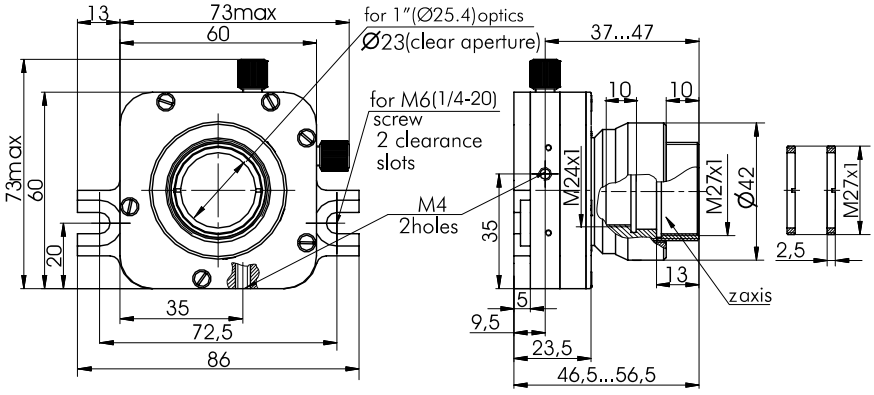
Five Axes Kinematic Optical Mount – 840-0210



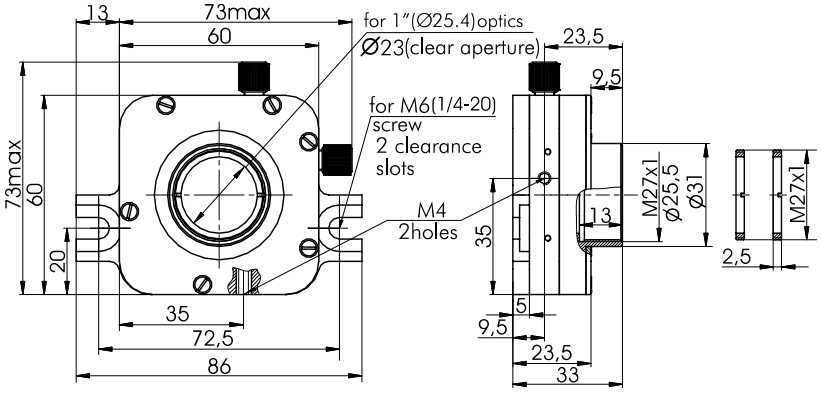
Four Axes Kinematic Optical Mount – 840-0209



Three Axes Translation Optical Mount – 840-0208



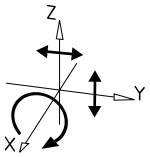
Two Axes Translation Optical Mount – 840-0207



Ordering Information

Code	Mount	Price, EUR
840-0210	Five Axes Kinematic Optical Mount: - Tilt/tip range; - XY translation range; - Z translation range	270
840-0209	Four Axes Kinematic Optical Mount: - Tilt/tip range; - XY translation range	257
840-0208	Three Axes Translation Optical Mount: - XY translation range; - Z translation range	213
840-0207	Two Axes Translation Optical Mount: - XY translation range	206

840-0240 TWO AXES TRANSLATION POLARIZER HOLDER

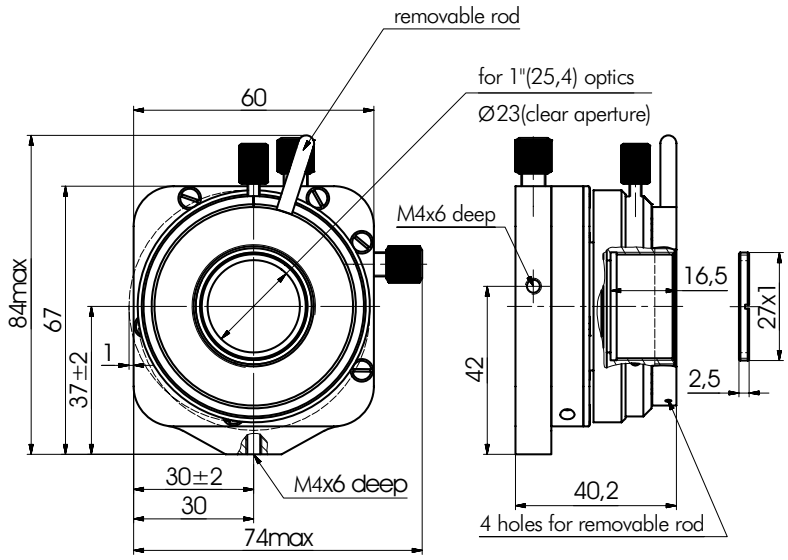


Two Axes Translation Polarizer Holder 840-0240 accepts optics of 25,4 mm diameter or with additionally provided adapter can accomodate smaller than 1" (25.4 mm) optics. The rotation position (X axis) is indicated on 360° angular scale with a gradation of 2°. The rotation platform has a removable rod that allows continuous 360° rotation without obscuring the aperture. This removable rod can be fitted into any of the four holes (10°, 100°, 290°, 280°) on the perimeter of rotation platform.

Two axes (Y-Z) translation stage with 2 mm travel range is driven by two screws. Two axes translation polarizer holder has M4 hole on the bottom and can be fitted in different mounting systems. A retaining ring M27×1, two teflon rings and tightening key are included.

Code	Weight, kg	Price, EUR
840-0240	0.27	290

- **For 1" or smaller optics**
- **Clear aperture Ø23 mm**
- **Continuous 360° rotation**
- **Scale gradation 2°**
- **X-Y travel range 2 mm**



Translation & Rotation Stages

860-0010 COMPACT TRANSLATION STAGE

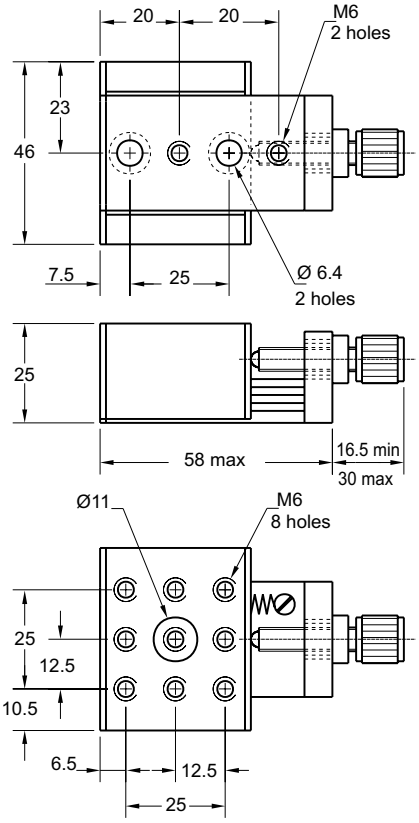
The model 860-0010 compact translation stage is well suited for positioning applications in laboratory experiments requiring linear motion within small space. Ball bearing rolling between opposing of hardened, polished steel rods provide smooth, accurate translating platform's ride.

Model 860-0010 stages are designed to stack for X-Y motion. Vertical motion may be also added using model 810-0100 angle bracket. Model 860-0010 stage provides 13 mm travel with 5 µm resolution and max. 3 kg loading capacity. Max. straightness is ± 6 µm only.

Model 860-0010 is completed with steel screw M6×0.5mm and brass collar with an outer thread M10×1mm for mounting.

Additionally model 860-0010-02 is completed with model 870-0010 precise screw. 860-0010-04 option comes with model 870-0020 micrometer screw with reading marks.

Finish: black oxidized steel.

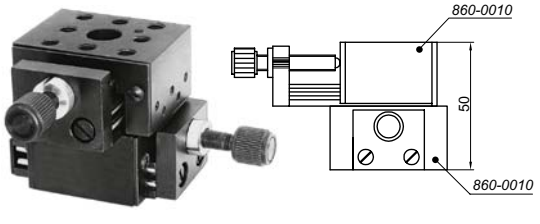


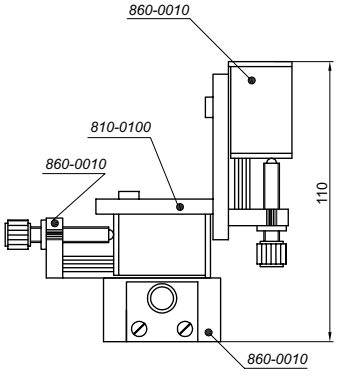
Mounting option: Large Rod with Rod Base 810-0050, Large Rod Mounting Clamp 810-0061, Movable Base 820-0090, Compact Translation Stages 860-0010 XYZ

Code	Weight, kg	Price, EUR
860-0010	0.31	107
860-0010-02	0.34	133
860-0010-04	0.34	138

Complementary Products

Code	Page
810-0050	7.10
810-0061	7.12
810-0100	online
820-0090	7.19
870-0010	online
870-0020	online





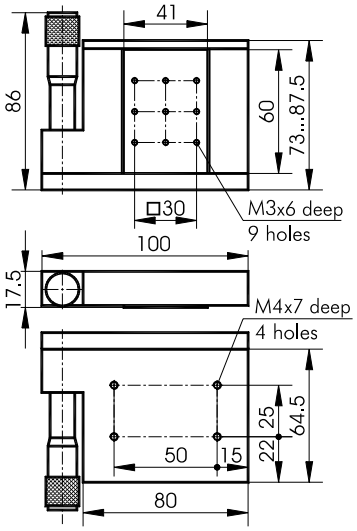
860-0051 TRANSLATION STAGE

- **Micrometer drive**
- **X-Y-Z configuration available**

SPECIFICATIONS

Travel range	15 mm
Sensitivity	1 µm
Scale graduation	10 µm
Tracking accuracy	2 µm
Load capacity:	
horizontal	10 kg
vertical	5 kg
Weight	0.41 kg

Code	Price, EUR
860-0051	249

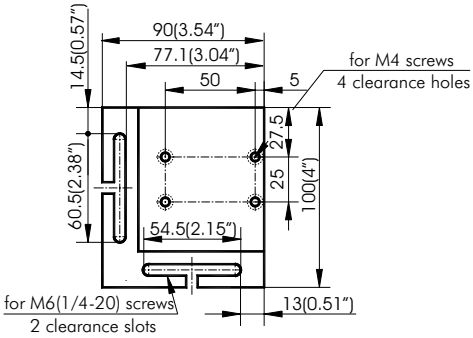


*Vacuum compatible Translation System 860-0051V-XYZ is available at **www.eksmaoptics.com***

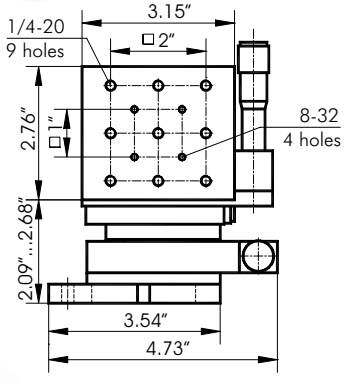
XYZ Translation System – 860-0051 XYZ

SPECIFICATIONS

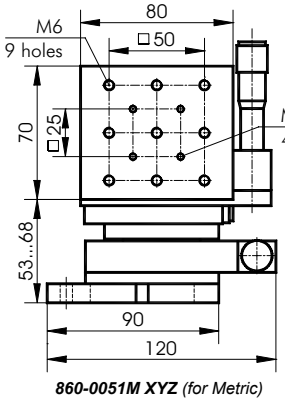
Travel range	15 mm
Sensitivity	1 µm
Scale graduation	10 µm
Tracking accuracy	2 µm
Load capacity	5 kg



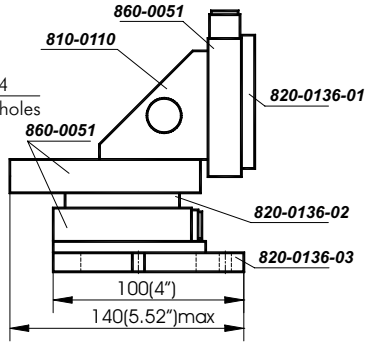
***Base Plate** top view*



***860-0051E XYZ** (for Inch)*



***860-0051M XYZ** (for Metric)*



820-0136-01

820-0136-02

810-0110

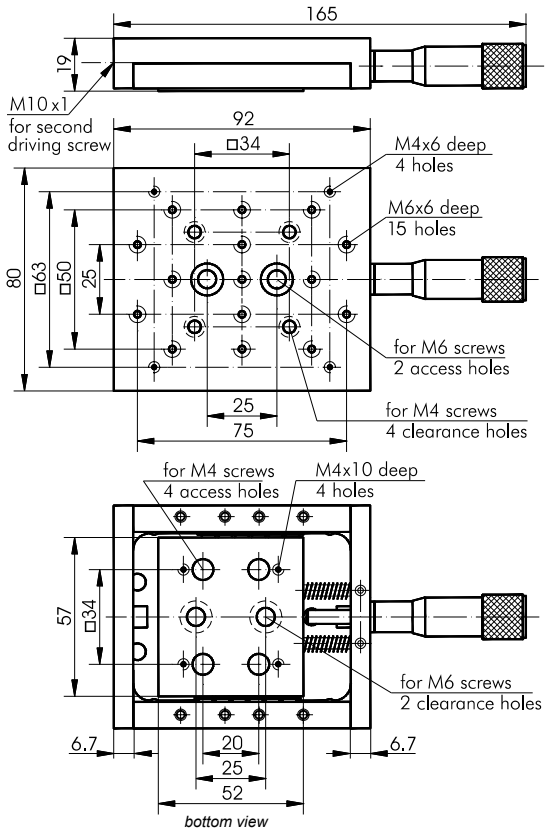
820-0136-03

The stages are assembled of:

3 pieces of 860-0051
1 piece of 820-0136-01
1 piece of 810-0110
1 piece of 820-0136-02
1 piece of 820-0136-03

Code	Weight, kg	Price, EUR
860-0051E XYZ	1.35	747
860-0051M XYZ	1.35	747

860-0052 STABLE STEEL TRANSLATION STAGE



- **Solid box design**
- **25 mm travel range**
- **Variety of mounting holes and options**
- **Easily stacked in X-Y configuration**
- **For Z axis add 810-0146**
- **Large mounting surface**
- **Made of steel**

SPECIFICATIONS

Travel range	25 mm
Sensitivity	1 µm
Reading accuracy	10 µm
Angular deviation	<200 µRad
Tracking accuracy	2 µm
Load capacity:	
horizontal	20 kg
vertical	5 kg
Assemblies:	
X-Y	directly
Z	810-0146

Complementary Products

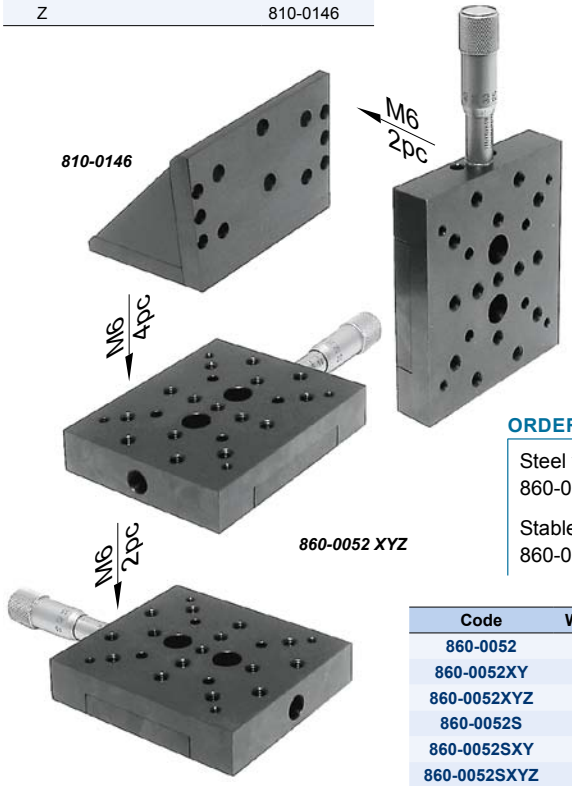
Code	Page
810-0146	online

Stable Steel Translation Stages 860-0052 have large mounting surface, great travel range for this relatively small size, low profile, and increased stability and precision. Box design reinforces the stage, reducing flex. Steel, as a material, adds to stability.

You can mount a second driving screw on the other end (to lock the platform in fixed positioning applications). The platform is preloaded by springs. The stages can be stacked immediately to other units, or to their own type (e.g. in X-Y configuration). The stages can be used upside-down.

For immediate attachment the base has 2 clearance holes for M6 screws. Similarly, the platform has 4 clearance holes for M4 screws. Slip the screws from top or under through the access holes in a platform/base. Micrometer 870-0040-25 comes as standard.

The stage has black anodized finish.



860-0052 XYZ

ORDERING INFORMATION

Steel version:
860-0052; 860-0052 XYZ

Stable Steel version:
860-0052S; 860-0052S XYZ

Code	Weight, kg	Price, EUR
860-0052	0.78	298
860-0052XY	1.7	596
860-0052XYZ	2.58	930
860-0052S	0.8	398
860-0052SXY	1.6	796
860-0052SXYZ	2.6	1230

Vacuum Compatible Translation Stage **860-0052V** is available.

860-0052V XYZ

For product data sheet please visit ***www.eksmaoptics.com***

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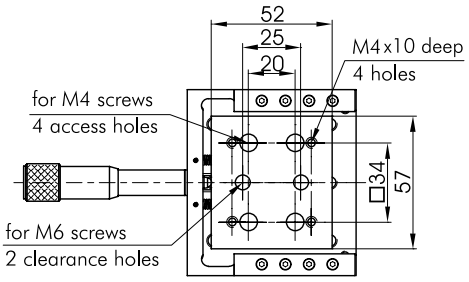
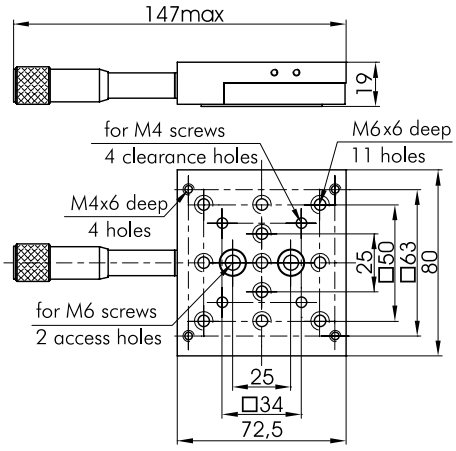
860-0053 LOW COST LINEAR TRANSLATION STAGE

860-0053-01

860-0053-02





860-0053-01

- **Solid box design**
- **25 mm travel range**
- **Variety of mounting holes and options**
- **Easily stacked in X-Y configuration**
  For Z axis add 810-0146-Al
- **Large mounting surface**
- **Made of aluminium**

SPECIFICATIONS

Travel range	25 mm
Sensitivity	1 µm
Reading accuracy	10 µm
Angular deviation	< 200 µrad
Tracking accuracy	2 µm
Load capacity:	
horizontal	20 kg
vertical	5 kg
Weight	0.4 kg
Material	black anodized aluminium
Assemblies:	
X-Y	directly
Z	810-0146-A

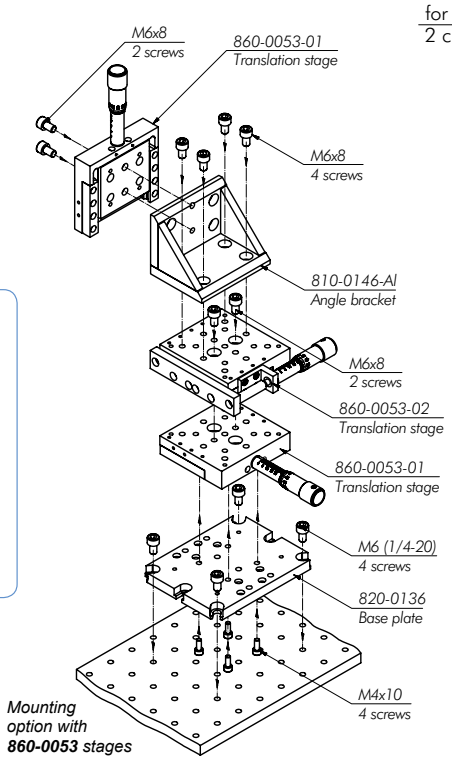
Code	Description	Price, EUR
860-0053-01	standard stage	210
860-0053-02	side driven stage	217
860-0053-03	side driven right hand stage	217

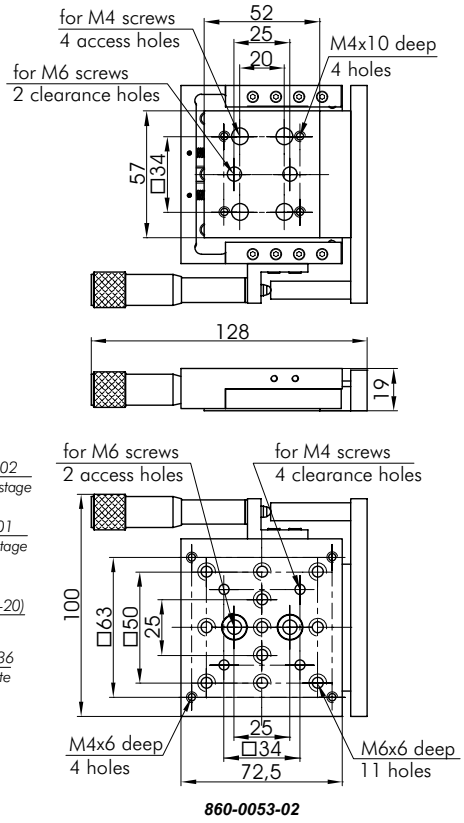
Stable Aluminium Translation Stages 860-0053 have large mounting surface, great travel range for this relatively small size, low profile and increased stability of precision. Box designed reinforces the stage, reducing flex. The platform is preloaded by springs. The stage could be stacked immediately to other units or to their own type (e.g. in X-Y configuration). Z-axis is attached through angle bracket 810-0146-A. The stage could be used upside-down. For immediate attachment the base has 2 clearance holes for M6 screws. Similarly, the platform has 4 clearance holes for M4 screws. Slip the screws from top or under through the across holes in a platform/base. Micrometers 870-0040-25 come as standard.

860-0053-03
Right hand version

Complementary Products

Code	Page
810-0146	online
820-0136	online





860-0053-02

860-0054 STAINLESS STEEL SINGLE TO MULTI-AXES STAGES

860-0054-02 and 860-0054

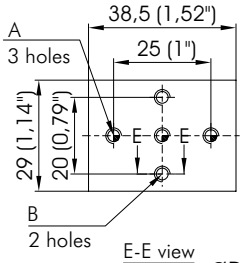
Stable Steel Translation Stages 860-0054 have low profile, and increased stability and precision.

Box design reinforces the stage, reducing flex. Steel, as a material, adds to stability. The platform is preloaded by springs.

The stages can be stacked immediately to other units, or to their own type (e.g. in X-Y configuration).

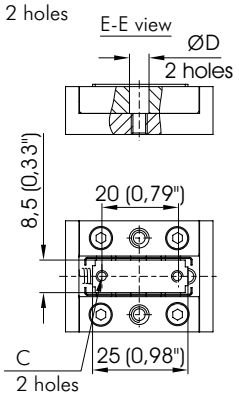
The stages can be used upside-down.

The stages are entirely made of stainless steel.



- **Solid box design**
- **Compact design**
- **6 mm travel range**
- **Large mounting surface**
- **Easily stacked in X-Y configuration**
- **Made entirely of stainless steel – easily adaptable for vacuum applications**

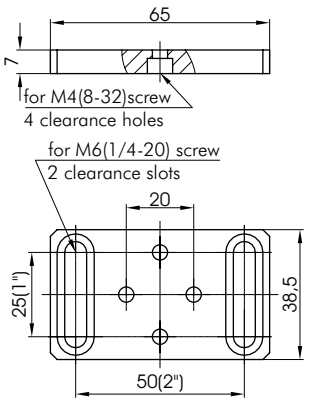
860-0054
with Mini Micrometer ***870-0055-04***



860-0054; 860-0054-02

860-0054
with Fine Hex Adjustment Screw ***870-0090MN***

860-0054
with Fine Hex Adjustment Screw ***870-0090ML***



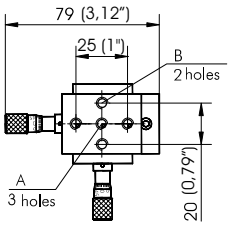
Base Plate

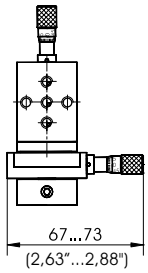
SPECIFICATIONS

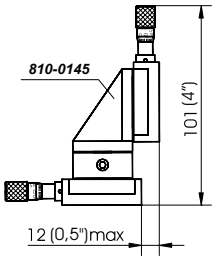
Travel range	6 mm
Sensitivity	1 µm
Reading accuracy	10 µm
Angular deviation	<150 µrad
Tracking accuracy	2 µm
Load capacity:	
horizontal	45 kg
vertical	3 kg
Weight	0.1 kg
Assemblies:	
X-Y	directly
Z	810-0145

Code	Price, EUR
860-0054	149
860-0054-02	149

860-0054 *XYZ*







Complementary Products

Code	Page
810-0145	online
860-0054	7.61
870-0055-04	online
870-0090ML	online
870-0090MN	online

Dimension	860-0054 (metric)	860-0054-02 (imperial)
A	M4×3 deep	#8-32×0.11" deep
B	M4×5 deep	#8-32×0.19" deep
C	M3×6 deep	#4-40×0.23" deep
D	6×7 deep	0.2×0.27" deep

ORDERING

860-0054 – model of **metric** dimensions – is the **standard** one.

860-0054-02 – model of **imperial** dimensions – is produced **on demand**.

Note: actuator is **not included**. It can be ordered separately. Suitable micrometers are: **870-0055-04, 870-0090M, 870-0090MN**.

For vacuum applications please indicate this in your order. We will prepare the stage with appropriate components (e.g. apply alternative lubricants).

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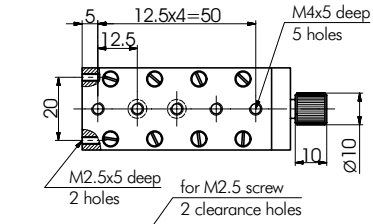
860-0056 NON-MAGNETIC TRANSLATION STAGE

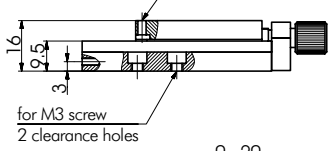
- **Precision non-magnetic translation stage**
- **In this stage are used only non-magnetic materials (brass, bronze, aluminium)**
- **X-Y-Z configurations available**

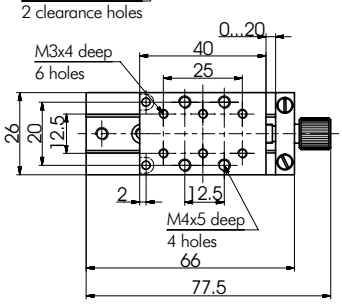
Code	Price, EUR
860-0056	280
860-0056 XY	560
860-0056 XYZ	889

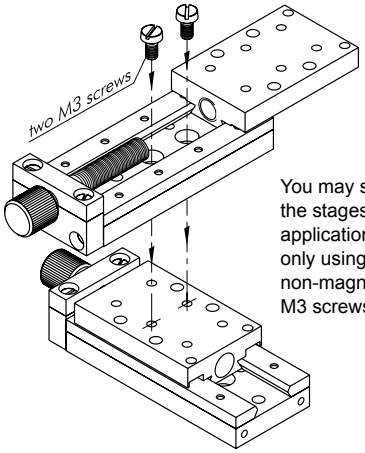
SPECIFICATIONS

Travel range	20 mm
Sensitivity	5 µm
Screw backlash	0.02 mm
Load capacity:	
horizontal	2 kg
vertical	1 kg
Weight	0.19 kg

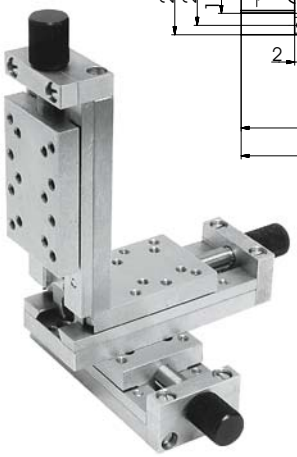


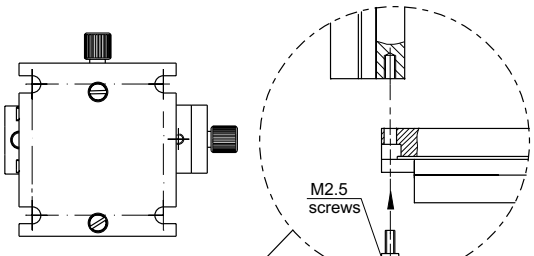


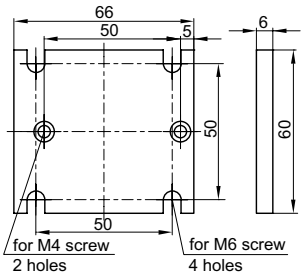




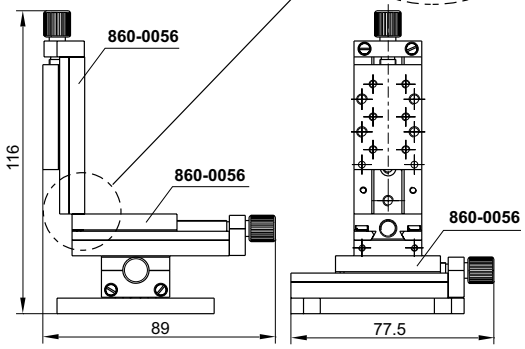
You may stack the stages for XY applications directly only using two non-magnetic M3 screws



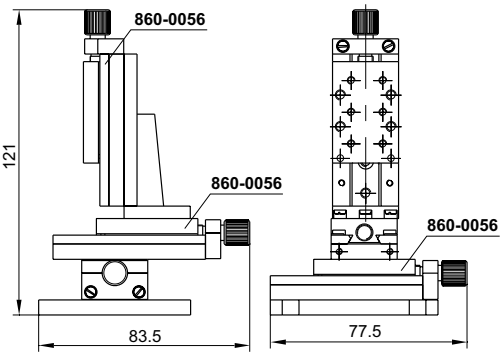




Base Plate



860-0056 XYZ
For quick YZ assembly stages may be stacked using two non-magnetic M2.5 screws



860-0056 XYZ
Angle bracket allow to stabilize stack the stages for YZ motion

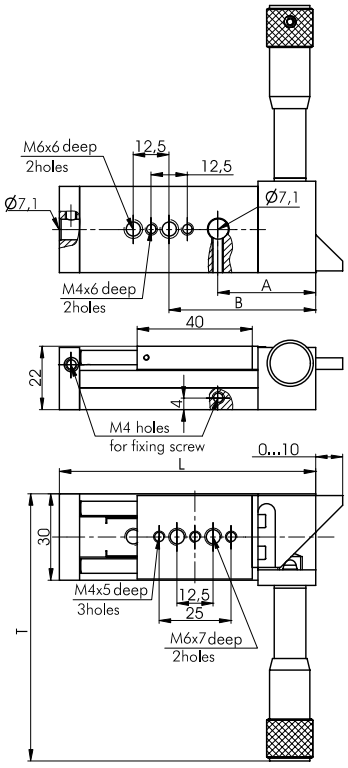
860-0058 SIDE CONTROL LINEAR STAGES

Side control linear translation stages 860-0058 are equipped with 870-0040 series micrometer screws and provide convenient control in limited space set-ups. Both left-hand (860-0058-10, 860-0058-20) and right-hand (860-0058-11; 860-0058-21) versions are available. These stages can be used in multi-axis combinations and are compatible with 860-0060 series stages. In dense optical schemes with limited access to multi-axis stages you have a possibility to control all three axes from one side.

- **10, 20 mm travel ranges**
- **Side Control Linear Stage**
- **Driving micrometer screw**
- **Precise ball bearings**
- **Compact XYZ configuration with all screws from one side**
- **Right and left hand versions are available**

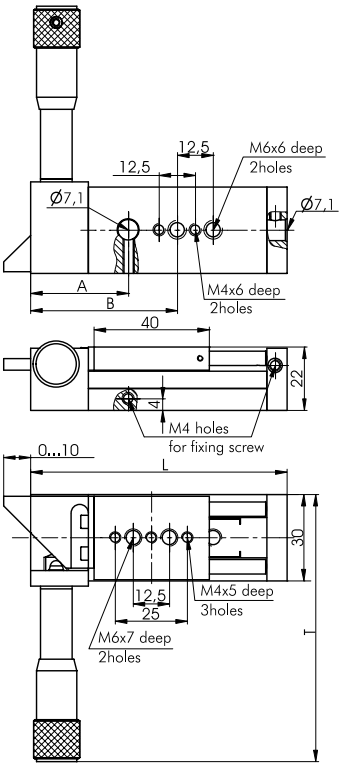
SPECIFICATIONS

Model	860-0058-10	860-0058-20
Travel range, mm	10	20
Sensitivity, µm	1	
Tracking accuracy, µm	2	
Reading accuracy, µm	5 (½ division)	
Load capacity:		
horizontal, kg	10	
vertical, kg	5	
Weight, kg	0.18	0.23
Assemblies:		
X-Y	810-0250	
Z	810-0150	
Price, EUR	206	239



860-0058
left hand version

Catalogue number	Description	A, mm	B, mm	L, mm	T, mm	Weight, kg
860-0058-10	left hand version	31	46	79	67-77	0.18
860-0058-11	right hand version	31	46	79	67-77	0.18
860-0058-20	left hand version	34	51	89	74-94	0.23
860-0058-21	right hand version	34	51	89	74-94	0.23



860-0058
right hand version

Base Plate 810-0250

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860-0060

NARROW (width 30 mm) ALUMINIUM TRANSLATION STAGES

860-0060-02

860-0060-04

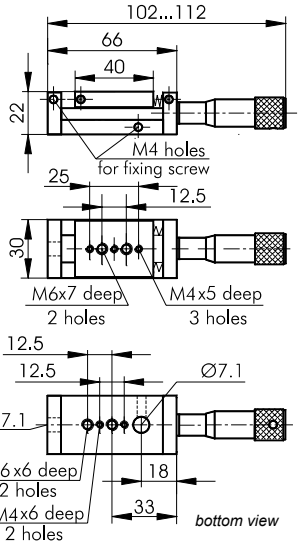
860-0060-05

Stages 860-0060 allow manual linear motion. Standard micrometers 870-0040 are used as driving screws. Customer may specify other screws with non-matching travel range to save space.

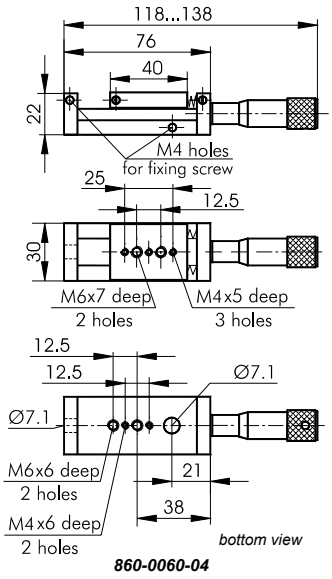
A platform is spring preloaded against the driving screw to provide high resolution, low backlash, smooth and accurate motion.

An array of mounting holes on a platform and on a base allow a variety of convenient mounting options, including mounting on Posts.

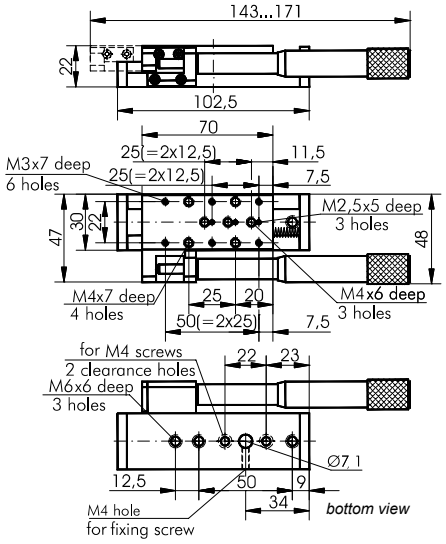
- **10, 20, 25, 50 mm travel ranges**
- **Optional travel: 5, 6, 30 mm**
- **Stackable for compact X-Y-Z configuration**
- **Custom angle brackets are made promptly**
- **Driving micrometer screw**
- **Precise ball bearings**
- **Material: black anodized aluminium**



860-0060-02



860-0060-04



860-0060-05

Specifications	860-0060-02	860-0060-04	860-0060-25	860-0060-05
Travel range, mm	10	20	25	50
Sensitivity, µm	1			
Tracking accuracy, µm	2			
Reading accuracy, µm	5 (½ division)			
Load capacity:				
horizontal, kg	10			
vertical, kg	5			
Weight, kg	0.16	0.2	0.21	0.31
Assemblies:				
X-Y	810-0250	810-0250	810-0250	directly
Z	810-0150	810-0150	810-0150	810-0160
Price, EUR	191	224	249	283

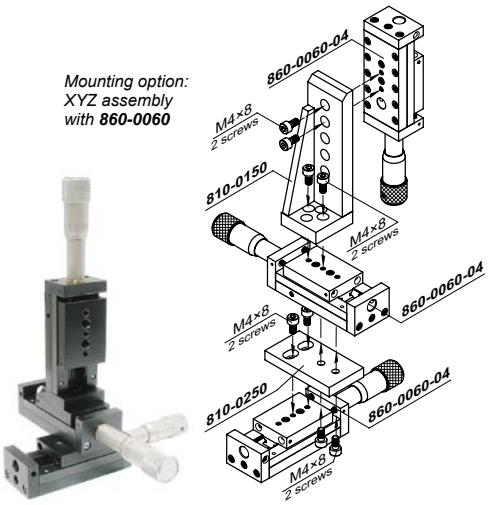
Complementary Products

Code	Page
810-0150	online
810-0150-01	online
810-0160	online
810-0250	7.63
820-0254	7.24
870-0040	online

For **rigid XYZ** assembly we offer a connecting plate 810-0250 (for Y axis) and an angle bracket 810-0150 (for Z axis).

For **quick XYZ** assembly stages may be stacked using connecting cones 820-0254 (Ø7.1 holes with fixing screws on the sides are provided).

Mounting option: XYZ assembly with ***860-0060***



860-0060

MEDIUM (width 50 mm) ALUMINIUM TRANSLATION STAGES

- **50, 100, 150 mm travel ranges**
- **Stackable for X-Y-Z configuration**
- **Convenient patterns of mounting holes**
- **Precise ball bearings**
- **Custom angle brackets are made promptly**
- **Material: black anodized aluminium**

860-0060-06 uses 870-0040 micrometer as a driving screw. The platform is spring preloaded against the screw.

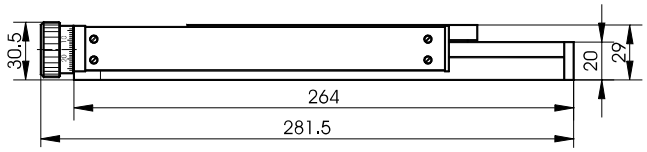
860-0060-08 and 860-0060-10 use their own integrated driving screws. The screw has a micrometric scale (on the body and knob). The pitch of the screw is 0.5 mm. Custom pitch and gears are available on request.

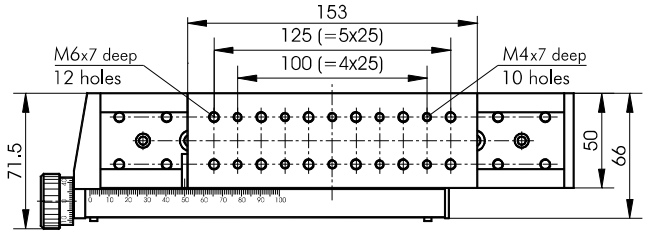
The platform of 860-0060-08 (-10) is preloaded by a collar of our original design on the screw, rendering an increased load capacity, stability, and reduced backlash.

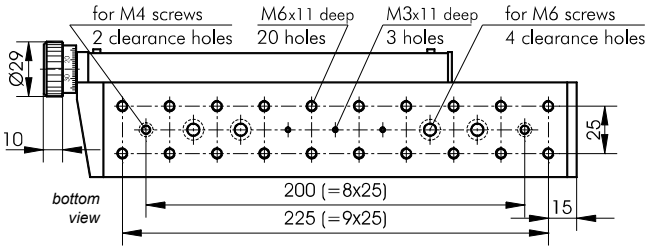
860-0060-08

860-0060-10

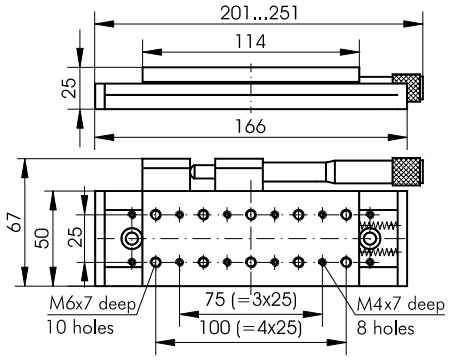
860-0060-06

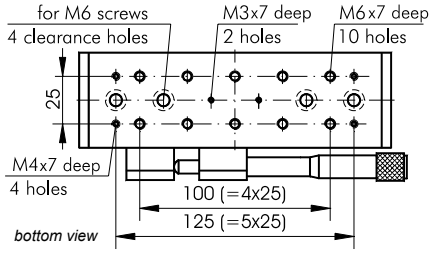






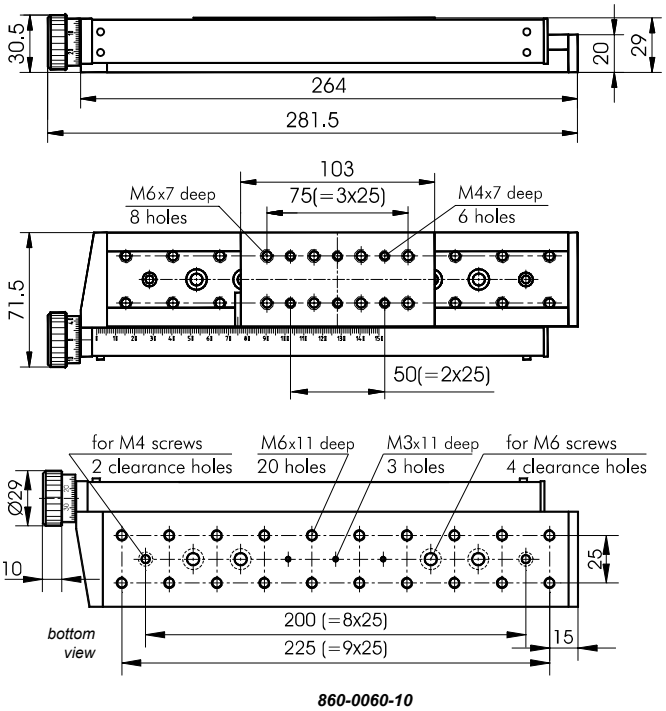
860-0060-08





860-0060-06

Specifications	860-0060-06	860-0060-08	860-0060-10
Travel range, mm	50	100	150
Sensitivity, µm		1	
Tracking accuracy, µm		2	
Reading accuracy, µm	10	10	10
Load capacity:			
horizontal, kg	40	40	40
vertical, kg	9	20	20
Weight, kg	0.74	1.24	1.15
Price, EUR	397	490	549



860-0060-10

X-Y-Z ASSEMBLIES

XY axes stages stack **directly**.
For **Z** axis we offer an angle bracket **810-0160**.

Complementary Products

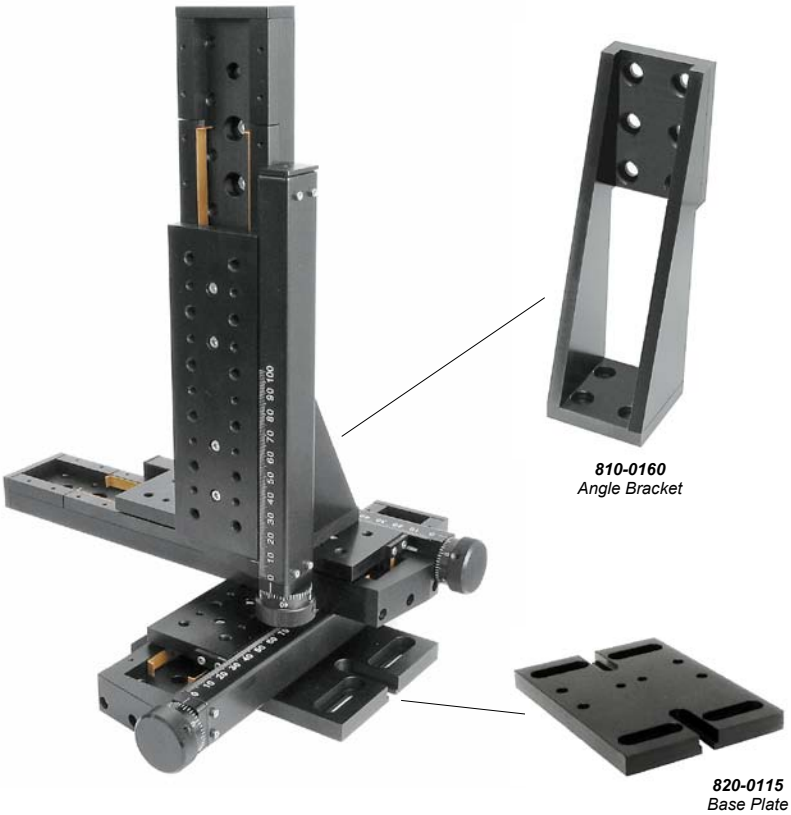
Code	Page
810-0160	online
870-0040	online

Vacuum Compatible Aluminium Translation Stages **860-0060V-08**, **860-0060V-10** is available.

860-0060V-10

For product data sheet please visit ***www.eksmaoptics.com***

Example of 860-0060-08 XYZ



810-0160
Angle Bracket

820-0115
Base Plate

Complementary Products

Code	Page
810-0160	online
860-0060-08	7.65

860-0070-06 LOW PROFILE TRANSLATION STAGE WITH QUICK MOVE LEVER

860-0070-06
with insert platform

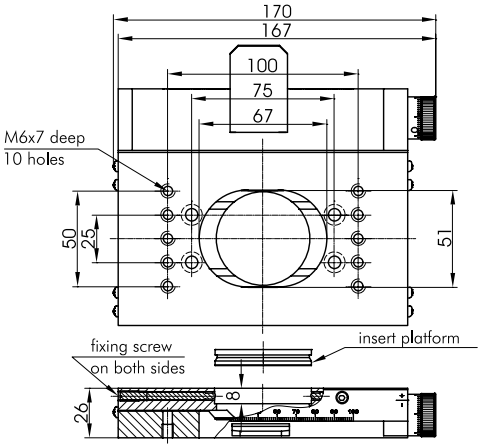
860-0070-06 xy
with insert platform

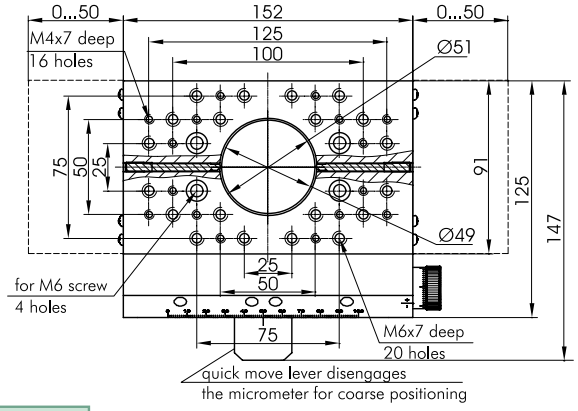
- **Lever for quick movement by passing the driving screw**
- **Precise movement**
- **100 mm travel range**
- **Quick move lever bypassing a driving screw**
- **Stackable for XY positioning**
- **2 inches (Ø50 mm) clear aperture**
- **Insert platform with M6, M4 and clearance holes**

SPECIFICATIONS

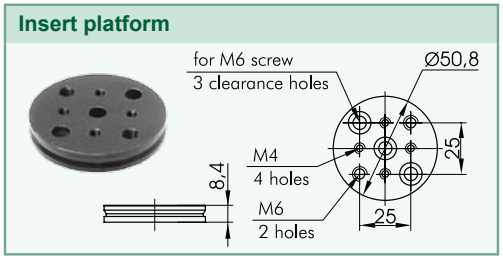
Travel range	100 mm
Sensitivity	1 µm
Scale graduation	10 µm
Load capacity	16 kg
Weight	0.6 kg

Code	Price, EUR
860-0070-06	498
860-0070-06 XY	996

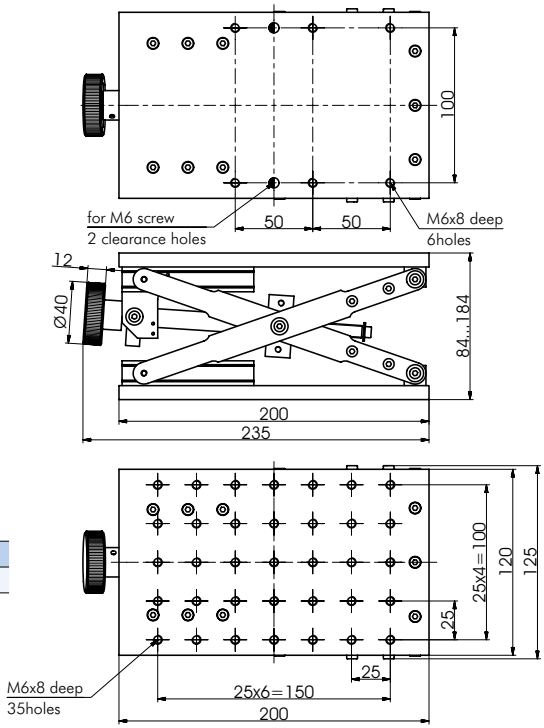




Insert platform



860-0075 VERTICAL TRANSLATION STAGE



- **Pantograph design**
- **16 ball bearings**
- **Precision lead screw**
- **100 mm vertical travel**
- **Height: min 84 mm**
  max 184 mm
- **Top and bottom plates parallel to 1 mm**
- **Load capacity 7 kg**
- **Weight 2.72 kg**

Code	Price, EUR
860-0075	381

Vertical Translation Stage 860-0075 boasts our unique design. Being very compact, it provides smooth and stable adjustment of height. It has a large travel range, and it supports large loads. While moving the platform stays parallel to the base.

The lead screw acts at a varying angle, so the resolution of the stage varies with position.

The platform has an array of M6 holes spaced by 25 mm. The base has six M6 and two Ø6.5 holes.

Material: black anodized aluminium.

860-0085 BASIC TRANSLATION STAGES

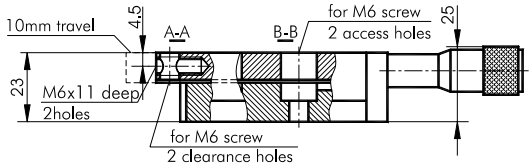
860-0085-02

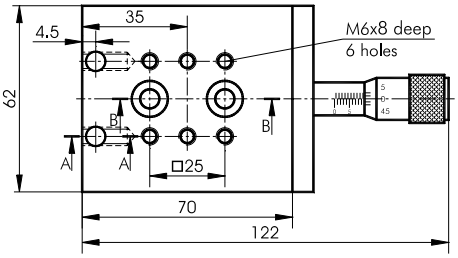
860-0085-01

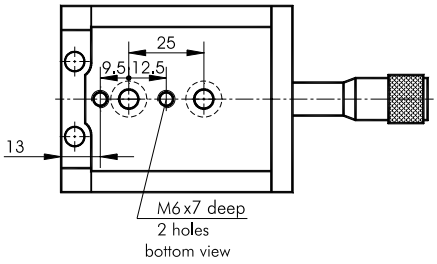
- **10 mm travel**
- **Low profile**
- **X-Y-Z direct stacking**

860-0085-02
bottom view

860-0085-01
bottom view







860-0085-01

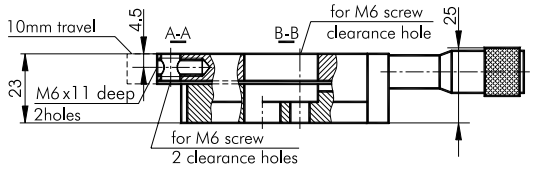
Basic Translation Stages 860-0085 can be stacked for XYZ applications. 860-0085-01 stage should be stacked in XY axes with greater stability (by two M6 screws) and 860-0085-02 should be used for Z axis (by two M6 screws). 860-0085-02 has less mounting provisions than 860-0085-01 with extra mounting holes for end items.

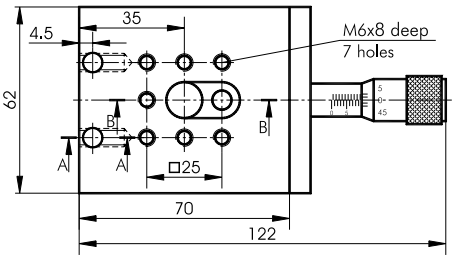
860-0085-02 has patterns of mounting holes: M6 on the platform, and M4 on the base. The base has a Ø12 mm clear aperture not obscured over the whole travel range. The platform rolls on ball bearing guides, and is preloaded against the driving screw by springs. Load capacity is up to 3 kg, when mounted vertically. The stages mount directly to their own type, or to other stages, optical tables. The stages are of black finished aluminium.

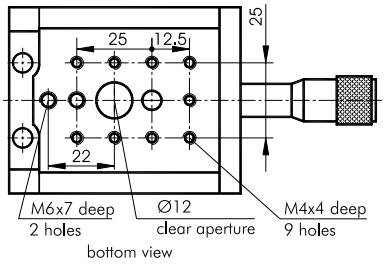
SPECIFICATIONS

Travel range	10 mm
Sensitivity	1 µm
Angular deviation	< 200 µrad
Tracking accuracy	2 µm
Reading accuracy	5 µm (½ div.)
Load capacity:	
horizontal	10 kg
vertical (relative to driving screw)	
against	3 kg
away	0.5 kg
Weight	0.3 kg

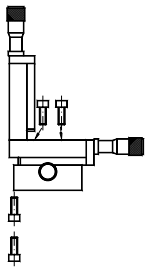
Code	Price, EUR
860-0085-01	179
860-0085-02	188



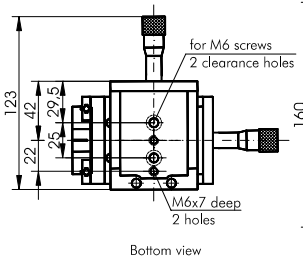


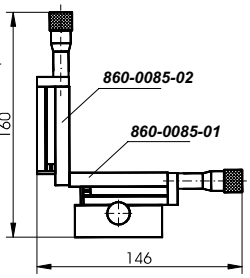


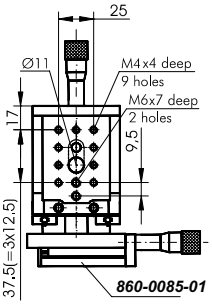
860-0085-02



You may stack the stages for XYZ applications directly – without intermediary pieces, using only 4 standard M6 screws.







860-0090 MINI RAIL SYSTEM BALL SLIDE POSITIONERS

860-0090-02

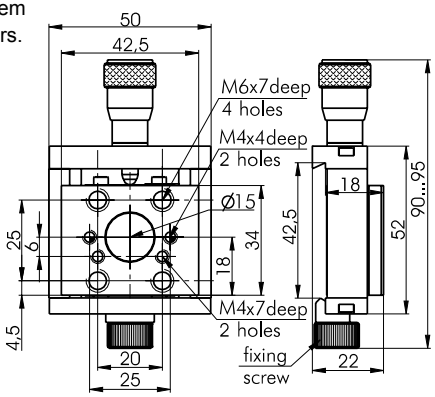
The Mini Rail System Ball Slide Positioner 860-0090-02 has a travel range 5 mm. Using the micrometer driving screw mounted into M10×1 taped hole, the resolution 10 µm is achieved. Positioners have adapters for mounting onto Mini Optical Rail System rails and can be locked in a position using a fixing screw. With a help of Rail Carriers the Mini Rail System Ball Slide Positioner 860-0090-02 can be coarsely positioned in a range of 30 mm. With two 860-0090-02 and one 860-0090-01 you may stack the X-Y-Z applications directly. 810-0010 for building optical bench or precise optical rail system suitable for these precise positioners.

860-0090-04

Code	Weight, kg	Price, EUR
860-0090-02	0.18	191
860-0090-04	0.23	206

SPECIFICATIONS

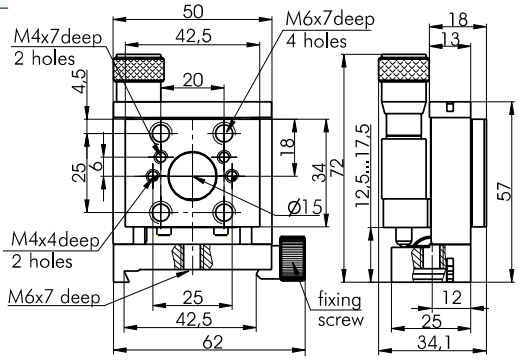
Travel range	5 mm
Rough XY travel range	±20 mm
Sensitivity	1 µm
Tracking accuracy	2 µm
Reading accuracy	5 µm (1/2 div.)
Load capacity:	
horizontal	3 kg
vertical	1 kg



860-0090-02

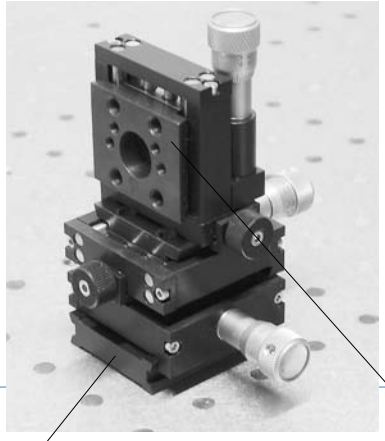
Complementary Products

Code	Page
810-0010	online

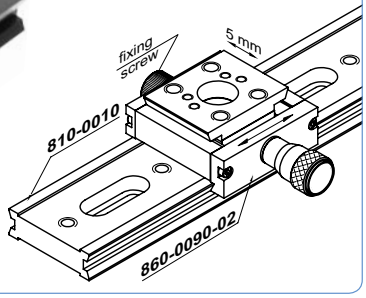


860-0090-04

You may stack the stages for X-Y-Z applications directly, without screws. Default base plate choice for 860-0090 XYZ is 810-0010-10 optical rail.



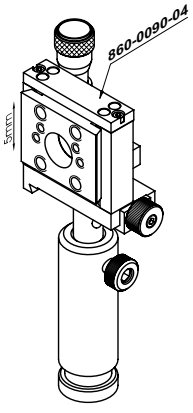
810-0010-10



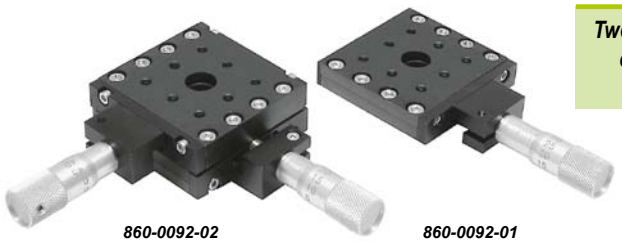
Optical Rails 810-0010-10 can be used as base plates for stacking translation stages 860-0090 to optical tables or to other stages

860-0090-04

810-0010-10



860-0092 ULTRA LOW PROFILE STEEL TRANSLATION STAGES SINGLE AND TWO-AXES



860-0092-02 860-0092-01

Two-Axes stages only 20 mm height !

Stages of stainless steel are available!

Ultra Low Profile Steel Two-Axes 860-0092-02 and Single Axis 860-0092-01 Translation Stages. The height of single axis translation stage is 10.5 mm, and of two axes translation stage – 20 mm. To match the low height of the stages Thin Micrometers 870-0045-54 with small knob diameter (13 mm) are used as driving screws.

It is possible to easily combine 860-0092-02, 860-0092-01 and angle bracket 810-0140 to have 3 axis translation system. Difference between models 860-0092-01 and 860-0092-01U is that the 860-0092-01U has a reversed central hole compared to the 860-0092-01. Although the system looks very light and thin, it is very reliable and precise.

- **Compact X-Y configuration**
- **Exceptionally precise orientation of axes at 90°**
- **Precision movement**
- **10 mm travel range**
- **Precision ball bearings**
- **Vacuum version available**

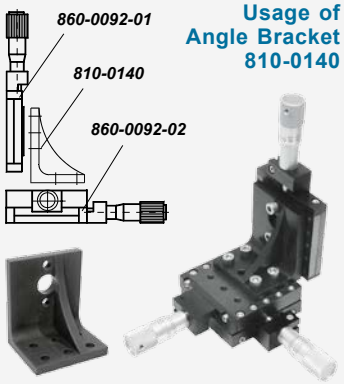
SPECIFICATIONS

Travel range	10 mm
Sensitivity	1 µm
Tracking accuracy	2 µm
Reading accuracy	5 µm (½ div.)
Load capacity:	
horizontal	6 kg
vertical	3 kg

Code	Weight, kg	Price, EUR
860-0092-01	0.14	171
860-0092-01U	0.14	171
860-0092-01SS	0.20	214
860-0092-01SSU	0.20	219
860-0092-01SSV	0.20	328
860-0092-01SSVU	0.20	328
860-0092-02	0.34	330
860-0092-02SS	0.35	415
860-0092-02SSV	0.35	625

-SS in product code indicates that stages are of stainless steel;
-V in product code indicates that stages are Vacuum 10^{-6} Torr compatible.

Usage of Angle Bracket 810-0140



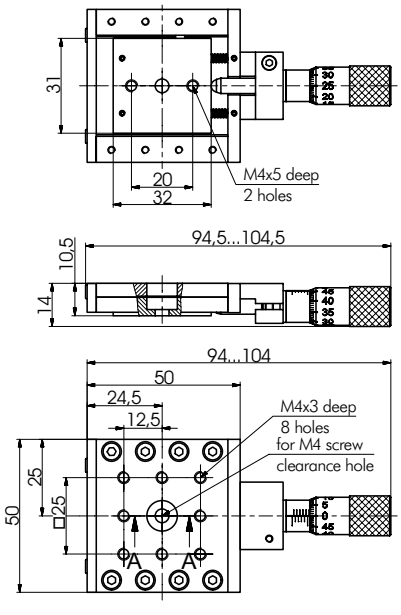
Base Plate 820-0135-04

820-0135-04 universal base plate for stacking the translation stages to optical tables or to another stages.

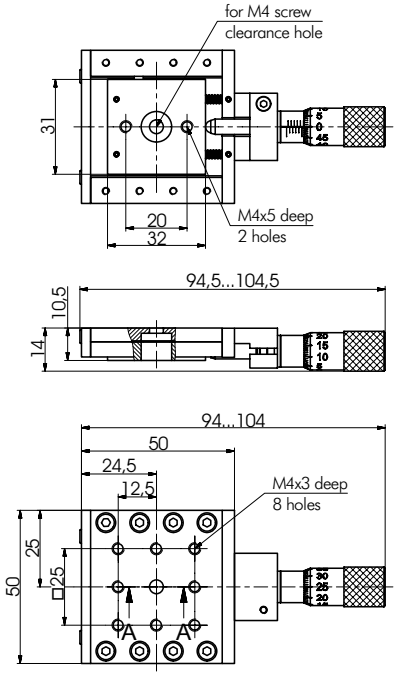
See page www.eksmaoptics.com

Complementary Products

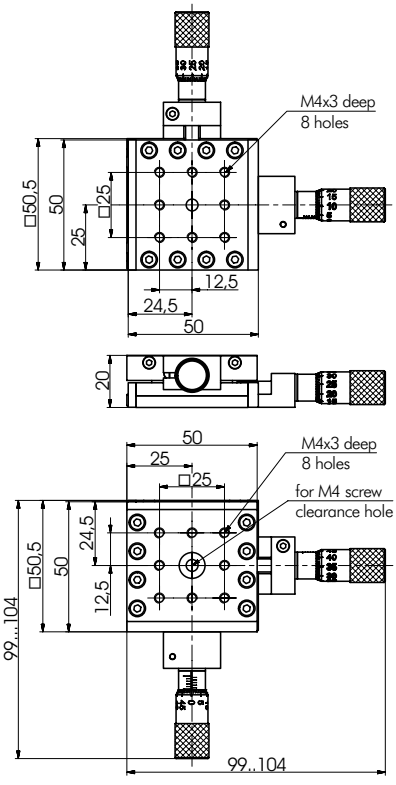
Code	Page
810-0140	online
820-0135-04	online



860-0092-01



860-0092-01U

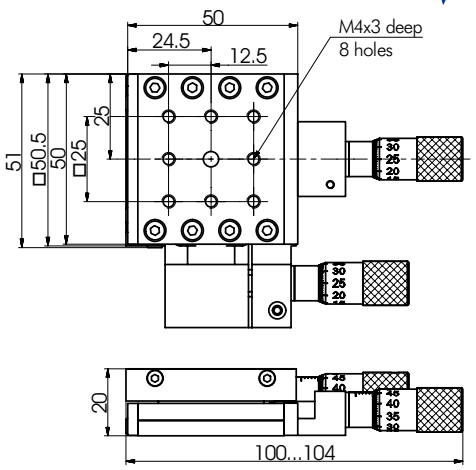


860-0092-02

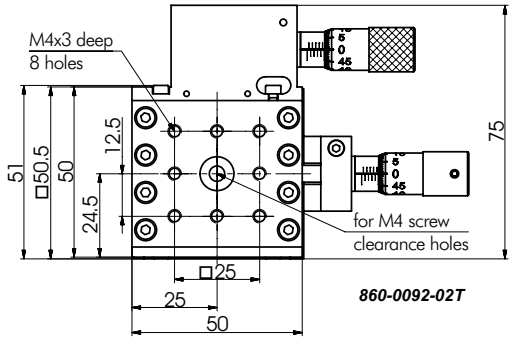
860-0092T SIDE CONTROL LINEAR STEEL STAGES

new

860-0092-01T



- **Stable Steel stage**
- **10 mm travel range**
- **Side Control Linear Stage**
- **Driving micrometer screw**
- **Precise ball bearings**
- **Compact XYZ configuration with all screws from one side**
- **Stainless Steel and Vacuum versions available**

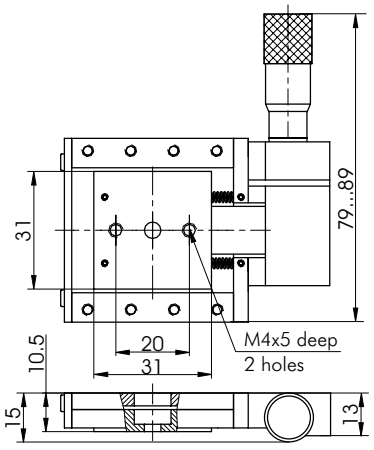


860-0092-02T

SPECIFICATIONS

Travel range	10 mm
Sensitivity	1 µm
Tracking accuracy	2 µm
Reading accuracy	5 µm (½ div.)
Load capacity:	
horizontal	6 kg
vertical	3 kg

Code	Weight, kg	Price, EUR
860-0092-01T	0.15	192
860-0092-02T	0.35	395



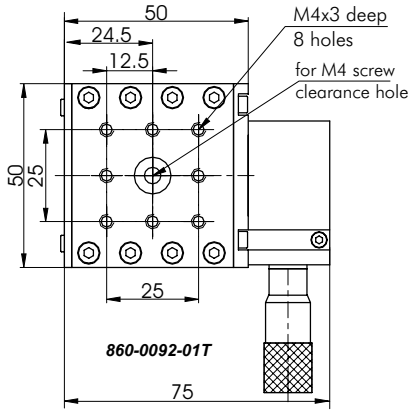
Complementary Products

Code	Page
810-0140	online
820-0135-04	online

Base Plate 820-0135-04

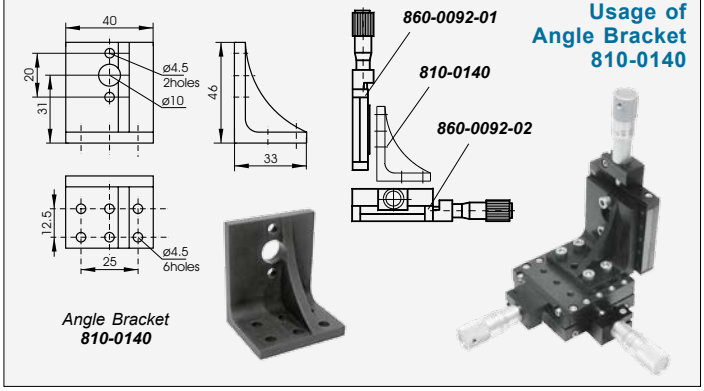
820-0135-04 universal base plate for stacking the translation stages to optical tables or to another stages.

See www.eksmaoptics.com



860-0092-01T

Usage of Angle Bracket 810-0140



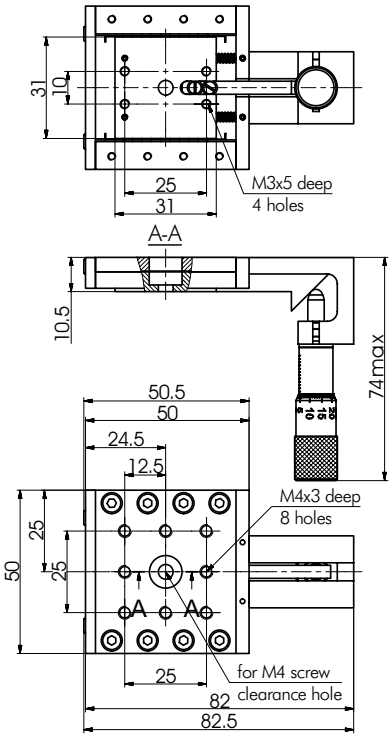
Angle Bracket
810-0140

860-0092D

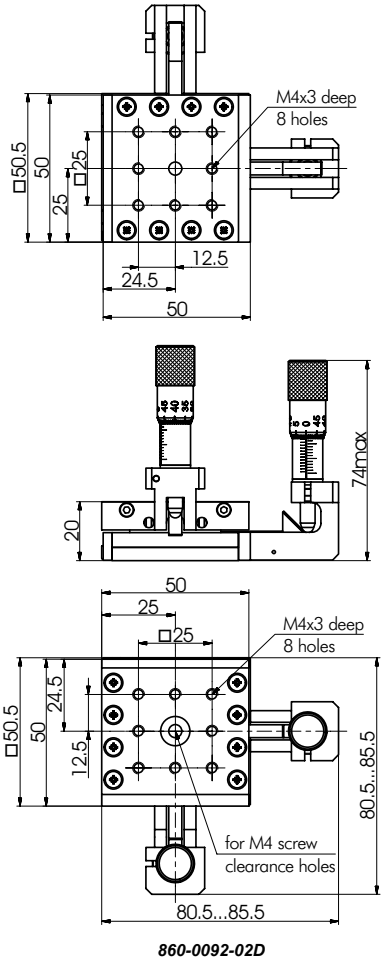
VERTICAL DRIVE ULTRA LOW PROFILE STEEL TRANSLATION STAGES

860-0092-02D

- **Stable Steel stage**
- **10 mm travel range**
- **Driving micrometer screw**
- **Precise ball bearings**
- **Stainless steel and vacuum versions available**



860-0092-01D



860-0092-02D

SPECIFICATIONS

Travel range	10 mm
Sensitivity	1 µm
Tracking accuracy	2 µm
Reading accuracy	5 µm (½ div.)
Load capacity:	
horizontal	6 kg
vertical	3 kg

Code	Weight, kg	Price, EUR
860-0092-01D	0.15	329
860-0092-02D	0.35	625

ORDERING INFORMATION

Application	Model	Note
X axis	860-0092-01 860-0092-01U 860-0092-01T 860-0092-01D	Steel Version
X axis	860-0092-01SS 860-0092-01SSU 860-0092-01SST 860-0092-01SSD	Stainless Steel Version
X axis	860-0092-01SSV 860-0092-01SSVU 860-0092-01SSVT 860-0092-01SSVD	Vacuum Version **10^{-6} Torr compactible**
XY system	860-0092-02 860-0092-02T 860-0092-02D	Steel Version
XY system	860-0092-02SS 860-0092-02SST 860-0092-02SSD	Stainless Steel Version
XY system	860-0092-02SSV 860-0092-02SSVT 860-0092-02SSVD	Vacuum Version **10^{-6} Torr compactible**

Angle Bracket 810-0140

Angle Bracket 810-0140 is used to transform "horizontal" translators into vertical ones.

810-0140 – steel version
810-0140SS – stainless steel version and version for vacuum

810-0140SS

860-0094 LOW PROFILE TWO-AXES ALUMINIUM TRANSLATION STAGE

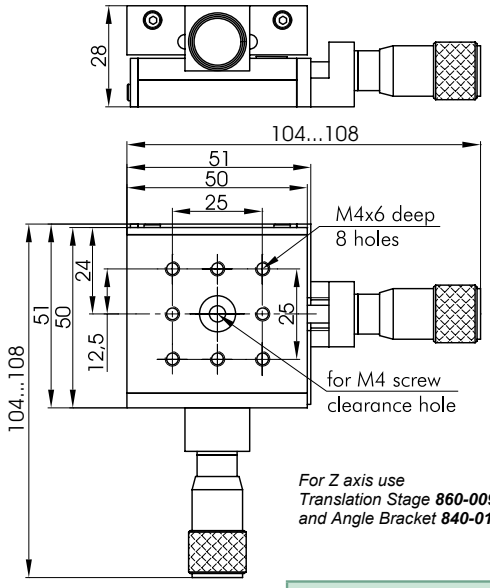
- **Compact X-Y configuration**
- **Exceptionally precise orientation of axes at 90°**
- **Precision movement**
- **10 mm travel range**
- **Precision ball bearings**
- **Perpendicular and side control configuration**

Low Profile Two-Axes Aluminium Translation Stage 860-0094 provides smooth, precise, X-Y axes movement. The travel of this Stage is 10 mm with resolution 10 µm.

Eight M4 tapped holes are provided in order to mount other components. It can be directly mounted to breadboards and other equipment from our by use of mounting holes Ø4.5 mm and M4.

The base and the platform are produced from the black anodized aluminium.

Code	Price, EUR
860-0094	319



*For Z axis use Translation Stage **860-0092** and Angle Bracket **840-0140.***

SPECIFICATIONS

Travel range	10 mm
Sensitivity	1 µm
Tracking accuracy	2 µm
Reading accuracy	5 µm (½ div.)
Load capacity:	
horizontal	15 kg
vertical	5 kg
Weight	0.38 kg

820-0135-04

820-0135-04 universal base plate for stacking the translation stages to optical tables or to another stages.

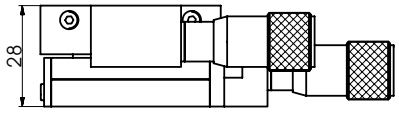
See www.eksmaoptics.com

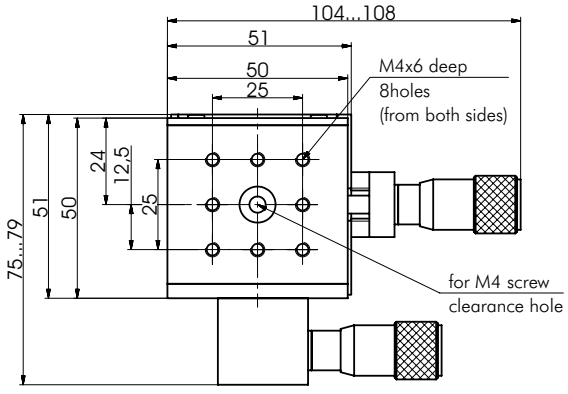
860-0094-02 LOW PROFILE TWO-AXES ALUMINIUM TRANSLATION STAGE OF SIDE CONTROL

A rare opportunity to control an X-Y translation stage by access from a single side

For your convenience we have rotated by 90° the driving screw for X axis in the Translation Stage 860-0094-02. Now it is situated parallel to the Y axis adjustment screw, so the stage is controlled from a single side. This helps in optical schemes of great concentration.

In other respects, including the specifications, the stage is the same as 860-0094.





*Other dimensions such as **860-0094***

SPECIFICATIONS

Travel range	10 mm
Sensitivity	1 µm
Tracking accuracy	2 µm
Reading accuracy	5 µm (½ div.)
Load capacity:	
horizontal	15 kg
vertical	5 kg
Weight	0.38 kg

Code	Weight, kg	Price, EUR
860-0094-02	0.38	384

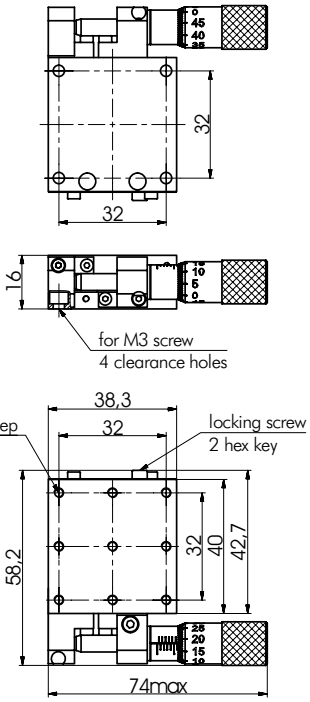
860-0096 ALUMINIUM BALL BEARING STAGE

- **Compact design**
- **Precise movement**
- **13 mm travel range**
- **Lockable**
- **X-Y direct stacking**

SPECIFICATIONS

Drive type	Side
Travel range	13 mm
Sensitivity	1 µm
Angular deviation	< 200 µrad
Tracking accuracy	2 µm
Reading accuracy	5 µm (½ division)
Load capacity	
horizontal	10 kg
vertical	3 kg
Lead screw pitch	0.5 mm
Guide	Ball bearings
Material	aluminium
Finish	black anodized
Weight	0.12 kg
Assemblies:	
X-Y	directly
Z	810-0112

Code	Price, EUR
860-0096	249



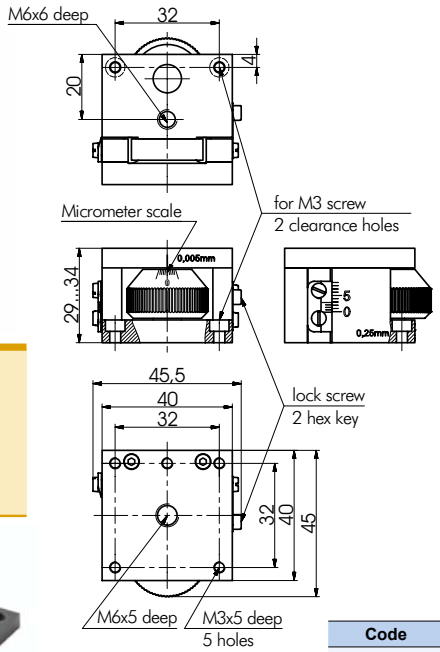
860-0096 *(2 pieces) and* ***860-0098-02*** *stacked in XYZ coordinates*
860-0096 may be stacked with 860-0098 on top or under

860-0096 *(2 pieces) stacked in XY coordinates*

860-0098 ALUMINIUM BALL BEARING VERTICAL STAGES

- **Compact**
- **Lockable**
- **High precision**
- **Travel range 5 mm**
- **See 860-0099 for 13 mm travel**

Vertical Stage ***860-0098*** *mounted on a Base Plate* ***820-0135-03***



Aluminium Ball Bearing Vertical Stage 860-0098 is made in most compact design. Vernier scale is engraved on one side of the stage. Travel range is 5 mm. Locking mechanism to secure stages in desired position is made on the other side. Two through holes for M3 screws are made in the positioner's platform for mounting on other suitable surfaces, for example on translation stage 860-0096. Can be fastened on mounting posts 820-0020 through M6 hole centered on the bottom surface.

SPECIFICATIONS

Travel range	5 mm
Sensitivity	1 µm
Tracking accuracy	1 µm
Reading accuracy	5 µm
Load capacity	3 kg
Material	aluminium
Finish	black anodized

Code	Travel, mm	H, mm	Weight, kg	Price, EUR
860-0098-02	5	29...34	0.15	169

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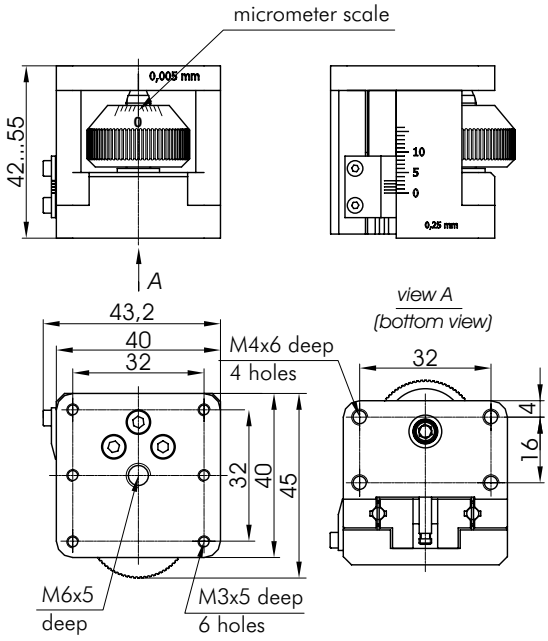
860-0099 VERTICAL STAGE

- **Compact**
- **High precision**
- **Travel range 13 mm**
- **See 860-0098 for 5 mm travel**
- **Motorized version 960-0199 available**

Vertical Stage 860-0099 is made in most compact design. Vernier scale is engraved on one side of the stage. Travel range is 13 mm. Four M4 holes are made in the positioner's platform for mounting on other suitable surfaces, two of those can be used as thought holes for M3×10 screws to stack stages ontop of others, for example on translation stage 860-0096.

SPECIFICATIONS

Travel range	13 mm
Sensitivity	1 µm
Tracking accuracy	1 µm
Reading accuracy	5 µm
Load capacity	5 kg
Material	Aluminium
Finish	Black anodized



Code	Weight, kg	Price, EUR
860-0099	0.25	189

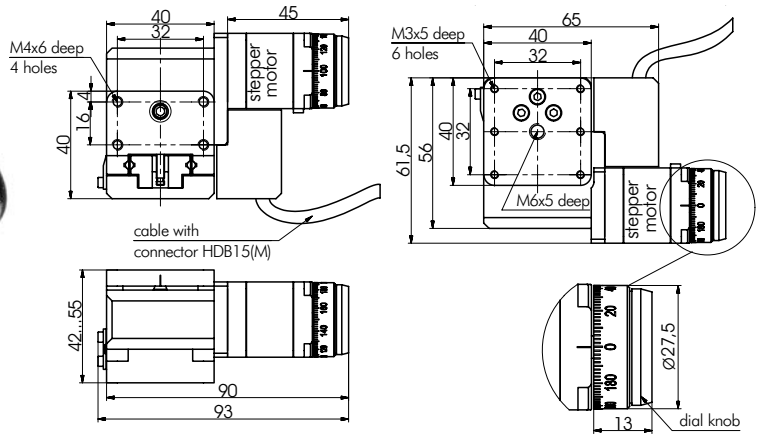
Base Plate 820-0135-03

820-0135-03 Universal Base Plate is required to fix stages to a flat surface, for example, optical table.

See www.eksmaoptics.com

Motorized Vertical Stage 960-0199

- **Resolution up to 0.03 µm**



Code	Page
960-0199	online

860-0100 MICRO TRANSLATION STAGE

***860-0100** Top view*

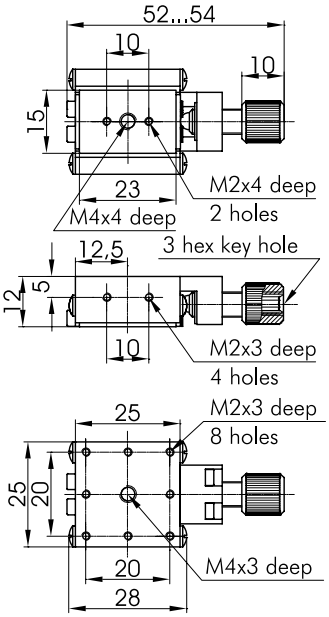
***860-0100** Bottom view*

Micro Translation Stage 860-0100 provides smooth, precise single axis movement. M2 and M4 mounting holes are provided. Angle brackets 810-0120 allow to stack the stages for X-Y and X-Y-Z motion. The base and the platform are produced from the black anodized aluminium.

SPECIFICATIONS

Travel range	5 mm
Sensitivity	1 µm
Tracking accuracy	2 µm
Load capacity:	
horizontal	0.5 kg
vertical	0.2 kg
Weight	0.04 kg

Code	Price, EUR
860-0100	142
860-0100-05	175



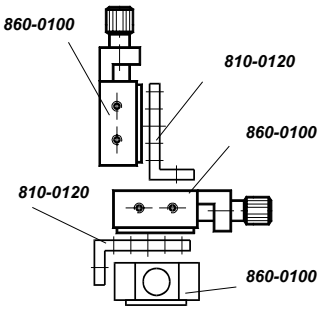
860-0100

- **Compact design**
- **Precision movement**
- **5 mm travel range**
- **Precision ball bearings**
- **X-Y units available**

*Use two Angle Brackets **810-0120** for X-Y-Z assembly.*

860-0100 XY

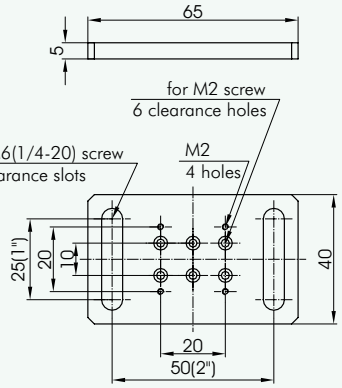
860-0100-05
*with Thin Micrometer **870-0055-02BL** installed*



*Usage of angle bracket **810-0120***

810-0120

Base Plate



*For stacking the translation stages **860-0100**, **860-0102** and rotation stage **860-0130** to optical tables or to another stages.*

Complementary Products

Code	Page
810-0120	online
870-0055-02	online

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860-0102 XZ MICRO TRANSLATION STAGE OF SIDE REGULATION

860-0102

860-0102-04; 860-0102
with mini micrometer
***870-0055-02BL** installed*

XZ Micro Translation Stage 860-0102 provides smooth, precise two axes movement.

The driving screws are positioned so that the unit is controlled only from one side. That's why 860-0102 is very handy in optical schemes with very dense placement of instruments.

The travel of the stage is 4 mm with 5 µm sensitivity. M2 tapped holes are provided for components mouting. The unit has a Ø7 mm clear aperture. Therefore, it is ideally suited for use as a holder of diaphragms.

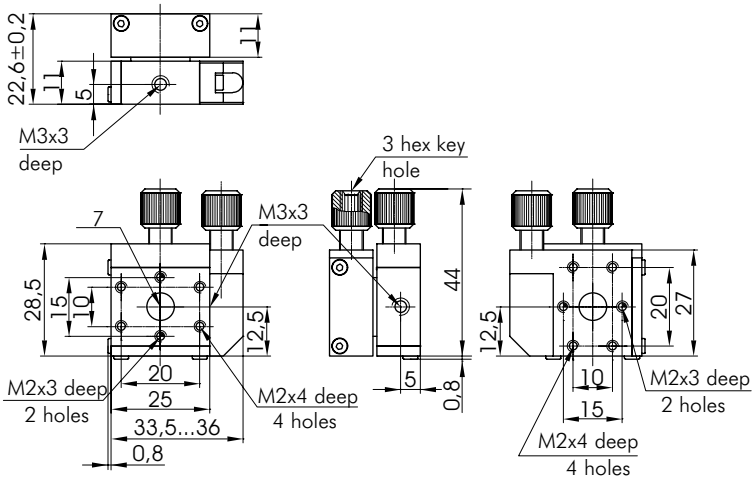
Angle bracket 810-0120 may be used to combine the stage with other units.

The base and the platform are made of black anodized aluminium.

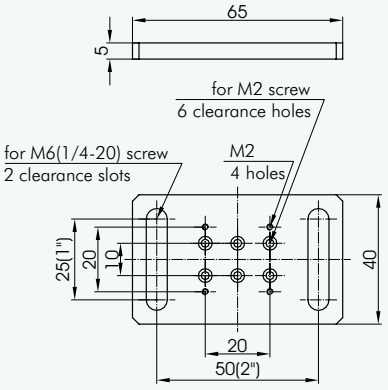
- **Ultra Compact configuration**
- **Precise rectilineal movement**
- **4 mm X-Z or X-Y travel range**
- **Precision ball bearings**
- **Fine Screws pitch 0.25 mm (100 threads per Inch)**

SPECIFICATIONS

Travel range	4 mm
Sensitivity	1 µm
Tracking accuracy	2 µm
Load capacity:	
horizontal	0.3 kg
vertical	0.1 kg



Base Plate



*For stacking the translation stages **860-0100**, **860-0102** and rotation stage **860-0130** to optical tables or to another stages.*

Code	Description	Weight, kg	Price, EUR
860-0102	standard version	0.06	220
860-0102L	lockable version	0.06	235
860-0102-04	with mini micrometer 870-0055-04 installed	0.08	290

Complementary Products

Code	Page
810-0120	online
870-0055-02	online

Lockable version

860-0105 LINEAR FLEXURE TRANSLATION STAGE

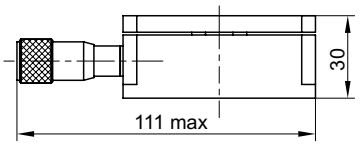
- **Travel range 5 mm**
- **Load capacity 1 kg**
- **Extremely low friction**
- **Stackable for X-Y-Z configurations**

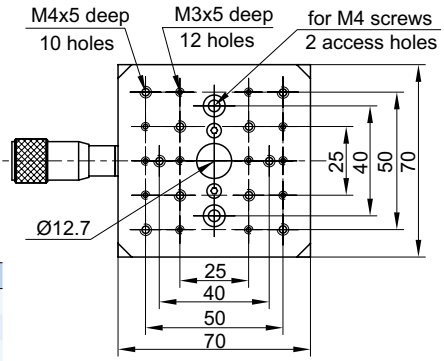
The 860-0105 Linear Flexure Translation Stages provide ultra smooth translation for optical assemblies and other components. These stages guarantee linearity of motion over the whole travel range. High stability and smoothness of translation of the stages is ideal for applications in interferometry, biomedicine, microscopy and other nanoprecision adjustment.

Available options include linear flexure stage equipped with stepper motor actuator, DC motor actuator and piezo actuator.

SPECIFICATIONS

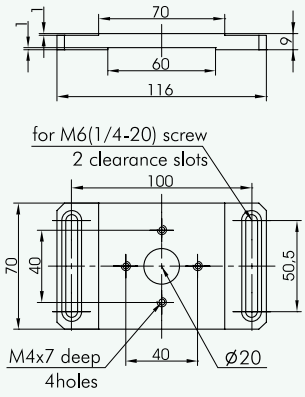
Travel range	5 mm
Sensitivity with:	
Micrometer screw	1 µm
Differential Screw	0.1 µm
Tracking accuracy	2 µm
Reading accuracy	10 µm
Load capacity	1 kg
Assemblies:	
X-Y	directly
Z	Angle Bracket

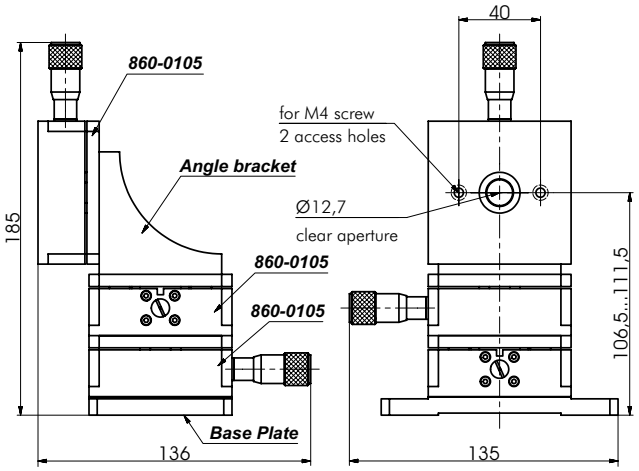


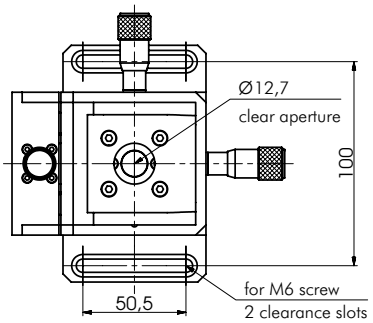


Code	Weight, kg	Price, EUR
860-0105	0.4	297
860-0105 XY	0.8	594
860-0105 XYZ	1.3	958

Base Plate





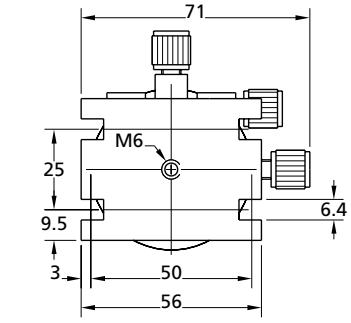


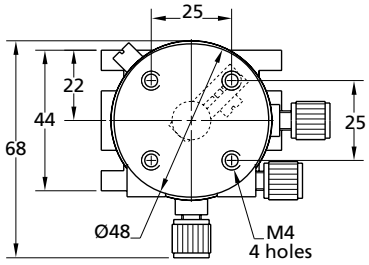
860-0105 XYZ
You may stack the stages for XY applications directly only using two M4x8 screws. Angle bracket allow to stabilize stack the stages for YZ motion.

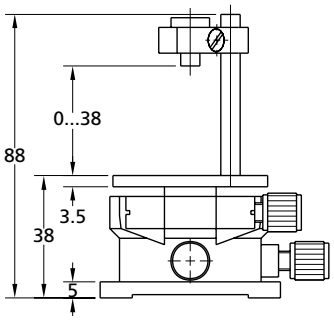
860-0110 TILT / ROTATION STAGE

The model 860-0110 tilt/rotation stage provides two independent tilt adjustments within ±5° range and 4° in-plane rotation adjustment. Precision screws provide 9 arcsec resolution in rotation and both tilt planes (adjustment screws M6×0.25, 3 pcs.).

The mounting clamp with a spring-loaded disengagement knob allows easy insertion and removal of optical components up to 39 mm height and 30×30 mm in square. 860-0110 stage is attached to a table through clearance holes in its base. The main elements of the stage are finished with black anodized aliuminium.







- **Two independent tilt adjustments within 5° range**
- **In-plane rotation adjustment within 4° range**
- **9 arcsec resolution**

Code	Weight, kg	Price, EUR
860-0110	0.23	175

*Mounting option: Large Rod with Rod Base **810-0050**, Large Rod Mounting Clamp **810-0061**, Movable Base **820-0090**, Tilt/Rotation Stage **860-0110***

860-0120 MINI ROTATION STAGE

860-0120

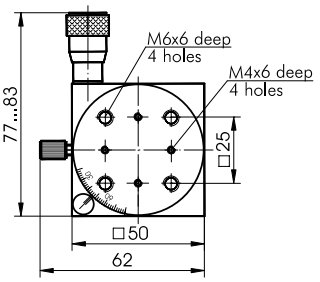
Mini Rotation Stage 860-0120 provides smooth, low friction 360° rotation.

A micrometer driving screw renders 1' resolution. A clear aperture of Ø15 mm allows attachment of lenses and filters directly in front of the stage.

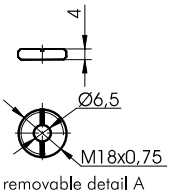
A removable ring (included) can be screwed into the aperture. The ring's hole is of Ø6.5 mm, so you can put an M6 screw from underneath to mount some component directly onto the stage.

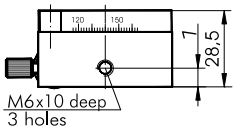
860-0120 can be mounted to optical rails using rail carriers.

"Clear top" design allows attachment of larger components.



860-0120E



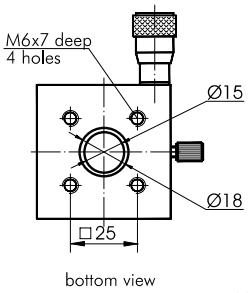


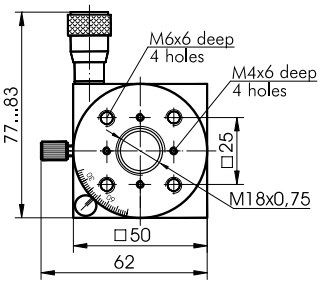
860-0120E

SPECIFICATIONS

Rotation	360° coarse, 15° fine
Resolution	1° coarse, 1' fine
Wobble	3 arcmin
Load capacity:	
horizontal	5 kg
vertical	2 kg
Weight	0.23 kg

Code	Price, EUR
860-0120	232
860-0120E	232





860-0120

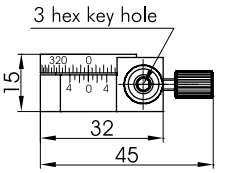
860-0130 MICRO ROTATION STAGE

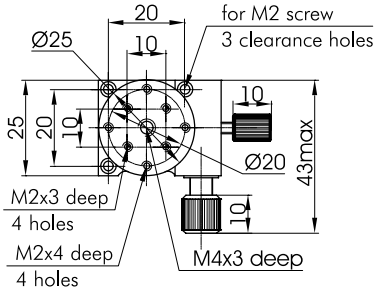
Micro Rotation Stage 860-0130 is a compact 360° rotation platform.

Using a fine screw it is possible to rotate platform precisely. Pitch of the screw is 0.25 mm. Vernier can be read to 1°.

Using M2 screws and an angle bracket 810-0120, this compact stage may be attached to other micro stages (like 860-0100). Other angle brackets 810-0120 are available in order to attach the stage to other units, e.g. to 840-0060.

The stage is produced from black anodized aluminium.





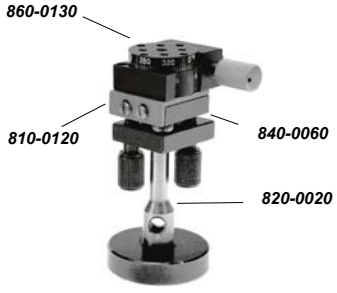
SPECIFICATIONS

Rotation range	360° coarse, 15° fine
Reading accuracy	1°
Sensitivity	0.5 arcmin
Wobble	1 arcmin
Load capacity:	
horizontal	0.1 kg
vertical	0.1 kg
Weight	0.04 kg

Code	Price, EUR
860-0130	186
860-0130-45	224

Complementary Products

Code	Page
810-0120	online
820-0020	7.16
840-0060	online
870-0045	online



860-00130-45.
860-0130 with thin micrometer 870-0045BL installed

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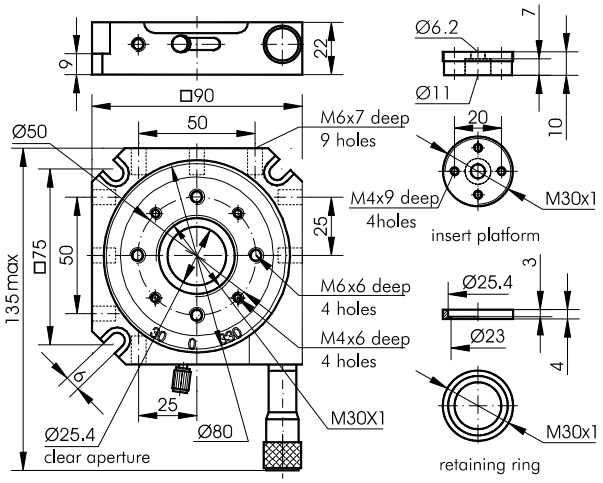
860-0140 PRECISION ROTARY STAGE



- **M30×1 diameter platform insert**
- **Two 25 mm (1 inch) retaining rings**
- **Centered platform insert**
- **Inch & vacuum versions are available**

We offer you a fine rotary stage with micrometer screw. Fine motion range is 15° with resolution of 1 arcmin. For coarse adjustment release the fixing screw and turn the platform.

The platform has M6 and M4 mounting holes. Precision rotary stage has an aperture M30×1 with clear aperture of 25 mm. Two retaining rings with 1 inch clear aperture are included.

To close the platform's aperture you can thread in an insert platform (included) with a centered clearance hole and M6, M4 holes. The stage can be fastened horizontally and vertically using M6 screws.

*Vacuum Compatible version 860-0140V is available at **www.eksmaoptics.com***

Code	Price, EUR
860-0140	324

SPECIFICATIONS

Rotation range	
coarse	360°, resolution 1°
fine	15°, resolution 1 arcmin
Sensitivity	20 arcsec
Reading Accuracy	1 arcmin
Wobble	1 arcmin
Load capacity	
horizontal	12 kg
vertical	5 kg
Max. drive torque	0.3 kgm
Weight	0.63 kg

860-0150 2 INCH APERTURE ROTATION STAGE

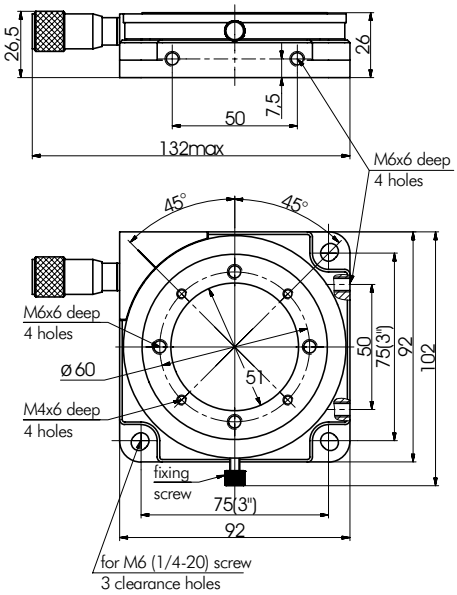
- **Rolling ball movement**
- **360° rotation**
- **10° fine adjustment**
- **Ø 50.8 mm (2") clear aperture**
- **Inch version 860-0150E is available**

Vertical mounting: *2 sides of the base each has two M6 holes spaced by 50 mm.*

2 inch Aperture Rotation Stage 860-0150 allows full 360° coarse rotation by hand. You may lock coarse adjustment. Then fine adjustment can be done over a range of 10° using the micrometer.

Angular position is read on 360° graduated scale on the platform, which is marked every 1°. The stage has a central aperture of Ø50.8 mm.

For horizontal fastening three corners of the base have clearance holes for M6 screws.



SPECIFICATIONS

Rotation range:	
coarse	360°, resolution 1°
fine	10°, resolution 1 arcmin
Sensitivity	20 arcsec
Reading accuracy	1 arcmin
Wobble	1 arcmin
Load capacity:	
horizontal	15 kg
vertical	7 kg
Weight	0.58 kg

Code	Price, EUR
860-0150	317

860-0155 ROTATION STAGES

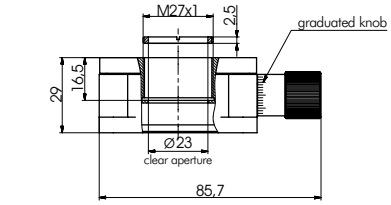
The main advantage of this precise rotation stage is that it has very compact dimensions and low-profile together with the great aperture in the middle. This rotation stage has two modifications with different apertures: M27×1 or 30 mm. 860-0155 doesn't need additional adapter plate to be mounted on any surface as it has 3 M6 holes on bottom.

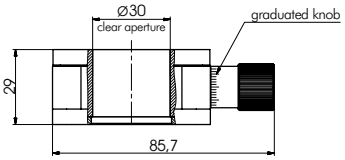
SPECIFICATIONS

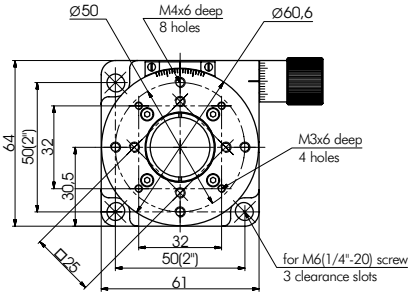
Rotation range	360°
Resolution	2 arcmin
Reading accuracy	2 arcmin
Sensitivity	0.4 arcmin
Wobble	0.6 arcmin
Eccentricity	10 µm
Load capacity:	
horizontal	8 kg
radial	1.7 kg
Weight	0.55 kg

Code	Aperture	Price, EUR
860-0155-01	M27×1	339
860-0155-02	30 mm	343
860-0155-01E	M27×1	339
860-0155-02E	30 mm	343

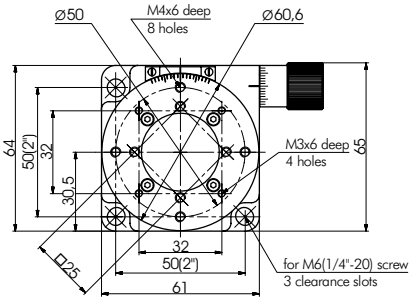
Vacuum Compatible Rotation Stage 860-0155V is available. For product data sheet please visit ***www.eksmaoptics.com***







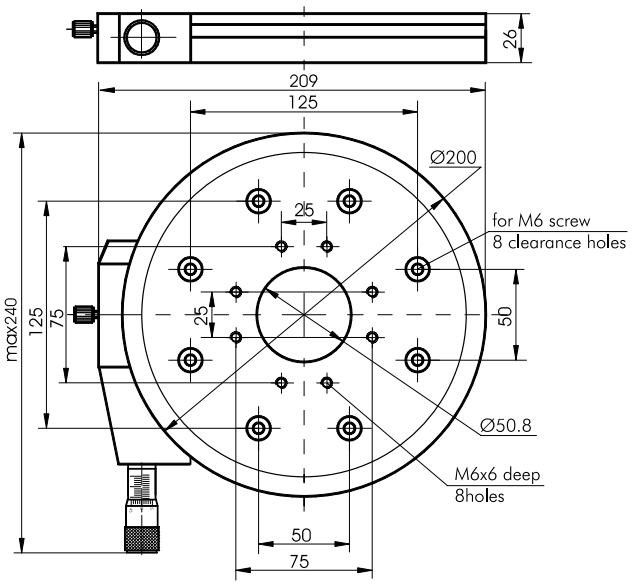
860-0155-01



860-0155-02

860-0160 ROTATION STAGE OF BIG PLATFORM

- **200 mm platform**
- **360° rotation**
- **10° fine adjustment**
- **Ø 50.8 mm (2") clear aperture**



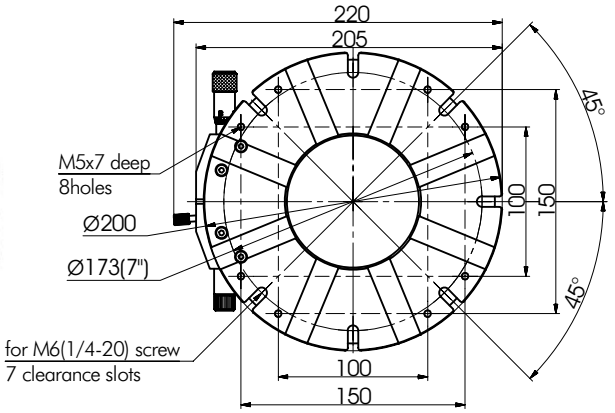
SPECIFICATIONS

Rotation range	
coarse	360°
fine	10°
Reading accuracy	0.5 arcmin
Sensitivity	0.1 arcmin
Wobble	1 arcmin
Horizontal load capacity	15 kg
Weight	2.55 kg

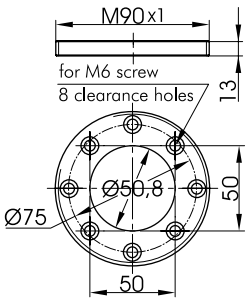
The Rotation Stage of Big Platform 860-0160 is used to manually rotate large optical components through continuous 360° with accuracy of 1°, and to adjust them finely within 10° by a micrometer, with accuracy of 0.5 arcmin. The stage has 50.8 mm clear aperture.

Code	Price, EUR
860-0160	399

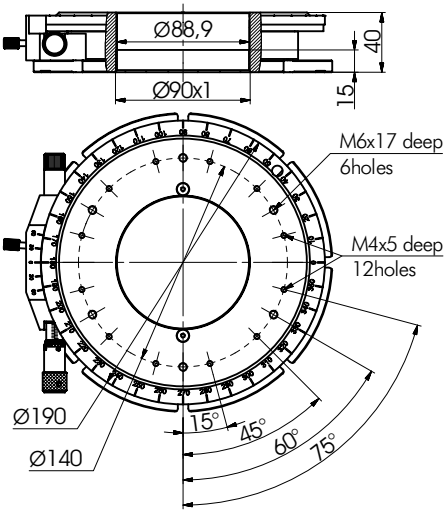
860-0165 ROTATION STAGE OF BIG PLATFORM



- **Ø190 mm platform**
- **360° rotation**
- **10° Fine adjustment**
- **Ø88.9 mm clear aperture**
- **Available for vacuum (860-0165V)**



An insert base plate for 860-0165



The Rotation Stage of Big Platform 860-0165 is used to rotate manually large optical components through continuous 360° with accuracy of 1°, and finely adjust them within 10° by a micrometer, with accuracy of 0.5 arcmin.

The stage has 88.9 mm clear aperture. The platform has a pattern of M6 and M4 mounting holes for components.

SPECIFICATIONS

Rotation range:	
coarse	360°
fine	10°
Reading accuracy	0.5 arcmin
Sensitivity	0.1 arcmin
Wobble	1 arcmin
Load capacity:	
horizontal	60 kg
Material	Aluminium
Finish	Black anodized
Weight	3 kg

Compatible with 10^{-6} Torr vacuum
860-0165V

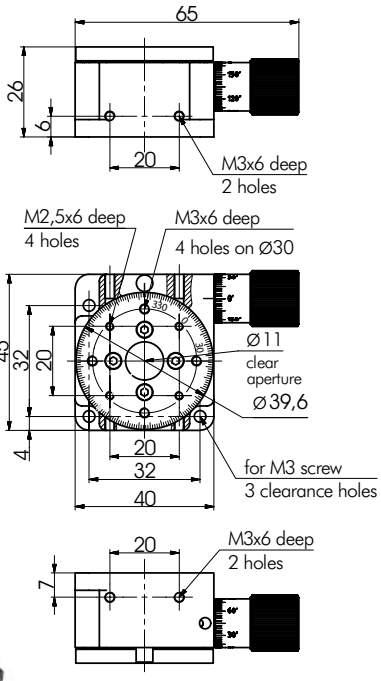
Code	Description	Price, EUR
860-0165	black anodized rotary stage	790
860-0165E	black anodized inch version	790

Vacuum compatible Rotation Stage of Big Platform 860-0165V is available. For product data sheet please visit ***www.eksmaoptics.com***

860-0170 MINI ROTATION STAGE

SPECIFICATIONS

Rotation range	360° (continuous)
Sensitivity	1 arcmin
Reading accuracy	3 arcmin
Wobble	1 arcmin
Eccentricity	10 µm
Load capacity:	
horizontal	4 kg
radial	1.5 kg
Clear aperture	Ø11 mm
Weight	0.2 kg



- **Worm gear design**
- **Ø11 mm clear aperture in the center**
- **Very compact design 46×65 mm**
- **No need in adapter plate for mounting (there are mounting holes on bottom)**
- **Resolution 3 arcmin**

Advantages of Rotation Stage 860-0170 regarding analogues of other manufacturers is existence of the Ø11 mm aperture in the center of rotation stage while it has very compact dimensions. Together with its high precision, there is no need to use extra adapter plate for mounting since there are mounting holes on bottom. There you could see examples of stacked stages:

Code	Price, EUR
860-0170	319
860-0170E	319

Complementary Products

Code	Page
860-0096	7.75
860-0098-02	7.75

*Motorized Rotation Stage **960-0170** stacked on **860-0096** (2 pieces), and **860-0098-02***

860-0170** stacked on **860-0096** (2 pieces), and **860-0098-02

860-0170** stacked on **860-0096

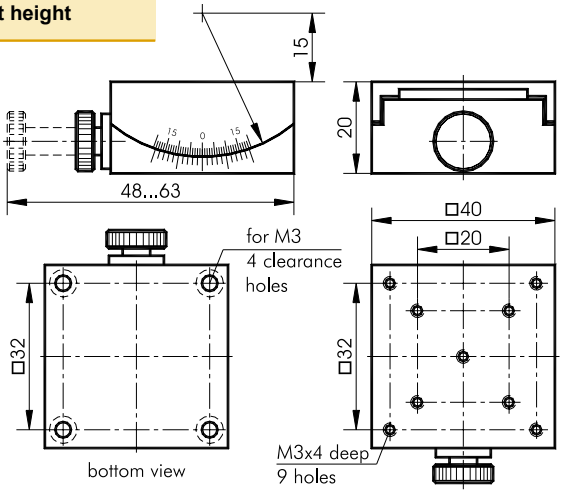
860-0180 SMALL GONIOMETER

- **Compact**
- **High precision**
- **Rotation about virtual point**
- **15 mm virtual point height**

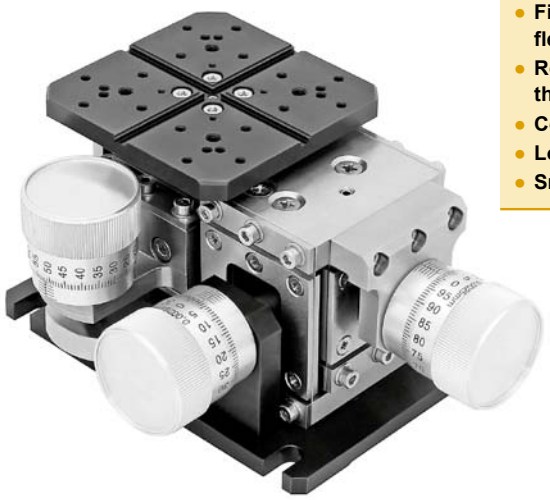
Code	Price, EUR
860-0180	190

SPECIFICATIONS

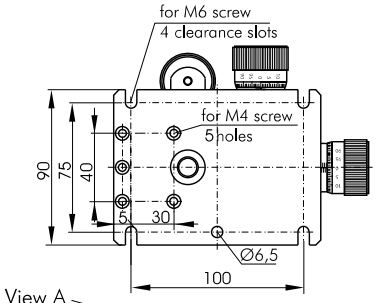
Rotation range	±15°
Reading resolution	0.1° (vernier scale)
Drive geometry	Lever (tangential)
driving screw pitch	0.25 mm
transmission ratio	0°27'59"...0°30'45"
ratio decimal *(the ratio is per revolution)*	0.4665°...0.5126°
Load capacity:	
horizontal	1 kg
Material	Aluminium
Finish	black anodized
Weight	0.1 kg

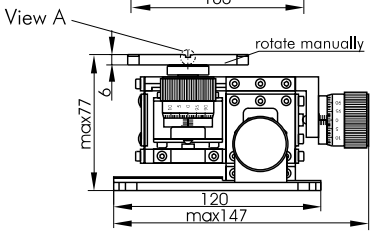


860-0210 FIBER COUPLING STAGE



- **Fiber coupling stage of flexure design**
- **Rotating platform on the top**
- **Compact block design**
- **Long-term stability**
- **Smooth motion**



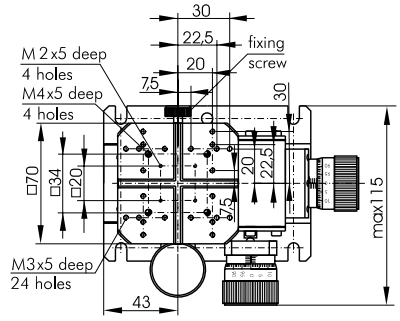


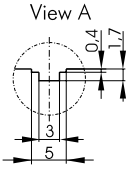
Code	Price, EUR
860-0210	660

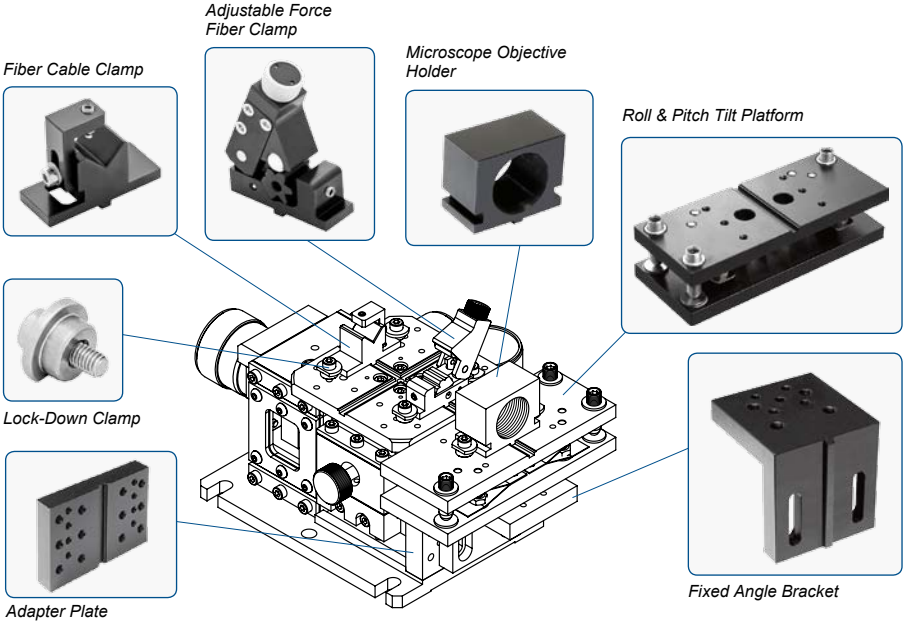
Flexure stages 860-0210 are ideal for high precision device manipulation. This stage suits almost any micropositioning applications range, for example, from fiber launch systems for single-mode, multi-mode and polarization maintaining fibers as well as waveguide alignment, through to the manipulation of microstructures in bioscience. Fiber Coupling Stage of flexure compact block design with high-resolution micrometers ensures long-termed stability and good stiffness together with smooth motion without the severe limitations of stiction and friction. Flexure stages have a combination of overall size, travel, resolution, and low cost that makes them unique decision to meet the stringent requirements of photonics laboratory applications. Vacuum compatible versions are delivered on request. Also as an option fiber coupling stage could be provided with differential screws.

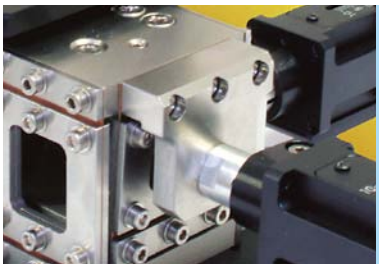
SPECIFICATIONS

Travel range in each XYZ direction	2 mm
Sensitivity	0.2 µm
Reading accuracy	1.25 µm (1/2 division)
Cross-Talk	20 µm/mm
Mechanical stability	flexure design with Stainless Steel Spring
Load capacity	1.5 kg
Weight	1.6 kg









Motorized Positioners

ORDERING INFORMATION for Motorized Translation and Rotation Stages

Default Choice

Default choice for ordering motorized translation or rotation stages is with damper RD1. When damper RD1 is used, vibrations and motor noise is greatly reduced, settling time is impoved and system resonances are suppressed.

Example:

960-0060-08 – translation stage 960-0060-08 with damper RD1.

968-0140 – rotation stage 968-0140 with damper RD1.

Revolution sensor

Revolution sensor counts stepper motor axis revolutions. It consists of Codewheel with one mark and Optointerrupter. When motor is connected to controller 980-0030F-USB, signal from revolution sensor allows monitoring of motor axis revolutions, possible loss of steps and detecting motor stalling. It is not as accurate as encoder, which provides feedback for each step of motor. Revolution sensor determines whether there was any loss of steps within one revolution of motor axis. This information is reported to the controller and corrective actions can be taken.

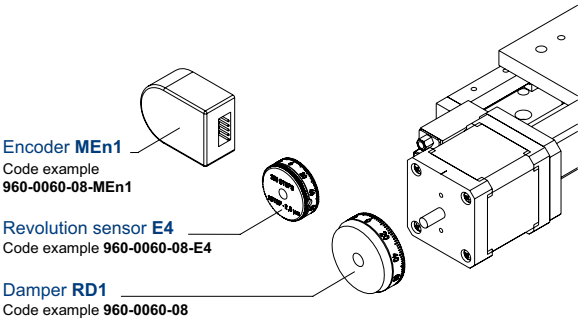
Revolution sensor can also be used for precise home position setting.

For ordering motorized stages with revolution sensor, please add symbols E4 to the code of motorized stages.

Example:

960-0060-08-E4 – translation stage 960-0060-08 with revolution sensor E4.

968-0140-E4 – rotation stage 968-0140 with revolution sensor E4.



Encoder

Our 2-channel encoder is compact and lightweight.

Technical Characteristics of Encoder

Operating Voltage	DC 4.5 V to 5.5 V
max. Current Consumption	(at 5 V) 57 mA
Pulse Width	180 ±45 degree
Signal-Phase Shift	(Channel A vs. B) 90 ±15 degree
Signal-Rise-/Fall-Time	0.25 / 0.25 µS
Limit Frequency	up to 100 kHz
Output Signals	rectangular 2
Pulses per Revolution	1000
Operating Temperature	0 °C to +70 °C

Encoder measures motor axis position change and direction and provides feedback to controller. Encoder type HEDS-5540-B14 with 1000 pulses per revolution is used by default. Controller 980-0030F-USB can use signal from the encoder for motion monitoring. Result of the monitoring is high system reliability - controller can detect motor stall situation very quickly. Threshold level of motor stall detection is programmable using program SMCVieW included with controller 980-0030F-USB. User specific software can get feedback from encoder through controller 980-0030F-USB and send motion correction commands back to it using provided software libraries.

Unlike servo motors, stepper motors do not necessarily require encoders for operation. Encoder provides monitoring option. 1000 pulses per revolution ensure precise step monitoring down to 1/4 microstep mode.

For ordering motorized stages with encoder, please add symbols MEn1 to the code of motorized stages.

Example:

960-0060-08-MEn1 – translation stage 960-0060-08 with encoder MEn1.

968-0140-MEn1 – rotation stage 968-0140 with encoder MEn1.

STEPPER AND DC MOTORS DATASHEETS

STEPPER MOTORS

Model	Wiring scheme	Design Voltage, V	Phase Current, A	Holding Torque, Nm	Detend Torque, mNm	Phase Resistance, Ohm	Inductance, mH	Steps/Revolution
20	bipolar	4.3	0.6	0.03	1.5	4.4±15%	1.5±20%	200 (1.8°)
28	bipolar	4.56	0.67	0.106	3.75	6.8±15%	4.8±20%	200 (1.8°)
28S	bipolar	3.75	0.67	0.071	2.5	5.6±15%	4±20%	200 (1.8°)
4233	bipolar	12	0.4	0.25	8.5	30±10%	37±20%	200 (1.8°)
4247	bipolar	3.84	1.2	0.45	15.5	3.2±10%	6±20%	200 (1.8°)
5618	bipolar	4.82	2.01	1.84	39	2.4±15%	8.4±20%	200 (1.8°)
5918	bipolar	3	2.1	1.98	68	2±10%	8.8±20%	200 (1.8°)
ZSS43	bipolar	42	1.2	0.26	7	19	22.9	200 (1.8°)

STEPPER MOTORS WITH BRAKE

Model	Wiring scheme	Design Voltage, V	Phase Current, A	Holding Torque, Nm	Detend Torque, mNm	Phase Resistance, Ohm	Inductance, mH	Steps/ Revolution	Braking Power
5918-B	bippolar	2.4	2.82	1.05	40	0.85±10%	3.6±20%	200 (1.8°)	0.4 Nm; 24 V; 10 W

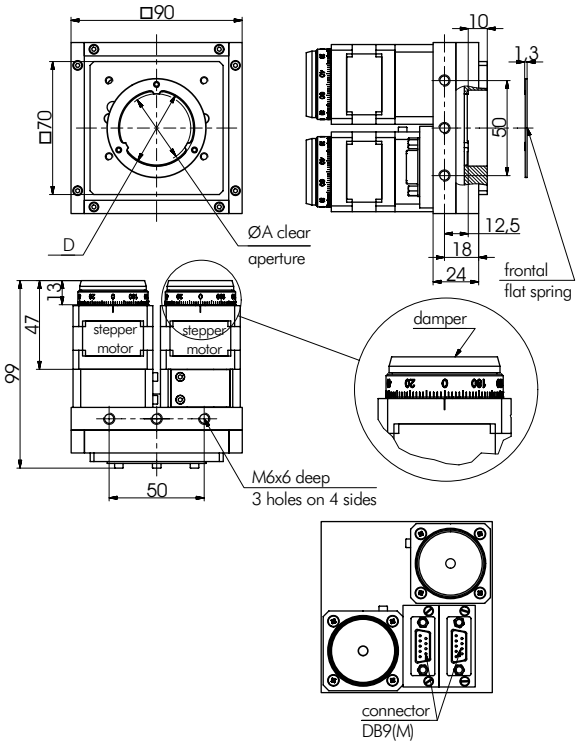
DC MOTORS

Model	Design Voltage, V	Continuous Current, A	Continuous Torque, Nm	Continuous Power, W	Resistance, Ohm	Inductance, mH	Max Speed, rpm	Gearbox	Encoder
DCE369751	3.6	0.587	0.3	2	3.5	0.114	120	67:1	16 CPT, 2 channels
DCJ252445	1.8	0.72	0.3	1.2	1.07	0.0216	7	1119:1	–
DCE1524	6	0.63	0.3	1.7	5.1	0.07	35	141:1	256 CPT, 2 channels
DCE RE25	24	1.37	0.5	20	1.53	0.186	1800	4.4:1	1000 CPT, 3 channels

940-0050 MOTORIZED MIRROR MOUNTS

Motorized Mirror Mounts 940-0050 are designed for precise angular alignment of optical elements. Platform is tilted about two axes.

A retaining ring keeps optics in a non-through mounting opening of the platform. The ring is fixed by 3 screws. It has 3 dents with which it clamps optics against similar 3 rests in the platform. The dents are exactly opposite to the rests – this minimizes deformation.



SPECIFICATIONS

Tilt range	5° both axes
Visual reading	dial knobs graduated in 200 steps per revolution
Resolution	0.0016° (0°00'06") per step
Optics accepted diameter (D), clear aperture (A):	
940-0051	Ø25.4 mm (1"), A=21.4 mm
940-0053	Ø40 mm, A=36 mm
940-0055	Ø50.8 (2"), A=46.8 mm
custom sizes available	
Optics thickness	10 mm (retaining rings for custom thickness available)
Material	black anodized aluminium
Motor	4233
Motor connector	DB9(M)
Mechanical end limit switches	2 per motor
Switch polarity	pushed is closed
Weight	1.08 kg

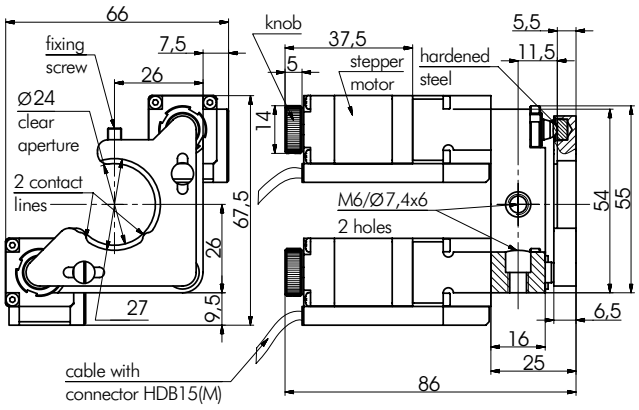
Code	Price, EUR
940-0051	575
940-0053	575
940-0055	575

RECOMMENDED CONTROLLERS

980-0045-USB
see page 7.98

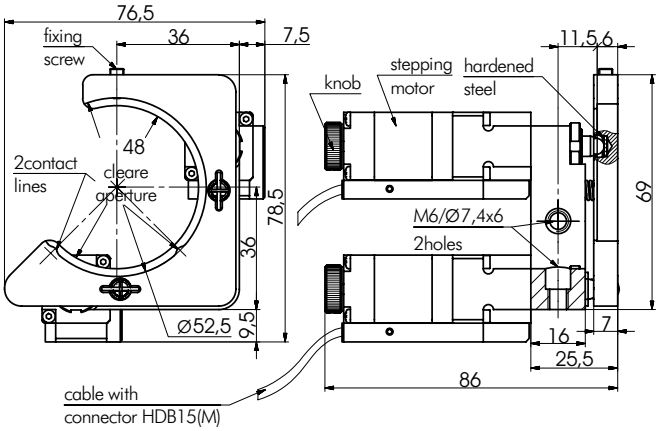
940-0060 MOTORIZED KINEMATIC MIRROR/BEAMSPLITTER MOUNTS

940-0060-01



940-0060-01

- **Clear Edge Design**
- **1", 2", 3" optics mounts**
- **Kinematic**
- **Stable**
- **Mounting on either of 2 sides**
- **Black anodized aliminium**



940-0060-02

940-0060 Motorized Mirror Mounts combine our traditional 840-0056 Kinematic Mirror/Beamsplitter Mount with our designed Motorized Compact Actuator 970-0060. This motorized mirror mount enables to achieve more precise positioning than with the manual adjusters. Ideal for use in closed systems. Integrated opto-electrical limit switches prevent damage, while providing homing – repeatability better than 10 arcsec.

DC motor base actuators are available on request.

SPECIFICATIONS

Model	940-0060-01	940-0060-02	940-0060-03
Travel range		4 mm	
Optics diameter	25.4 mm	50.8 mm	76.2 mm
Clear aperture	23 mm	48 mm	74 mm
Resolution		<1 arcsec	
Tilt range		± 4.5°	± 2.8°
Speed (980-0030F-USB)		from 1 arcsec/sec to 1°/sec	
Installed actuators		2 × 970-0060	
Optocoupler end limit switches		2 per actuator, pushed is open	
Cable		1.2 m length cable included	
Weight		0.3 kg	
Price	699 EUR	731 EUR	776 EUR

RECOMMENDED CONTROLLERS

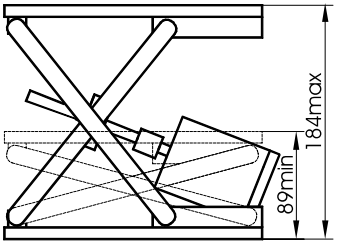
980-0045-USB
see page 7.98

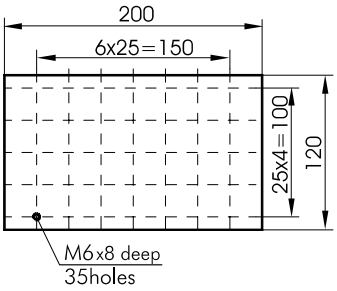
Complementary Products

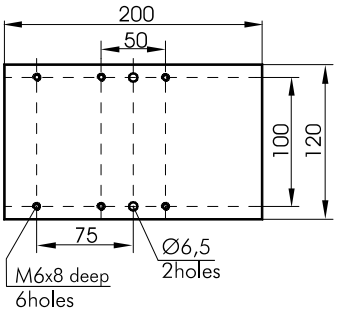
Code	Page
970-0060	online

940-0200 MOTORIZED VERTICAL TRANSLATION STAGE

- **Pantograph design**
- **95 mm vertical travel range**
- **16 ball bearings**
- **Stepping motor drive**
- **Precision lead screw**







Motorized Vertical Translation Stage 940-0200 boasts our unique design. Being very compact, it provides smooth and stable adjustment of height. It has a large travel range and supports large loads. While moving the platform stays parallel to the base.

Examples of use: making up for height differences during the set up; automation of technological processes, like laser welding.

A stepper motor type – 5918, 200 steps. Customer can specify other type of motors to install.

Load capacity and speed all greatly depend on the motor. We can test and select an appropriate motor for your requirements.

The lead screw acts at a varying angle, so the resolution of the stage varies with position.

The platform has an array of M6 holes spaced by 25 mm. The base has six M6 and two Ø6.5 holes.

Material: black anodized aluminium.

SPECIFICATIONS

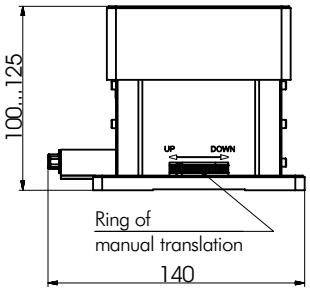
Travel range	95 mm
Height:	
Min.	89 mm
Max.	184 mm
Lead screw pitch	1 mm
Top and bottom plates parallel to	1 mm
Load capacity	8 kg (depending on motor and controller)
Material	black anodized aluminium
Supply voltage	36 V
Motor connector	DB9(M)
Motor	5918
Weight	4.3 kg
Mechanical end limit switches	2
Switch polarity	pushed is closed

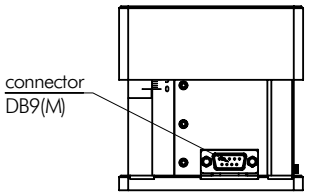
Code	Price, EUR
940-0200	798

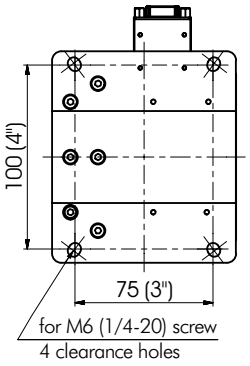
RECOMMENDED CONTROLLERS

980-0045-USB
see page 7.98

940-0210 MOTORIZED VERTICAL STAGE



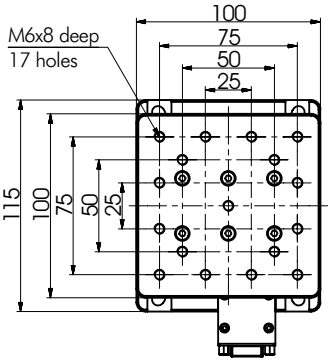




- **High precision**
- **High speed (up to 20 mm/sec)**
- **Loads up to 8 kg**
- **Compact design**
- **Direct drive actuator**
- **Stacks directly with 960-0130, 960-0150 rotators**

SPECIFICATIONS

Travel range	25 + 1 mm
Resolution in full step	5 µm
Resolution in 1/8 step	0.625 µm
Lead screw pitch	1 mm
Maximum speed	20 mm/sec
Load capacity	8 kg
Unidirectional repeatability	1 µm
Bi-directional repeatability	2 µm
Motor	2 phase stepper actuator
Limit switch	2, optocoupler
Switch polarity	pushed is open
Weight	2.2 kg

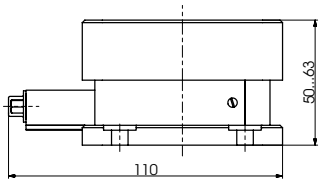


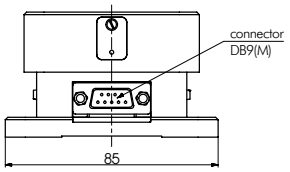
RECOMMENDED CONTROLLERS

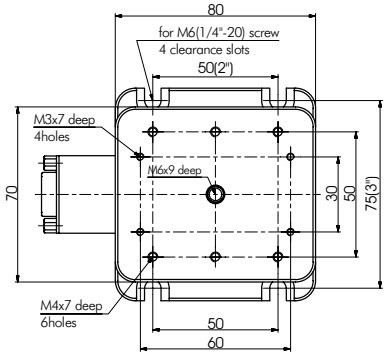
- 980-0045-USB *see page 7.98*

Code	Price, EUR
940-0210	1515

940-0212 MOTORIZED Z STAGE







Compact Motorized Z Stage provides 13 mm travel range. The stages ideally fits many motorized linear stages. 960-0170 series motorized rotation stages can be directly mounted on the top of 940-0212.

SPECIFICATIONS

Travel range	13 mm
Resolution in full step	5 µm
Resolution in 1/8 step	0.625 µm
Lead screw pitch	1 mm
Maximum speed	20 mm/sec
Load capacity	4 kg
Unidirectional repeatability	1 µm
Bi-directional repeatability	2 µm
Motor	2 phase stepper actuator
Limit switch	2, optocoupler
Switch polarity	pushed is open
Weight	0.75 kg

RECOMMENDED CONTROLLERS

- 980-0045-USB *see page 7.98*

Code	Price, EUR
940-0212	975

960-0095 MOTORIZED TRANSLATION STAGE

SPECIFICATIONS

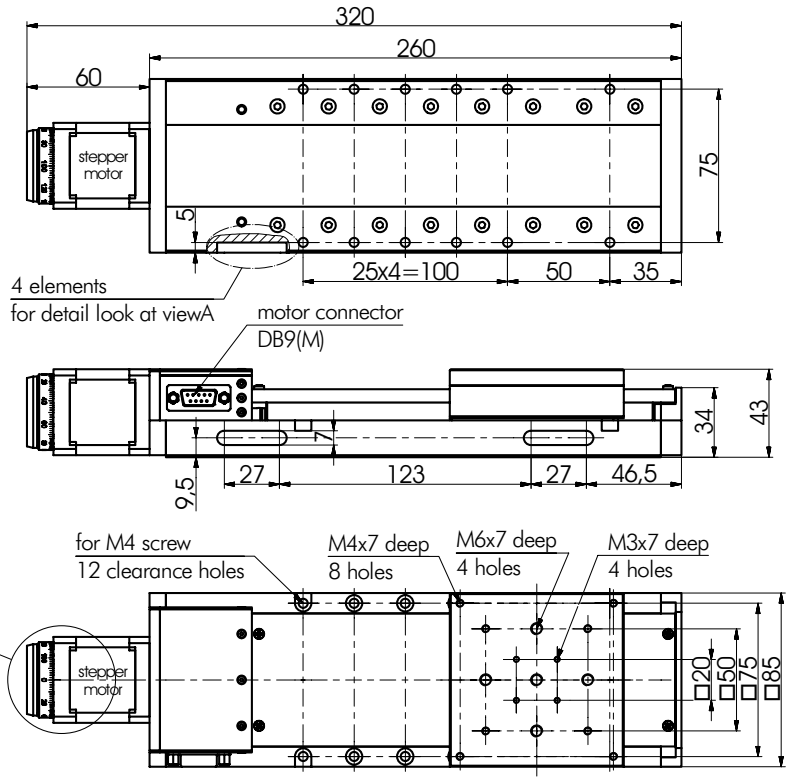
Travel range	100 mm
Lead screw pitch	0.5 mm
Resolution:	
in full step*	2.5 μm
in 1/8 step*	0.31 μm
Max. speed*	10 mm/s
Load capacity:	
horizontal	40 kg
vertical	6 kg
Motor connector	DB9(M)
Stepper motor	4247
Weight	2.2 kg

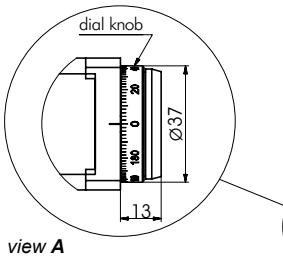
Motors of other types are available.

***Test condition:**
- 980-0030 controllers;
- Power supply – 36 V.

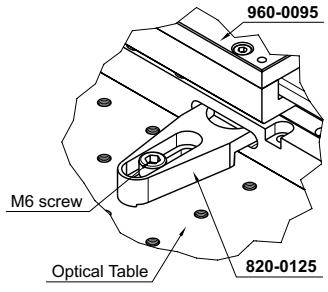
- **Huge load**
- **Easy use and combining**
- **Vacuum version available**

Code	Price, EUR
960-0095	1515

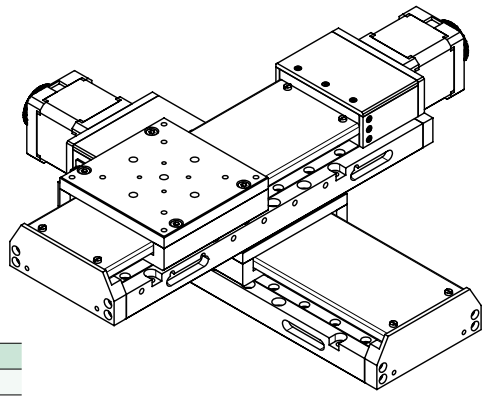




*view **A***



In X-Y configuration **960-0095** stages stack directly using M4 screws



RECOMMENDED CONTROLLERS

- 980-0045-USB *see page 7.98*

Complementary Products

Code	Page
820-0125	7.20

960-0095SM MOTORIZED TRANSLATION STAGE WITH SM SYSTEM

SPECIFICATIONS

Travel range	100 mm
Lead screw pitch	0.5 mm
Encoder resolution	4000 counts/rev
Minimal incremental motion	0.125 µm
Max. speed	25 mm/s
Load capacity	
Horizontal	40 kg
Vertical	6 kg
Cable*	2 m
Motor	SM
Weight	2.5 kg

**Cable supplied with 960-0095SM consists of power cable and RS232 communication cable and includes connector to computer RS232 (DSUB9), connector to motor (DSUB 7W2) and power connector (SOCKET DC 2.1/5.5 mm for Cable).*

960-0095SM consists of DC servo motor, motion controller, encoder and amplifier.

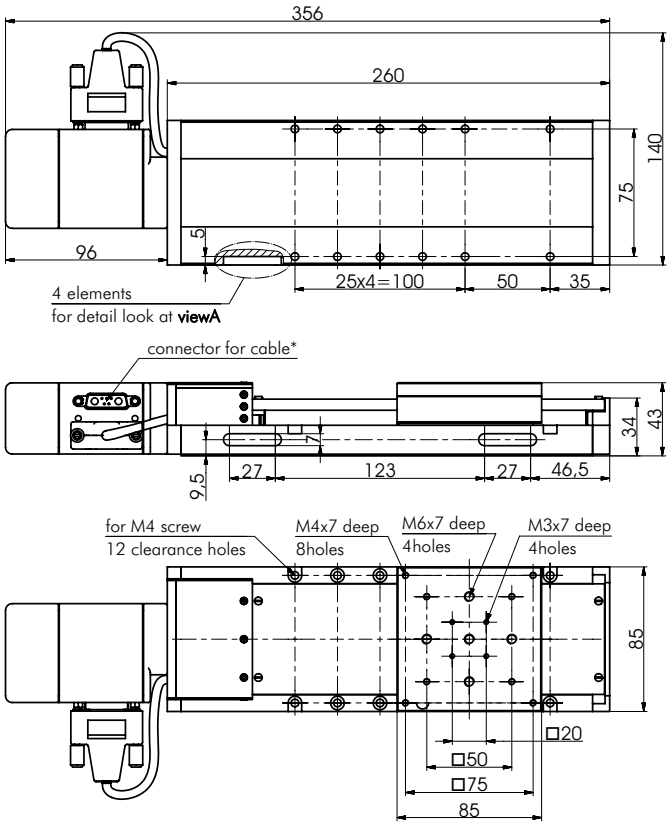
Requires only power supply
Power supply PS36-3.4-4
36 V; 3.34 A
167 × 65 × 37 mm
640 g
Mini-DIN male 4-pin power connector.

The SM system is a complete, compact and user-friendly integrated control system that features a brushless DC servo motor, motion controller, encoder and amplifier.

It is a decentralized drive system. It is a fully integrated motor system that includes a Brushless D.C. Servo-Motor (BLDC), Motion Controller, Drive-Electronics, Position Feedback Encoder and Fully Programmable Points of I/O (Inputs/Outputs). All these components are placed inside one integral frame or housing.

Each decentralized drive system is fully programmable as a stand-alone system or as part of a network fieldbus - Profibus, DeviceNet or RS232, RS485.

The integration of motor, controller and drive reduces complexity in an application and significantly increases reliability. The command set and firmware enables the SM system to perform a wide range of motion controls, arithmetic and conditional logic functions. The unit is a highly capable, stand-alone, complete motion control system that is easy to implement and use.



The SM system has more features than most full-size controls:

- Brushless DC servo motor
- S-232 & RS-485
- Stand alone capability
- Torque to 2000+ oz. in. / 15 NM
- Network up to 100 Servida Motors
- 4kHz PID
- Speeds 0 - 10,000 RPM
- CE marked & UL registered
- Expandable and programmable I/O expandable to 800 inputs and 800 outputs
- On-the-fly parameter changes
- Position Mode
- Velocity Mode
- Torque Mode
- Infinite Ratio Gearing
- Electronic Gearing/ Following Mode
- Step & Direction Mode
- Limit switch inputs
- Closed loop on external encoder
- Single voltage input
- Standard NEMA mount
- 32k user EEPROM
- Software current limit
- Thermal protection
- Easy Windows Software
- Contouring mode from host PC

961-0095 MOTORIZED TRANSLATION STAGE WITH DC MOTOR

SPECIFICATIONS

Travel range	100 mm
Lead screw pitch	0.5 mm
Minimal incremental motion	0.2 µm
Resolution	0.028 µm
Max. speed	13 mm/s
Load capacity	
Horizontal	30 kg
Vertical	5 kg
Motor connector	HDB15(M)
DC motor	DCE RE25
Weight	2.2 kg

RECOMMENDED CONTROLLERS

980-0045-USB
see page 7.98

ORDERING INFORMATION

Code	Description	Price, EUR
960-0095	Motorized Translation Stage with stepper motor 4247	1515
961-0095	Motorized Translation Stage with DC motor & encoder	1852
960-0095SM	Motorized Translation Stage with SM system	2945

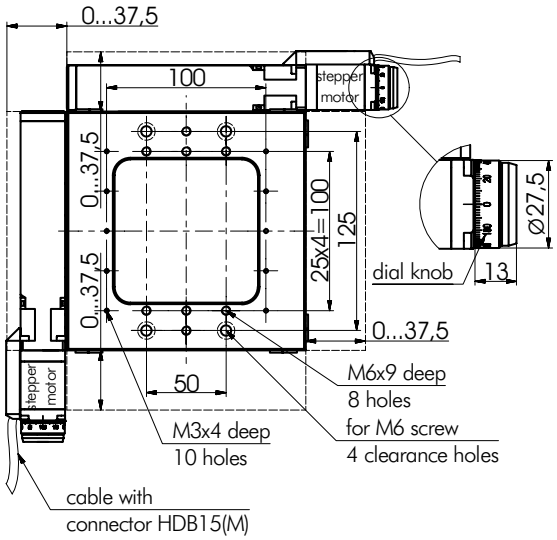
960-0095SM-XY-960-0150SM
3 Axis Motorized Translation-Rotation System

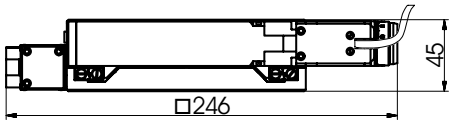
SPECIFICATIONS

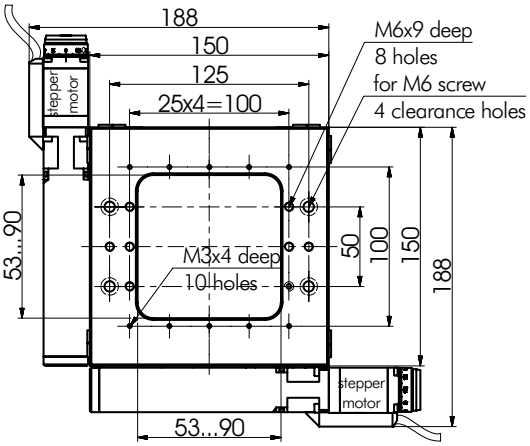
Translation xy	100×100 mm **960-0095SM**
Rotation z	360° **960-0150SM**
Load capacity	5 kg on rotation stage

960-0097 MOTORIZED XY SCANNING STAGE

960-0097-03







960-0097-03

- **Travel range 75×75 mm (3”) or 102×102 mm (4”)**
- **Accepts linear encoders**
- **RS232 and USB controll**
- **For image analysys**
- **Suitable for most major brand Microscopes and Macroviewers**
- **Custom support brackets available for various microscope types**

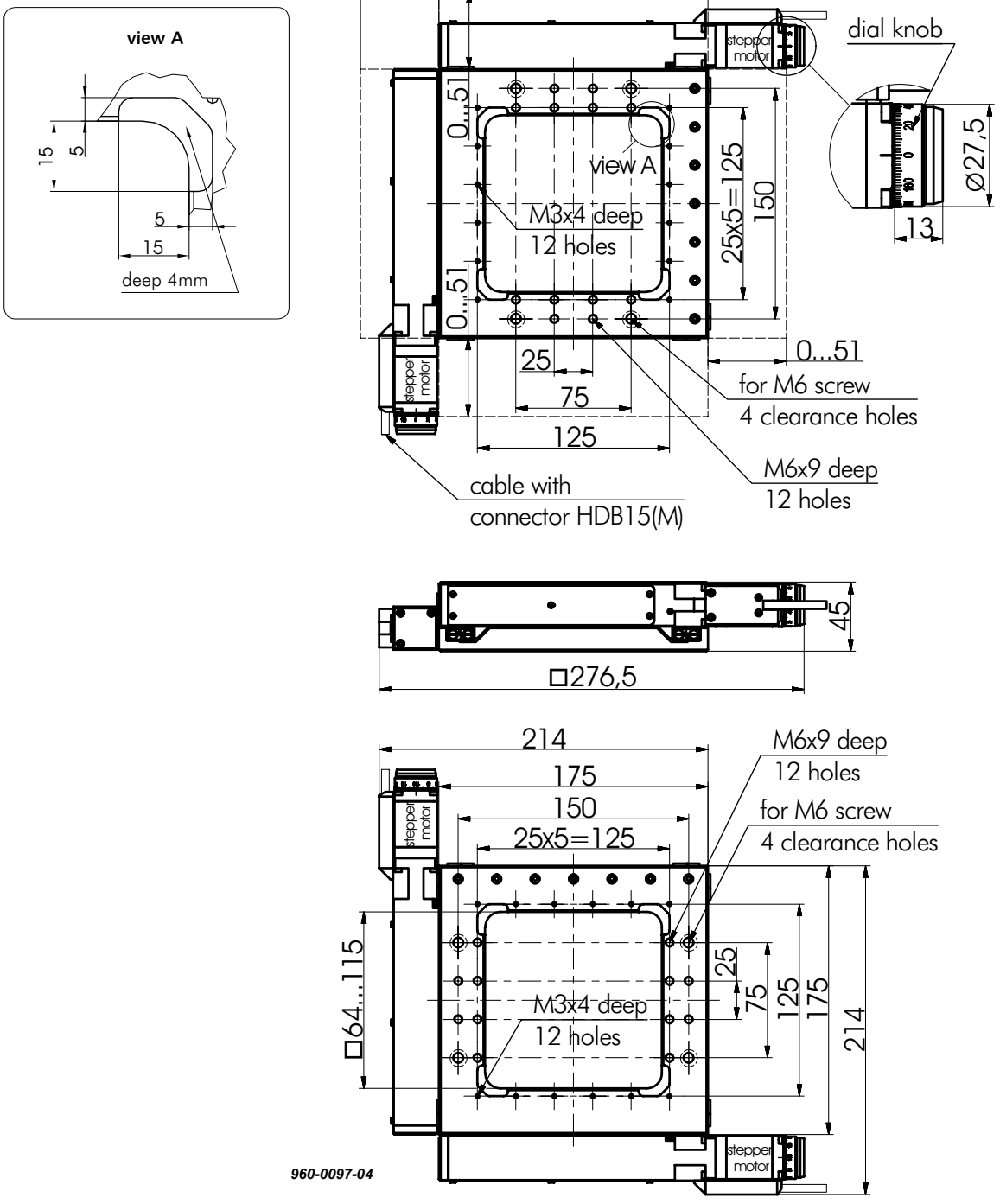
SPECIFICATIONS

Travel range	75×75 mm (3”) 102×102 mm (4”)
Lead screw pitch	0.5 mm
Resolution:	
in full step*	2.5 µm
in 1/8 step*	0.31 µm
Max. speed*	10 mm/s
Load capacity:	
Horizontal	50 kg
Vertical	6 kg
Motor connector	HDB15(M)
Cable	integrated, 1.6 m length
Stepper motor	28

***Test condition:**
• 980-0040 controllers;
• Power supply – 36 V.

ORDERING INFORMATION

Code	Travel range	Price, EUR
960-0097-03	Travel range 75×75 mm (3”)	1900
960-0097-04	Travel range 102×102 mm (4”)	1990



RECOMMENDED CONTROLLERS

980-0045-USB
see page 7.98

Joystick 981-0010 for Motorized Stages

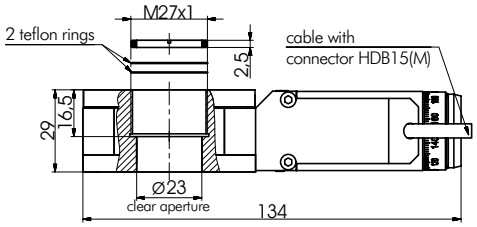
Joystick developed for manual control of one or two-axis all Stepper motor equipped motorizes stages.

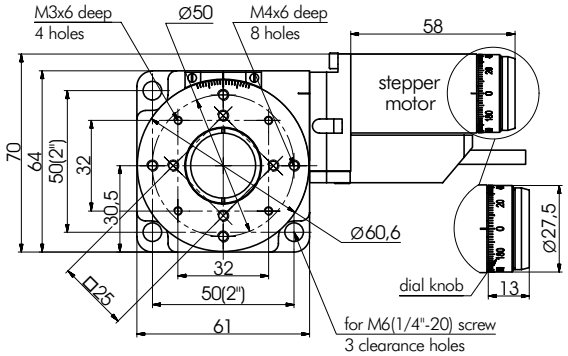
See page 7.98

960-0160 MOTORIZED ROTATION STAGES

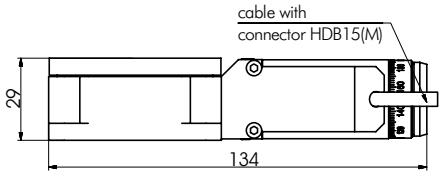
960-0161

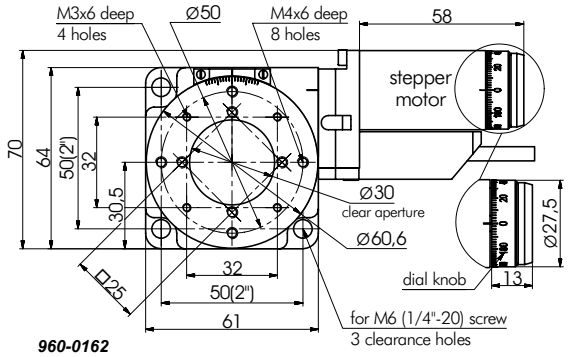
960-0162





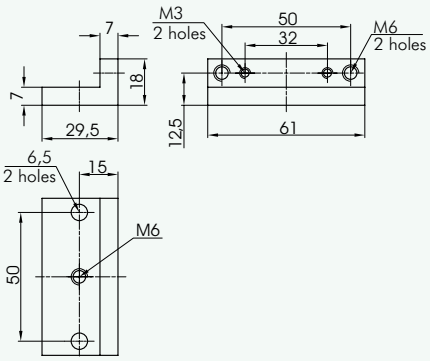
960-0161





960-0162

Angle bracket for vertical mounting



Code	Price, EUR
960-0161	687
960-0162	697

ORDERING INFORMATION

960-0161 has M27×1 for 1" optics mounting (Ø23 mm clear aperture).

960-0162 has a 30 mm aperture.

SPECIFICATIONS

Rotation range	360°
Resolution*	
in full step	0.6 arcmin
in 1/8 step	4.5 arcsec
Max. rotation speed*	50 deg/s
Wobble	0.6 arcmin
Eccentricity	10 µm
Load capacity:	
horizontal	6 kg
radial	1.7 kg
torque	0.5 Nm
Cable	integrated, 1.6 m length
Motor connector	HDB15(M)
Stepper motor	28
Weight	0.56 kg
Optocoupler reference home switch	1
Switch polarity	Pushed is open, sensor schematic

*Please visit our website **www.eksmaoptics.com** for Motorized Rotation Stages 960-0160 with imperial standards.*

RECOMMENDED CONTROLLERS

- 980-0045-USB *see page 7.98*

***Test condition:**
- 980-0030 controllers;
- Power supply – 36 V.

980-0045-USB STEPPER & DC MOTOR CONTROLLER

One axis controller ***980-1045***

Two axis controller ***980-1245***

Three axis controller ***980-1345***

Joystick for manual control ***981-0010***

- **One interface for stepper and DC motors**
- **Up to 35000 steps/s even in microstep mode, 20000 rpm for DC motor**
- **High resolution – 256 microsteps**
- **Smooth movement at low speeds**
- **Compatible with the latest Windows, Linux & MacOS including 64-bit OS versions**
- **Programming examples for all popular programming languages are supplied**
- **Closed loop motion control with encoder feedback**

980-0045-USB is designed for flexible motion control in laboratory experiments. With modern design of the controller even simple and inexpensive positioner can be utilized to achieve high speed and precision.

Controller is compatible with stepper, DC motors, incremental rotary and linear encoders, magnetic brake, limit switches and home switch. It has an integrated zero position calibration, which can be achieved with just one command, using signals from limit switches, home switch, external signals or their combinations. Controller features high level of protection from electrostatic discharge of all external connections and from short circuit in motor windings.

Controller software includes two user-friendly XILab user interfaces that allow controlling and testing of all controller functions without developing custom code. XILab interfaces are designed for positioners control, diagnostic and fine tuning of the motors driven by the controllers. XILab supports multiaxial mode and multidimensional control scripts. Script language integrated in XILab interfaces allows easy creation of algorithms, including loops and conditional statements, without compiling and learning a programming language.

980-0045-USB can be used as a stand-alone controller without PC, it is also compatible with external joystick.

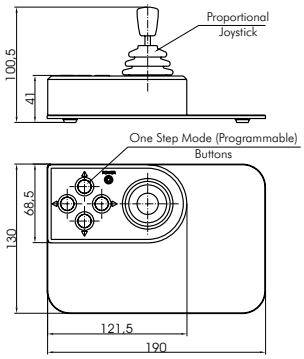
980-0045-USB can drive:

– Bipolar two phase stepper motors with current ratings 0.1 – 3 A

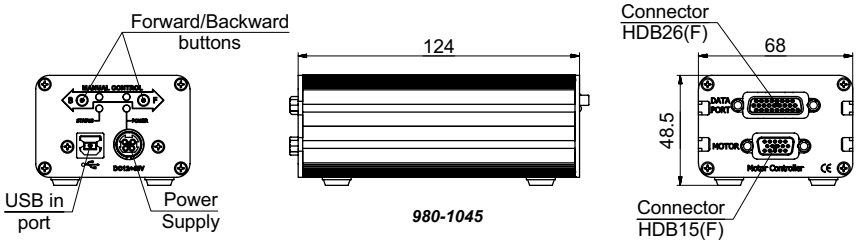
– DC motors with the winding current up to 6 A

ORDERING INFORMATION

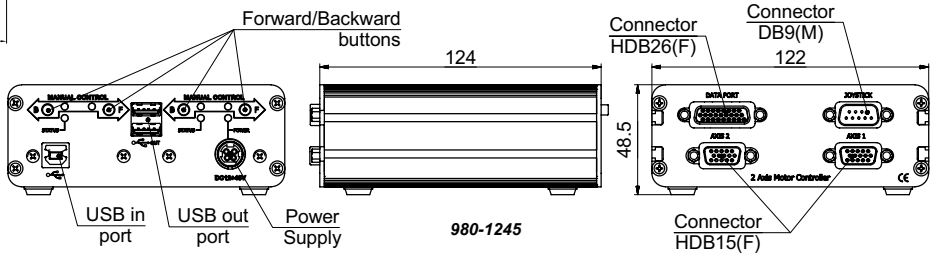
Code	Description	Price, EUR
980-0045	1-axis controller circuit card assembly	395
980-0045-BR	1-axis controller circuit card assembly (for brake equipped motor)	425
980-1045	1-axis controller	550
980-1045-BR	1-axis controller (for brake equipped motor)	650
980-1245	2-axis controller	940
980-1245-BR	2-axis controller (for brake equipped motor)	970
980-1345	3-axis controller	1490
980-1345-BR	3-axis controller (for brake equipped motor)	1590
980-1445	4-axis controller	1880
980-1445-BR	4-axis controller (for brake equipped motor)	1980



981-0010



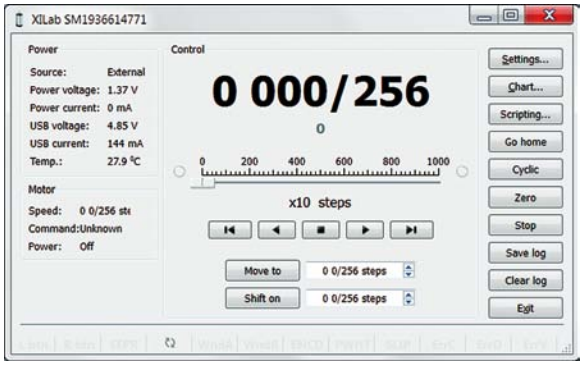
980-1045



980-1245

Software

Controller software includes two user-friendly XILab user interfaces that allow controlling and testing of all controller functions without developing custom code. XILab interfaces are designed for positioners control, diagnostic and fine tuning of the motors driven by the controllers. XILab supports multiaxial mode and multidimensional control scripts. Script language integrated in XILab interfaces allows easy creation of algorithms, including loops and conditional statements, without compiling and learning a programming language.



XILab Main window in single-axis control mode

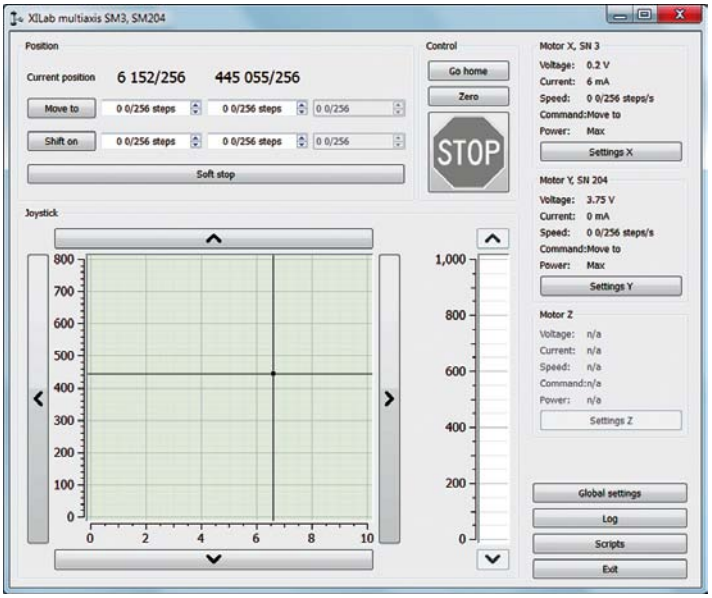
RELATED POWER SUPPLIES

A 12V – 36V, 1.5A – 3.6 A power supply is required to operate the controller. You can use your own power supply or the following power supplies:

model ***PS12-2.5-4*** (12 V; 2.5 A)
model ***PS36-3.4-4*** (36 V; 3.34 A)
model ***PS24-2.5-4*** (24 V; 2.5 A).

See page 7.100

PS36-3.4-4



XILab Main window in multi-axis control mode

POWER SUPPLIES FOR CONTROLLERS

PS12-1.5-4

PS12-2.5-4

PS24-2.5-4

PS36-3.4-4

Current requirements for stepper motor controller power supplies:

During operation, current consumption will vary depending upon how the controller is being used. Before shipment, our controllers are calibrated to the rated current of the motors they are to be used with. If you do not specify a motor, the controllers will be calibrated to a factory default value. Due to Pulse Width Modulation (PWM) our controllers usually consume less current than the rated current of motors. However, to avoid problems during worst case scenarios, we recommend selecting a power supply with a max current not less than the rated current of motors that will be connected to the controller. In case of multi-axis controllers you will need to sum the current of all controllers connected to the power supply.

Requirements for stepper motor controllers power supply voltage:

Our stepper motor controllers are a “chopper drive” type. This means that in the initial phase of the motor step our controller will apply significantly higher voltage to motor winding than will occur in other drive types. This method allows stepper motors to be driven with higher torque at higher speeds. It should also be noted that stepper motor parasitic resonant effect behavior (“bad” frequencies position, for example) depends on supply voltage. Minimal allowable DC voltage of our stepper motor controllers is 12V and maximum is 36V, both of which we keep in stock.

SPECIFICATIONS

Model	Voltage, V	Current, A	Dimensions, mm	Weight, kg	Connector	Price, EUR
PS12-1.5-4	12	1.5	98.5 × 55 × 31.5	0.2	2.1/5.5	33
PS12-2.5-4	12	2.5	98.5 × 55 × 31.5	0.25	2.1/5.5	51
PS24-2.5-4	24	2.5	125 × 50 × 31.5	0.31	KPPX-4P power connector	67
PS36-4.4-4	36	3.34	167 × 65 × 37	0.64	KPPX-4P power connector	180

Appendixes

Useful Formulas & Constants A.2
Optical Components Cleaning Instructions A.4
Tweezers / Forceps for Optical Components A.4
Crystals Handling Safety Guide A.5

EKSMA OPTICS • Tel.: +370 5 272 99 00 • Fax: +370 5 272 92 99 • info@eksmaoptics.com • www.eksmaoptics.com

Useful Formulas & Constants

Physical Constants

Planck's constant $h = 6.6260755\times10^{-34}$ J·s = 4.5×10^{-15} eV·s
= 6.626×10^{-27} erg·s

Dirac's constant $\hbar = h/2\pi = 1.054\times10^{-34}$ J·s
= 1.054×10^{-27} erg·s

Boltzmann's constant $k_B = 1.380\times10^{-16}$ erg/K
= 8.62×10^{-5} eV/K = 1.380×10^{-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 ($\Im$). 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*.

$$FSR = \frac{c}{2nl} \qquad \Im = \frac{FSR}{FWHM} = \frac{\pi\sqrt{R}}{1-R}$$

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),

$$R \approx 1 - \frac{\pi}{\Im}$$

Finesse	Reflectivity
2	24%
4	47%
6	60%
8	68%
10	73%
15	81%
20	85%

Wave Vector, Frequency, Wavelength & Wavenumbers

$$k = \frac{2\pi}{\lambda} = \frac{2\pi n}{\lambda_0} = \frac{2\pi n\nu}{c} = \frac{n\omega}{c} \qquad \lambda = \frac{c}{n\nu} = \frac{\lambda_0}{n} = \frac{2\pi}{k} = \frac{2\pi c}{n\omega}$$

$$\nu = \frac{c}{\lambda_0} = \frac{c}{n\lambda} = \frac{kc}{2\pi n} = \frac{\omega}{2\pi} \qquad \Delta\lambda = \frac{c\,\Delta\nu}{\nu^2} = \frac{\lambda^2\Delta\nu}{c}$$

k = wave vector
ν = frequency
$\omega = 2\pi\nu$ = angular frequency
λ = wavelength
λ_0 = wavelength in vacuum
n = refractive index

An easy number to remember is a 1-pm linewidth is approximately 125 MHz at 1550 nm.

Wavenumber (cm^{-1}) $= \frac{10^7}{\lambda\ (nm)}$

Electron Volts (eV) $= \frac{1242}{\lambda\ (nm)}$

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

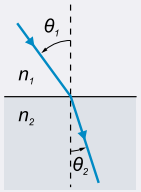
Common Material Properties

Material	Refractive Index, *n*	Δ*FSR**, 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

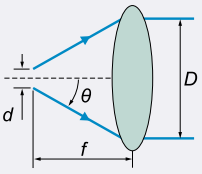
$n_1 \sin\theta_1 = n_2 \sin\theta_2$



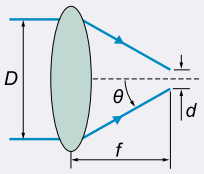
Numerical Aperture

$$f/\# = \frac{f}{D} \approx \frac{1}{2NA} \qquad NA = n\sin\theta$$

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"

Type 2 $k_{e1}(\theta)+k_{o2}=k_{o3}$
or "eoo interaction"

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)

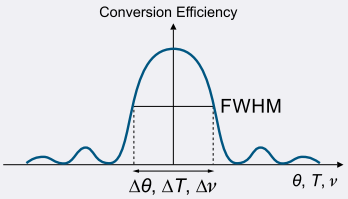
$$L = \frac{t}{GVM} \qquad GVM = \frac{1}{u_1} - \frac{1}{u_2}$$

$$u = \frac{c}{n(\lambda)}\left[1+\frac{\lambda}{n(\lambda)}\frac{\partial n(\lambda)}{\partial\lambda}\right]$$

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 $\Delta\upsilon$ – 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

$$E = E_1\sqrt{\frac{t}{t_1}}$$

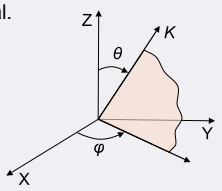
where E [J/cm^2] is the damage threshold, t is the pulse duration, E_1 and t_1 are the reference damage threshold and pulse duration.

Non Critical Phase Matching

NCPM – when crystal phase matching angle equals 90° (θ = 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

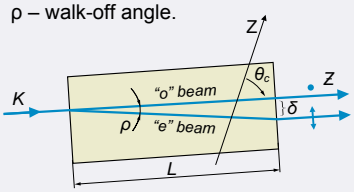
$$\rho(\theta) = \pm\arctan\left[\left(\frac{n_o}{n_e}\right)^2\tan(\theta)\right] \pm \theta$$

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.



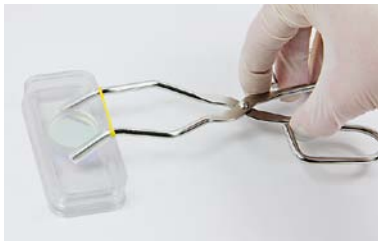
Optical Components Cleaning Instructions

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.

260-1050 TWEEZERS / FORCEPS FOR OPTICAL COMPONENTS



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.

Code	Price, EUR
260-1050	9

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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