# Optical Systems

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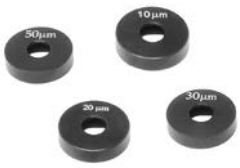


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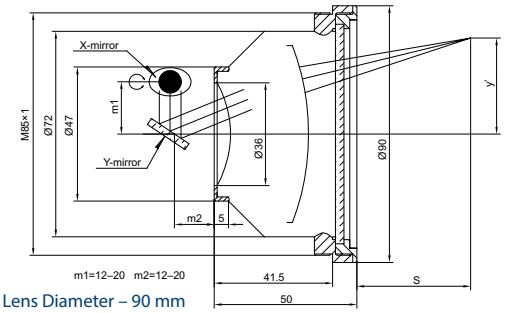
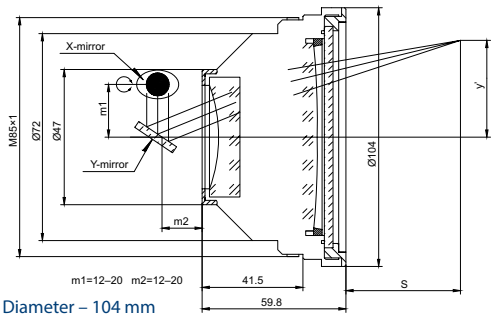
# F-THETA LENS

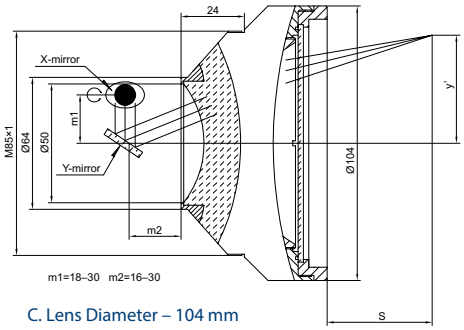
F-Theta lenses are designed to provide a flat field on the image plane for scanning and engraving applications where a high power laser and a set of rotating mirrors are used to scan across a given field.




A. Lens Diameter – 90 mm




B. Lens Diameter – 104 mm




C. Lens Diameter – 104 mm

## BEST MIRROR PLACES m1/m2 – 16/16 mm, screw size – M85×1

**Wavelength – 1064 nm**, Lens Diameter – 90 mm

| Focus length, mm | Working distance S, mm | Max. scan area, mm² | Max. scan angle, θ max | Input beam diameter, mm | Spot size, µm | Drawing | Catalogue number | Price, EUR |
|---|---|---|---|---|---|---|---|---|
| 100 | 114 | 70×70 | ±28° | 12 | 16 | A | 150-1001 | 420 |
| 160 | 232 | 140×140 | ±28° | 12 | 26 | A | 150-1601 | 420 |
| 210 | 287 | 145×145 | ±28° | 12 | 34 | A | 150-2101 | 420 |
| 254 | 284 | 175×175 | ±28° | 12 | 31 | A | 150-2541 | 420 |
| 290 | 355 | 200×200 | ±28° | 12 | 31 | A | 150-2901 | 420 |
| 330 | 465 | 220×220 | ±28° | 12 | 40 | A | 150-3301 | 420 |
| 420 | 467 | 300×300 | ±28° | 12 | 50 | A | 150-4201 | 420 |

**Wavelength – 532 nm**, Lens Diameter – 90 mm

| Focus length, mm | Working distance S, mm | Max. scan area, mm² | Max. scan angle, θ max | Input beam diameter, mm | Spot size, µm | Drawing | Catalogue number | Price, EUR |
|---|---|---|---|---|---|---|---|---|
| 100 | 114 | 70×70 | ±28° | 12 | 16 | A | 150-1002 | 460 |
| 160 | 180 | 110×110 | ±28° | 12 | 16 | A | 150-1602 | 460 |

**Wavelength – 355 nm**

| Focus length, mm | Working distance S, mm | Max. scan area, mm² | Max. scan angle, θ max | Input beam diameter, mm | Spot size, µm | Drawing | Catalogue number | Price, EUR |
|---|---|---|---|---|---|---|---|---|
| 100 | 136 | 70×70 | ±25° | 7 | 10 | B | 150-1003D1 | 930 |
| 160 | 186 | 110×110 | ±25° | 7 | 15 | B | 150-1603 | 930 |

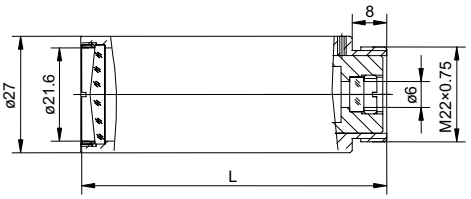
## BEST MIRROR PLACES m1/m2 – 24/24 mm, screw size – M85×1

**Wavelength – 1064 nm**, Lens Diameter – 104 mm

| Focus length, mm | Working distance S, mm | Max. scan area, mm² | Max. scan angle, θ max | Input beam diameter, mm | Spot size, µm | Drawing | Catalogue number | Price, EUR |
|---|---|---|---|---|---|---|---|---|
| 163 | 185 | 110×110 | ±28° | 20 | 17 | C | 151-1631 | 520 |
| 210 | 255 | 150×150 | ±28° | 20 | 24 | C | 151-2101 | 520 |
| 254 | 285 | 175×175 | ±28° | 20 | 31 | C | 151-2541 | 520 |
| 420 | 467 | 300×300 | ±28° | 20 | 55 | C | 151-4201 | 520 |
| 650 | 697 | 400×400 | ±25° | 20 | 85 | C | 151-6501 | 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 |

| Wavelength, nm | Expansion ratio | Beam expander size L, mm | Transmission, % | Catalogue number | Price, EUR |
|---|---|---|---|---|---|
| 1064 | 2X | 51 | >96 | 160-0021 | 235 |
| 1064 | 2.5X | 51 | >96 | 160-0251 | 235 |
| 1064 | 3X | 68 | >96 | 160-0031 | 235 |
| 1064 | 4X | 75 | >96 | 160-0041 | 235 |
| 1064 | 5X | 73 | >96 | 160-0051 | 235 |
| 1064 | 6X | 75 | >96 | 160-0061 | 235 |
| 1064 | 8X | 77 | >96 | 160-0081 | 235 |
| 1064 | 10X | 70 | >96 | 160-0101 | 235 |
| 532 | 2X | 51 | >96 | 160-0022 | 235 |
| 532 | 2.5X | 51 | >96 | 160-0252 | 235 |
| 532 | 3X | 68 | >96 | 160-0032 | 235 |
| 532 | 4X | 75 | >96 | 160-0042 | 235 |
| 532 | 5X | 73 | >96 | 160-0052 | 235 |
| 532 | 6X | 75 | >96 | 160-0062 | 235 |
| 532 | 8X | 77 | >96 | 160-0082 | 235 |
| 532 | 10X | 70 | >96 | 160-0102 | 235 |
| 355 | 4X | 75 | >96 | 160-0043 | 250 |
| 355 | 6X | 75 | >96 | 160-0063 | 250 |
| 355 | 8X | 68 | >96 | 160-0083 | 250 |
| 355 | 10X | 71 | >96 | 160-0103 | 250 |

Compact beam expanders of other expansion ratio are available upon request.

### Related Product

Large Rod Small Mounting Clamp (aluminium) 810-0062A

Find more at EksmaOptics.com

## ZOOM BEAM EXPANDER

### Features

- Adjustable 1X – 8X or 2X – 8X expansion ratio
- Adjustable divergence
- Galilean design

Compact Galilean type zoom beam expanders are designed for Nd:YAG fundamental and harmonic wavelengths: 1064 nm, 532 nm and 355 nm. Zoom beam expanders provide 1X – 8X or 2X – 8X continuous magnification with adjustable focus to correct for laser beam divergence.

| Wavelength, nm | Expantion ratio | Input Clear Aperture, mm | Output Clear Aperture, mm | Length, mm | Catalogue number | Price, EUR |
|---|---|---|---|---|---|---|
| 1064 | 1x-8x | 12 | 33 | 162 | 165-1181 | 860 |
| 1064 | 2x-8x | 12 | 33 | 143.3 | 165-1281 | 860 |
| 532 | 1x-8x | 12 | 33 | 162 | 165-1185 | 860 |
| 532 | 2x-8x | 12 | 33 | 139.9 | 165-1285 | 860 |
| 355 | 1x-8x | 12 | 33 | 162 | 165-1183 | 1120 |
| 355 | 2x-8x | 12 | 33 | 158.5 | 165-1283 | 860 |

Visit our e-shop www.eksmaoptics.com and find the drawings of all zoom beam expanders.

### Related Product

Universal Adjustable Optics Mount 830-0035

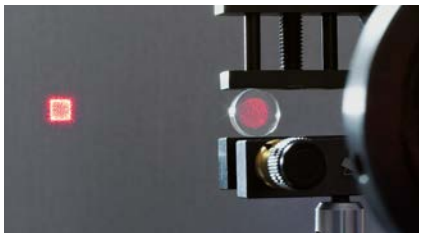
Find more at EksmaOptics.com

# TOP HAT BEAM SHAPING LENSES – FBS

## Features

- Transforms Gaussian beams into flat-top beams
- Different shapes of Top Hat spots - round, square, line
- Easy to integrate into existing beam paths

FBS Series beam shapers are designed to transform collimated Gaussian beams into small and homogeneous Top Hat spots of square, round or line shapes. FBS beam shapers should be used in setup with focusing optics, and the working distance of a Top Hat beam shaper is determined by the focal length of the focusing optics.



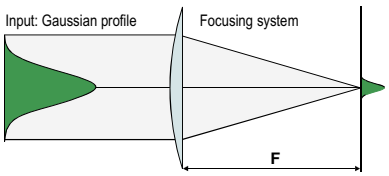
## Specifications

| | |
|---|---|
| Material | UV Fused Silica |
| Transmission | >99% |
| Diameter | 25.4 mm |
| Thickness | 3 mm |
| Laser Damage Threshold | 10 J/cm$^2$ @ 1064 nm, 10 ns<br>5 J/cm$^2$ @ 532 nm, 10 ns<br>3 J/cm$^2$ @ 355 nm, 10 ns |

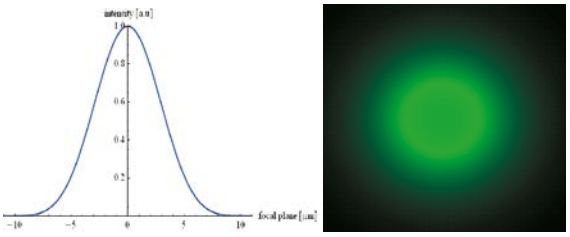
## Operation Requirements

| | |
|---|---|
| Input beam | Gaussian beam (TEM$_{00}$), $M^2 < 1.4$ |
| Input beam diameter | Fixed, ±5% tolerance |
| Operation wavelength | Fixed |
| Optical setup | Clear apertures along beam path at least 2.2x larger than the beam size @ 1/e$^2$ |

## Without FBS Beam Shaper

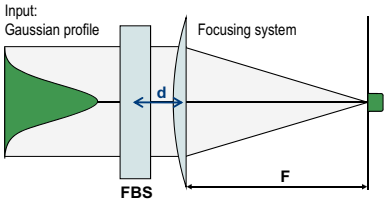



Gaussian-profile at focal plane

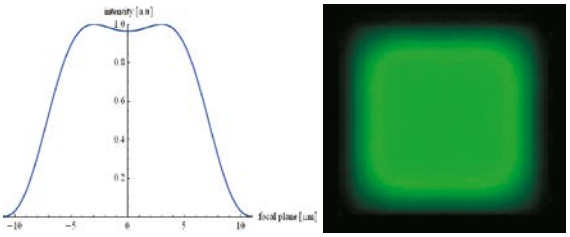


Diffraction limited Gaussian profile

## With FBS Beam Shaper

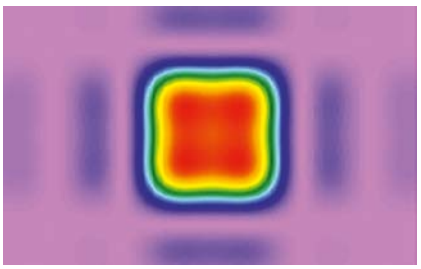



Top-Hat-profile at focal plane



Near diffraction limited Top Hat profile

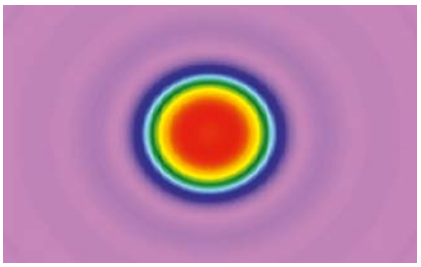
## FBS2 – Square Top Hat Profile



### Spot Geometry

| | |
|---|---|
| Top Hat width | approximately 2 × λ ×(f/d), with f = focal length, d = beam diameter @ 1/e² |
| Efficiency | up to 90% |
| Homogeneity | ca. ± 2.5% (rel. to average intensity of the Top Hat plateau) |
| Side modes (strongest) | ~16.5x weaker than line plateau (< 1.5% of input energy) |
| Depth of focus (DOF) | ~60% of the Rayleigh length |

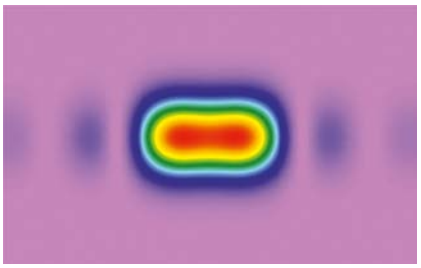
## FBSR – Round Top Hat Profile



### Spot Geometry

| | |
|---|---|
| Top Hat diameter | approximately 2 × λ × (f/d), with f = focal length, d = beam diameter @ 1/e² |
| Efficiency | up to 95% |
| Homogeneity | ca. ± 2.5% (rel. to average intensity of the Top Hat plateau) |
| Side modes (strongest) | ~70x weaker than line plateau (< 1.5% of input energy) |
| Depth of focus (DOF) | ~30% of the Rayleigh length |

## FBSL – Line Top Hat Profile



### Spot Geometry

| | |
|---|---|
| Line length (Top Hat) | approximately 2 × λ × (f/d), with f = focal length, d = beam diameter @1/e² |
| Line width (Gaussian) | Similar to the diameter of Gaussian spot in the same optical configuration |
| Efficiency | up to 92.5% |
| Homogeneity | ca. ± 2.5% (rel. to average intensity of the Top Hat plateau) |
| Side modes (strongest) | ~15x weaker than line plateau (< 1.7% of input energy) |
| Depth of focus (DOF) | ~50% of the Rayleigh length |

## Ordering information

**FBS2-1064-1.0**

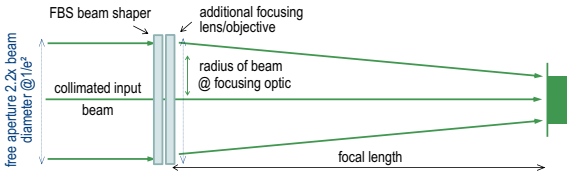
Model name:
- FBS2 – Square profile
- FBSR – Round profile
- FBSL – Line profile

Operation wavelength:
- 1064 nm
- 1030 nm
- 532 nm
- 515 nm
- 355 nm
- 343 nm

Input beam diameter (@ 1/e²):
- From 1.0 to 6.0 mm, increment: 0.5 mm

There are different possibilities to integrate the FBS beam shaper into an optical setup.

**1. Beam shaper directly in front of a focusing optic/objective**

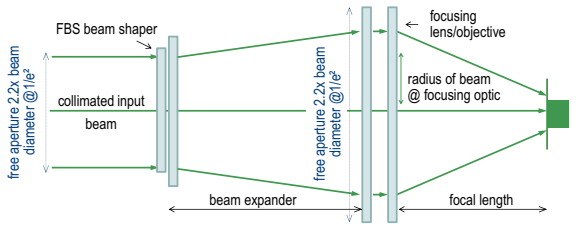



By introducing the FBS beam shaper into the beam path in front of a lens/objective the initial diffraction limited Gaussian spot will be transformed into a homogeneous Top-Hat profile.

When a Gaussian $TEM_{00}$ input beam with a diameter of 5 mm @ $1/e^2$ is used the diameter of the free aperture along the total beam path have to be at least 11 mm (better 13 mm).

If for example a wavelength with 532 nm, a Gaussian $TEM_{00}$ input beam with a diameter of 5 mm@$1/e^2$ and a focusing lens with f=160 mm is used, ones will get a homogeneous Top Hat profile with a diameter of 34 µm.

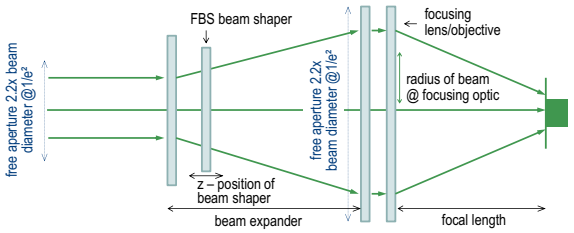
**2. Beam shaper in front of a beam expander**




There is also the possibility to introduce the FBS beam shaper into the beam path in front of a beam expander. This leads to a higher numerical aperture of the focused beam and to a smaller Top Hat profile.

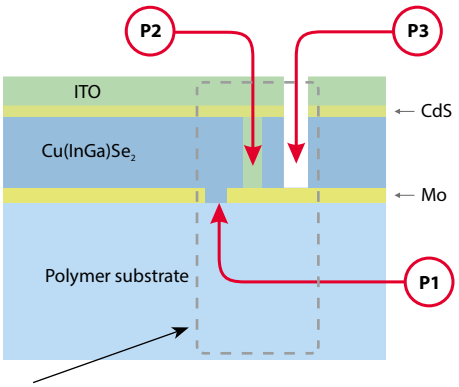
Example: A Gaussian beam with a diameter of 5 mm@$1/e^2$ illuminates the FBS beam shaper and is afterwards increased by a beam expander to a beam diameter of 8 mm. With an focusing optic with f=50 mm the user can generate a Top Hat with a diameter of 7 µm. The needed free aperture increases with the expanded beam. For a beam with a diameter of 8 mm the free aperture has to be at least 18 mm.

**3. Beam shaper within a beam expander**



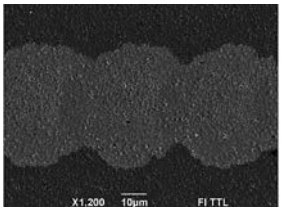

A further and even more flexible possibility is to introduce the FBS beam shaper into the beam path within a beam expander. The user has the possibility for an easy "fine tuning" of beam diameter at the position of FBS beam shaper by shifting shaper along z-axis.

## Scribing of CIGS-solar cells

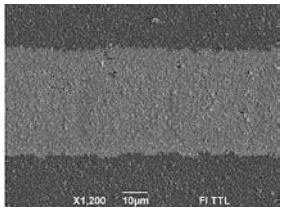



- Wasted area, reducing efficiency → need of smallest scribing lines
- Cut quality influence efficiency → need of small HAZ, no debris, smooth edges
- High scanning speed for high throughput → need of small pulse overlap

**P1 – „Scribing"**



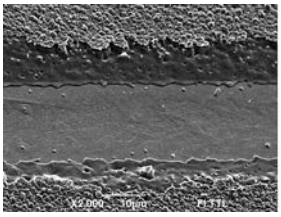
Gaussian Profile



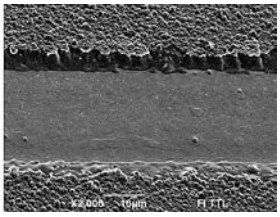
FBS-Top-Hat Profile
small overlap, smooth edges

Removal of a front contact in ZnO(1 µm)/CIGS/Mo/PI structure. Laser PL10100/SH, 10 ps, 370 mW, 100 kHz, 532 nm; scanning speed 4.3 m/s, single pass.

**P3 – „Scribing"**



Gaussian Profile



FBS-Top-Hat Profile
small HAZ, smooth edges

Tilted SEM pictures of the P3 scribe in ZnO(1 µm)/CIGS/ Mo/PI structure. Laser PL10100/SH, 10 ps, 370 mW, 100 kHz, 532 nm; scanning speed 60 mm/s, single pass.

Raciukaitis et. al, JLMN-Vol. 6, No. 1, 2011

## Recommended Accessories

Zoom Beam Expander
See page 5.4

Two Axes Translation Polarizer Holder
840-0240
Find more at EksmaOptics.com

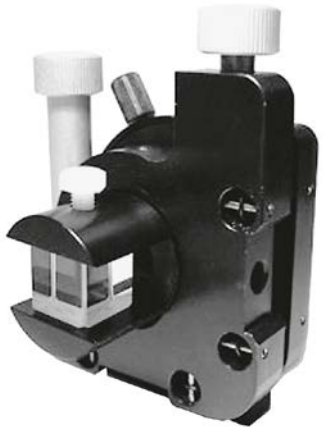
# CONTINUOUSLY VARIABLE ATTENUATOR / BEAMSPLITTER – 990-0060

## Features

- Divides laser beam into two beams of manually adjustable intensity ratio
- Convenient 90° angle between reflected and transmitted beams
- Negligible beam deviation
- Large dynamic range
- Broadband transmission
- Weight – 0.16 kg

Continuously Variable Attenuator/ Beamsplitter is designed to be used for laser pulses as short as 100 fs. It consists of 2 high-performance polarizing optics components placed in precision opto-mechanical holder 840-0197. Variable attenuator/beamsplitter incorporates a high-performance Polarizing Cube Beamsplitter which reflects s-polarized light at 90° while transmitting p-polarized light.

A rotating λ/2 waveplate is placed in the incident polarized laser beam. The intensity ratio of those two beams may be continuously varied without alteration of other beam parameters by rotating the waveplate. The intensity of either exit beam, and their intensity ratio, can be controlled over a wide dynamic range. Pure p-polarization could be selected for maximum transmission, or pure s-polarization for maximum attenuation of the transmitted beam.



## ACHROMATIC AIR-SPACED WAVEPLATE AND HIGH POWER BROADBAND CUBE POLARIZING BEAMSPLITTER

### Specifications

| | |
|---|---|
| Extinction ratio | Ts/Tp < 1:200 |
| Clear aperture | 11 mm |

**for Broadband Region**

| Central wavelength, nm | LDT, J/cm² | Catalogue number | Price, EUR |
|---|---|---|---|
| 450-680 | 1 [1)] | 990-0060-11VIS | 1060 |
| 700-1000 | 2 [2)] | 990-0060-11IR | 1060 |

[1)] LDT measured at 532 nm, 10 Hz, 10 ns pulses.
[2)] LDT measured at 1064 nm, 10 Hz, 10 ns pulses.

## MULTIPLE ORDER HALF WAVEPLATE AND HIGH POWER CUBE POLARIZING BEAMSPLITTER

### Specifications

| | |
|---|---|
| Extinction ratio | Ts/Tp < 1:500 |
| Clear aperture | 11 mm |

| Central wavelength, nm | LDT, J/cm² * | Catalogue number | Price, EUR |
|---|---|---|---|
| 1064 | 15 | 990-0061-11 | 740 |
| 1030 | 15 | 990-0062-11 | 740 |
| 800 | 8 | 990-0063-11 | 740 |
| 532 | 6 | 990-0064-11 | 740 |
| 355 | 3 | 990-0065-11 | 770 |

* LDT measured at designed wavelength, 10 Hz, 10 ns pulses.

# VARIABLE ATTENUATORS FOR LINEARLY POLARIZED LASER BEAM – 990-0070

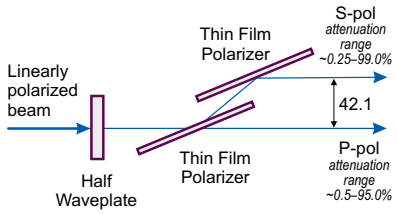
## Features

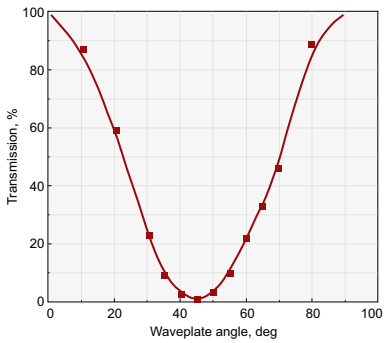
- Divides laser beam into two parallel beams of manually adjustable intensity ratio
- Large dynamic range
- Transmitted beam shift ~ 0.5 mm
- High optical damage threshold

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

This variable attenuator/beamsplitter consists of special design opto-mechanical Adapter and precision opto-mechanical holder 840-0197. Two Thin Film Brewster type polarizers, which reflect s-polarized light while transmitting p-polarized light, are housed into Adapter. Quartz Half Waveplates are housed in rotating holder 840-0197.

The intensity ratio of those two beams may be continuously varied without alteration of other beam parameters by rotating the waveplate. The intensity of either exit beam, or their intensity ratio, can be controlled over a wide dynamic range. P-polarization could be selected for maximum transmission, or high-purity s-polarization could be reflected when maximum attenuation of the transmitted beam takes place. The holder 840-0197 allows to adjust Angle Of Incidence of the Thin Film Brewster type polarizers by ±2° and to get the maximum polarization contrast.




## For Nd:YAG Laser Applications

| | |
|---|---|
| Aperture diameter | 17 mm |
| Damage threshold | 5 J/cm² pulsed at 1064 nm, typical |
| Polarization Contrast (after 1st polarizer) | >1:200 |
| Polarization Contrast (after 2nd polarizer) | >1:500 |
| Weight | 0.35 kg |

**For Nd:YAG Laser Applications**

| Wavelength, nm | Catalogue number | Price, EUR |
|---|---|---|
| 266 | 990-0070-266H * | 1050 |
| 355 | 990-0070-355 | 780 |
| 532 | 990-0070-532 | 680 |
| 1064 | 990-0070-1064 | 680 |

Multi order half waveplate is housed in rotating holder 840-0197 for Nd:YAG laser pulses (laser damage threshold: 5 J/cm² pulsed at 1064 nm, typical).

* With Zero Order Air-Spaced half waveplate.

## For Femtosecond Applications

| | |
|---|---|
| Aperture diameter | 17 mm |
| Damage threshold | >10 mJ/cm², 50 fs pulse at 800 nm, typical |
| for high power laser applications | >100 mJ/cm², 50 fs pulse at 800 nm, typical |
| Time dispersion | t<4 fs for 100 fs Ti:Sapphire laser pulses |
| Polarization Contrast (after 1st polarizer) | >1:200 |
| Polarization Contrast (after 2nd polarizer) | >1:500 |
| Weight | 0.35 kg |

**For Femtosecond Applications**

| Wavelength, nm | Catalogue number | Price, EUR |
|---|---|---|
| 257 | 990-0070-257 | 975 |
| 266 | 990-0070-266 | 975 |
| 343 | 990-0070-343 | 870 |
| 400 | 990-0070-400 | 770 |
| 390-410 | 990-0070-400B | 920 |
| 515 | 990-0070-515 | 770 |
| 505-525 | 990-0070-515B | 920 |
| 800 | 990-0070-800 | 770 |
| 780-820 | 990-0070-800B | 920 |
| 1030 | 990-0070-1030 | 770 |
| 1010-1050 | 990-0070-1030B | 920 |

Zero order optically contacted half waveplate is housed in rotating holder 840-0197 for femtosecond laser pulses (laser damage threshold: >10 mJ/cm², 50 fsec pulse, 800 nm typical).

**For High Power Femtosecond Laser Applications**

| Wavelength, nm | Catalogue number | Price, EUR |
|---|---|---|
| 257 | 990-0070-257H | 1050 |
| 266 | 990-0070-266H | 1050 |
| 343 | 990-0070-343H | 945 |
| 400 | 990-0070-400H | 845 |
| 390-410 | 990-0070-400HB | 995 |
| 515 | 990-0070-515H | 845 |
| 505-525 | 990-0070-515HB | 995 |
| 800 | 990-0070-800H | 845 |
| 780-820 | 990-0070-800HB | 995 |
| 1030 | 990-0070-1030H | 845 |
| 1010-1050 | 990-0070-1030HB | 995 |

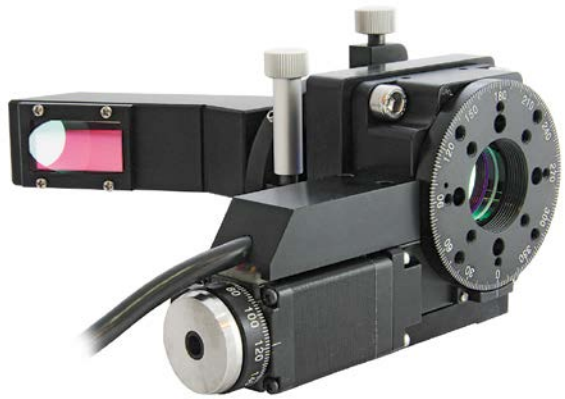
Zero Order Air-Spaced half waveplate is housed in rotating holder 840-0197 for high power femtosecond applications (laser damage threshold: >100 mJ/cm², 50 fsec pulse, 800 nm typical).

## Related Products

Beam dumps 990-0800, 990-0820

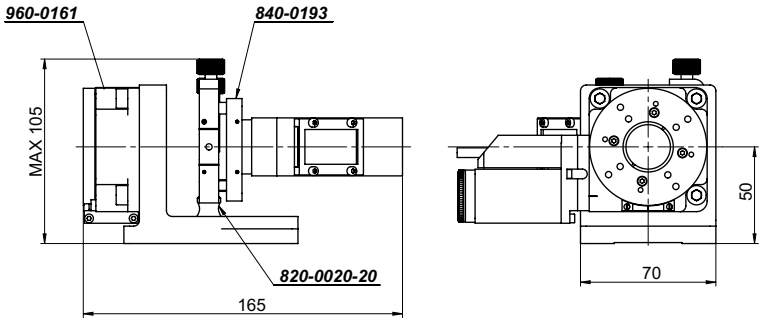
See page 5.19

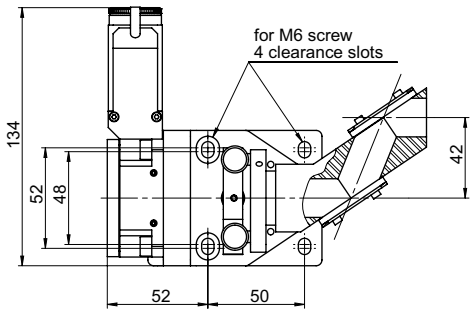
# MOTORIZED VARIABLE ATTENUATOR FOR LINEARLY POLARIZED LASER BEAM – 990-0070M



This motorized variable attenuator/beamsplitter consists of special design opto-mechanical Adapter and precision opto-mechanical holder 840-0193. Two Thin Film Brewster type polarizers, which reflect s-polarized light while transmitting p-polarized light, are housed into Adapter. Quartz Half Waveplates are housed in motorized rotation stage 960-0161.

The intensity ratio of those two beams may be continuously varied without alteration of other beam parameters by rotating the waveplate. The intensity of either exit beam, or their intensity ratio, can be controlled over a wide dynamic range. P-polarization could be selected for maximum transmission, or high-purity s-polarization could be reflected when maximum attenuation of the transmitted beam takes place. The holder 840-0193 allows to adjust Angle Of Incidence of the Thin Film Brewster type polarizers by ±2° and to get the maximum polarization contrast.




## Ordering information

**Please note:** these motorized variable attenuators for linearly polarized laser beam are provided without controller and power supply. If you would like to order the complete solution (controller 980-1045 and power supply: PS12-1.5-4), please ad CP to code and 695 EUR to price.

Example:

**990-0070-266M** – motorized attenuator without controller and power supply.

Price – 1830 EUR

**990-0070-266M+CP** – motorized attenuator with controller and power supply.

Price – 2525 EUR

### For Nd:YAG Laser Applications

| Wavelength, nm | Catalogue number | Price, EUR |
|---|---|---|
| 266 | 990-0070-266HM * | 1830 |
| 355 | 990-0070-355M | 1560 |
| 532 | 990-0070-532M | 1460 |
| 1064 | 990-0070-1064M | 1460 |

Multi order half waveplate is housed in Motorized Rotation Stage 960-0161 and Polarizer with adapter in Kinematic Optical Mount 840-0193 for Nd:YAG laser application (laser damage threshold: 5 J/cm², 10 ns pulses, 10 Hz at 1064 nm, typical).

* With Zero Order Air-Spaced half waveplate.

### For Femtosecond Applications

| Wavelength, nm | Catalogue number | Price, EUR |
|---|---|---|
| 257 | 990-0070-257M | 1755 |
| 266 | 990-0070-266M | 1755 |
| 343 | 990-0070-343M | 1650 |
| 400 | 990-0070-400M | 1550 |
| 390-410 | 990-0070-400BM | 1700 |
| 515 | 990-0070-515M | 1550 |
| 505-525 | 990-0070-515BM | 1700 |
| 800 | 990-0070-800M | 1550 |
| 780-820 | 990-0070-800BM | 1700 |
| 1030 | 990-0070-1030M | 1550 |
| 1010-1050 | 990-0070-1030BM | 1700 |

Zero order optically contacted half waveplate is housed in Motorized Rotation Stage 960-0161 and Polarizer with adapter in Kinematic Optical Mount 840-0193 for femtosecond laser application (laser damage threshold: >10 mJ/cm², 50 fsec pulse, 800 nm typical).

### For High Power Femtosecond Applications

| Wavelength, nm | Catalogue number | Price, EUR |
|---|---|---|
| 257 | 990-0070-257HM | 1830 |
| 266 | 990-0070-266HM | 1830 |
| 343 | 990-0070-343HM | 1725 |
| 400 | 990-0070-400HM | 1625 |
| 390-410 | 990-0070-400HBM | 1775 |
| 515 | 990-0070-515HM | 1625 |
| 505-525 | 990-0070-515HBM | 1775 |
| 800 | 990-0070-800HM | 1625 |
| 780-820 | 990-0070-800HBM | 1775 |
| 1030 | 990-0070-1030HM | 1625 |
| 1010-1050 | 990-0070-1030HBM | 1775 |

Zero Order Air-Spaced half waveplate is housed in Motorized Rotation Stage 960-0161 and Polarizer with adapter in Kinematic Optical Mount 840-0193 for high power femtosecond laser application (laser damage threshold: >100 mJ/cm², 50 fsec pulse, 800 nm typical).

# BROADBAND VARIABLE ATTENUATOR FOR FEMTOSECOND LASER PULSES – 990-0070HBBI70

## Features

- Divides laser beam into two parallel beams of manually adjustable intensity ratio
- Large dynamic range
- Transmitted beam shift ~ 2.6 mm
- High optical damage threshold

*990-0070-800HBBi70*

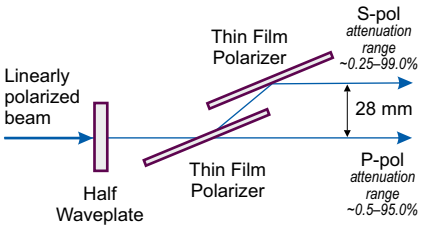
*990-0070-800HBBi70M*

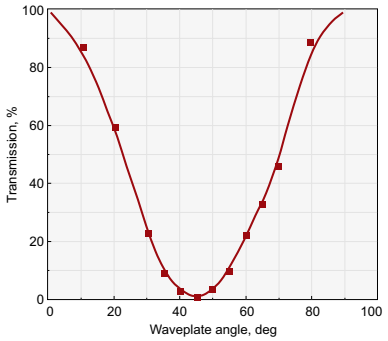
This variable attenuator/beamsplitter consists of a special design opto-mechanical adapter and a precision opto-mechanical holder 840-0197. Two thin film polarizers, operating at AOI=70° and reflecting s-polarized light while transmitting p-polarized light, are housed into the adapter. A quartz zero order air-spaced half waveplate is housed into the rotating holder 840-0197.

The intensity ratio of outgoing two parallel beams may be continuously varied without alteration of other beam parameters by rotating the waveplate. The intensity of the exit beam or outgoing beams intensity ratio can be controlled over a wide dynamic range.

P-polarized beam is transmitted straightly with a 2.6 mm shift and s-polarized beam (after 2 reflections) is parallel to the outgoing p-polarized beam, just separated by 28 mm.

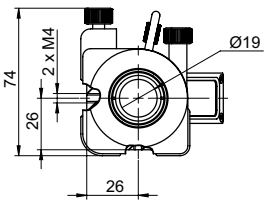
The 840-0197 holder allows to adjust angle of incidence of the thin film polarizers by ±2° and to achieve the maximum polarization contrast.

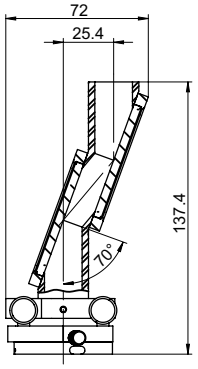



## Specifications

| | |
|---|---|
| Aperture diameter | 12 mm |
| Operating bandwidth | 100 nm |
| Damage treshold | 50 mJ/cm² pulsed at 800 nm, 50 fsec, 50 Hz |
| Polarization contrast (after 1st polarizer) | >1:200 |
| Polarization contrast (after 2nd polarizer) | >1:500 |



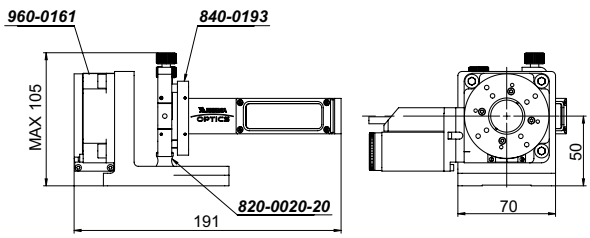

*990-0070-800HBBi70*

**Manual attenuators**

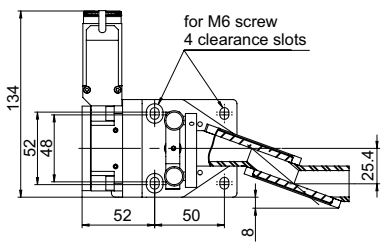
| Wavelength, nm | Catalogue number | Price, EUR |
|---|---|---|
| 750-850 | 990-0070-800HBBi70 | 1300 |
| 980-1080 | 990-0070-1030HBBi70 | 1300 |

**Motorized attenuators**

| Wavelength, nm | Catalogue number | Price, EUR |
|---|---|---|
| 750-850 | 990-0070-800HBBi70M | 2080 |
| 980-1080 | 990-0070-1030HBBi70M | 2080 |




*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: PS12-1.5-4), please ad CP to code and 695 EUR to price.

Example:

**990-0070-800HBBi70** – motorized attenuator without controller and power supply.

Price – 2080 EUR

**990-0070-800HBBi70+CP** – motorized attenuator with controller and power supply.

Price – 2775 EUR

# VARIABLE ATTENUATORS FOR LINEARLY POLARIZED LASER BEAM – 990-0071

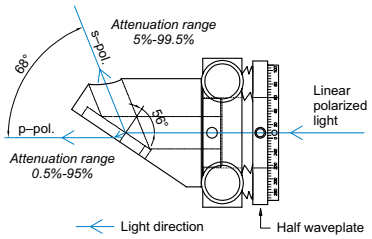
## Features

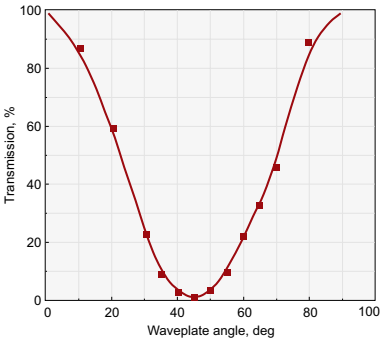
- Divides laser beam into separated by 68° angle two beams of manually adjustable intensity ratio
- Large dynamic range
- Transmitted beam shift ~0.5 mm
- High Optical damage threshold

Note: Solid Base Height Extender ***820-0210*** and Standard Rod ***820-0020-20*** should be ordered separately

This variable attenuator/beamsplitter consists of special design opto-mechanical adapter for polarizer at 56° 840-0117A or 840-0118A and precision opto-mechanical holder 840-0197. Thin Film Brewster type polarizer, which reflect s-polarized light at 56° while transmitting p-polarized light, is housed into adapter for polarizer at 56°. Quartz Half Waveplates are housed in rotating holder 840-0197.

The intensity ratio of those two beams may be continuously varied without alteration of other beam parameters by rotating the waveplate. The intensity of either exit beam, or their intensity ratio, can be controlled over a wide dynamic range. P-polarization could be selected for maximum transmission, or high-purity s-polarization could be reflected when maximum attenuation of the transmitted beam takes place. The holder 840-0197 allows to adjust Angle Of Incidence of the Thin Film Brewster type polarizer by ±2° and to get the maximum polarization contrast.




## For Nd:YAG Laser Applications

| | |
|---|---|
| Aperture diameter | 10 mm |
| Damage threshold | 5 J/cm² pulsed at 1064 nm, typical |
| Polarization Contrast | >1:200 |
| Weight | 0.25 kg |

### For Nd:YAG Laser Applications

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

Multi order half waveplate is housed in rotating holder 840-0197 for Nd:YAG laser pulses (laser damage threshold: 5 J/cm² pulsed at 1064 nm, typical).

* With Zero Order Air-Spaced half waveplate.

## For Femtosecond Applications

| | |
|---|---|
| Aperture diameter | 10 mm |
| Damage threshold | >10 mJ/cm², 50 fs pulse at 800 nm, typical |
| for high power laser applications | >100 mJ/cm², 50 fsec pulse, 800 nm typical |
| Time dispersion | t<4 fs for 100 fs Ti:Sapphire laser pulses |
| Polarization Contrast | >1:200 |
| Weight | 0.25 kg |

### For Femtosecond Applications

| Wavelength, nm | Catalogue number | Price, EUR |
|---|---|---|
| 257 | 990-0071-257 | 655 |
| 266 | 990-0071-266 | 655 |
| 343 | 990-0071-343 | 630 |
| 400 | 990-0071-400 | 580 |
| 390-410 | 990-0071-400B | 680 |
| 515 | 990-0071-515 | 580 |
| 505-525 | 990-0071-515B | 680 |
| 800 | 990-0071-800 | 580 |
| 780-820 | 990-0071-800B | 680 |
| 1030 | 990-0071-1030 | 580 |
| 1010-1050 | 990-0071-1030B | 680 |

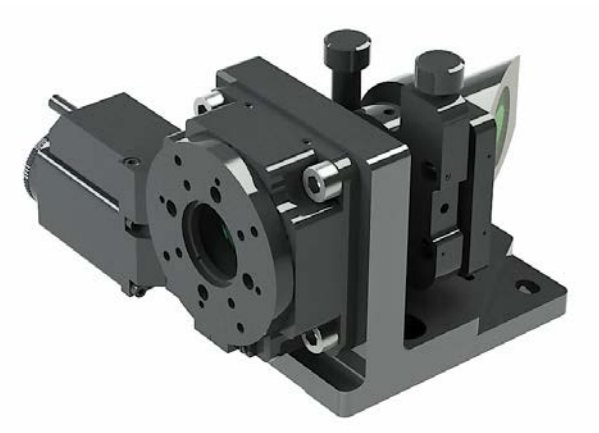
Zero order optically contacted half waveplate is housed in rotating holder 840-0197 for femtosecond laser pulses (laser damage threshold: >10 mJ/cm², 50 fs pulse at 800 nm, typical).

### For High Power Femtosecond Laser Applications

| Wavelength, nm | Catalogue number | Price, EUR |
|---|---|---|
| 257 | 990-0071-257H | 720 |
| 266 | 990-0071-266H | 720 |
| 343 | 990-0071-343H | 695 |
| 400 | 990-0071-400H | 645 |
| 390-410 | 990-0071-400HB | 745 |
| 515 | 990-0071-515H | 645 |
| 505-525 | 990-0071-515HB | 745 |
| 800 | 990-0071-800H | 645 |
| 780-820 | 990-0071-800HB | 745 |
| 1030 | 990-0071-1030H | 645 |
| 1010-1050 | 990-0071-1030HB | 745 |

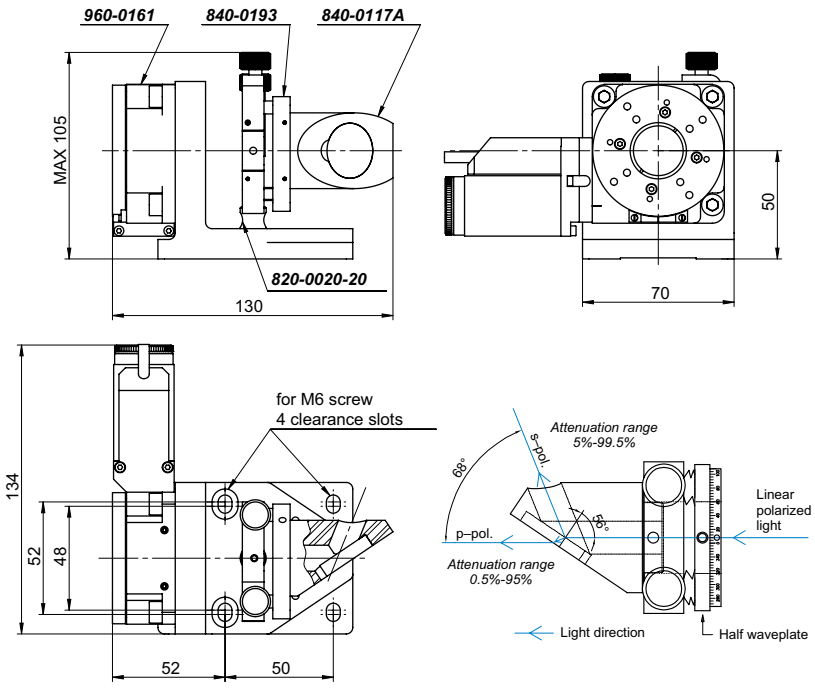
Zero Order Air-Spaced half waveplate is housed in rotating holder 840-0197 for high power femtosecond applications (laser damage threshold: >100 mJ/cm², 50 fsec pulse, 800 nm typical).

# MOTORIZED VARIABLE ATTENUATOR FOR LINEARLY POLARIZED LASER BEAM – 990-0071M



This motorized variable attenuator/beamsplitter consists of special design opto-mechanical adapter for polarizer at 56° 840-0117A or 840-0118A and precision opto-mechanical holder 840-0193. Thin Film Brewster type polarizer, which reflect s-polarized light at 56° while transmitting p-polarized light, is housed into adapter for polarizer at 56°. Quartz Half Waveplates are housed in motorized rotation stage 960-0161.

The intensity ratio of those two beams may be continuously varied without alteration of other beam parameters by rotating the waveplate. The intensity of either exit beam, or their intensity ratio, can be controlled over a wide dynamic range. P-polarization could be selected for maximum transmission, or high-purity s-polarization could be reflected when maximum attenuation of the transmitted beam takes place. The holder 840-0193 allows to adjust Angle of Incidence of the Thin Film Brewster type polarizer by ±2° and to get the maximum polarization contrast.




## Ordering information

**Please note:** these motorized variable attenuators for linearly polarized laser beam are provided without controller and power supply. If you would like to order the complete solution (controller 980-1045 and power supply: PS12-1.5-4), please ad CP to code and 695 EUR to price.

Example:

**990-0071-266M** – motorized attenuator without controller and power supply.

Price – 1435 EUR

**990-0071-266M+CP** – motorized attenuator with controller and power supply.

Price – 2130 EUR

### For Nd:YAG Laser Applications

| Wavelength, nm | Catalogue number | Price, EUR |
|---|---|---|
| 266 | 990-0071-266HM * | 1500 |
| 355 | 990-0071-355M | 1290 |
| 532 | 990-0071-532M | 1260 |
| 1064 | 990-0071-1064M | 1260 |

Multi order half waveplate is housed in Motorized Rotation Stage 960-0161 and Polarizer with adapter in Kinematic Optical Mount 840-0193 for Nd:YAG laser application (laser damage threshold: 5 J/cm$^2$, 10 ns pulses, 10 Hz at 1064 nm, typical).

* With Zero Order Air-Spaced half waveplate.

### For Femtosecond Applications

| Wavelength, nm | Catalogue number | Price, EUR |
|---|---|---|
| 266 | 990-0071-266M | 1435 |
| 343 | 990-0071-343M | 1410 |
| 400 | 990-0071-400M | 1360 |
| 390 – 410 | 990-0071-400BM | 1460 |
| 515 | 990-0071-515M | 1360 |
| 505 – 525 | 990-0071-515BM | 1460 |
| 800 | 990-0071-800M | 1360 |
| 780 – 820 | 990-0071-800BM | 1460 |
| 1030 | 990-0071-1030M | 1360 |
| 1010 – 1050 | 990-0071-1030BM | 1460 |

Zero order optically contacted half waveplate is housed in Motorized Rotation Stage 960-0161 and Polarizer with adapter in Kinematic Optical Mount 840-0193 for femtosecond laser application (laser damage threshold: >10 mJ/cm$^2$, 50 fsec pulse, 800 nm typical).

### For High Power Femtosecond Laser Applications

| Wavelength, nm | Catalogue number | Price, EUR |
|---|---|---|
| 266 | 990-0071-266HM | 1500 |
| 343 | 990-0071-343HM | 1475 |
| 400 | 990-0071-400HM | 1425 |
| 390 – 410 | 990-0071-400HBM | 1525 |
| 515 | 990-0071-515HM | 1425 |
| 505 – 525 | 990-0071-515HBM | 1525 |
| 800 | 990-0071-800HM | 1425 |
| 780 – 820 | 990-0071-800HBM | 1525 |
| 1030 | 990-0071-1030HM | 1425 |
| 1010 – 1050 | 990-0071-1030HBM | 1525 |

Zero Order Air-Spaced half waveplate is housed in Motorized Rotation Stage 960-0161 and Polarizer with adapter in Kinematic Optical Mount 840-0193 for high power femtosecond laser application (laser damage threshold: >100 mJ/cm$^2$, 50 fsec pulse, 800 nm typical).

# VARIABLE ATTENUATOR FOR FEMTOSECOND LASER PULSES – 990-0072

## Features

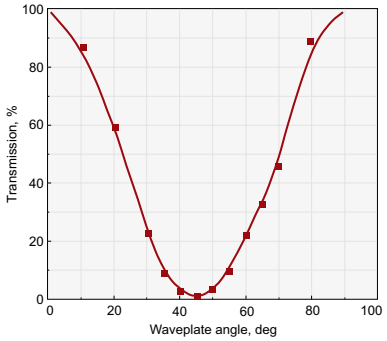
- Divides laser beam into two beams of manually adjustable intensity ratio separated by 68° angle
- Large dynamic range
- Trasmitted beam shift ~1 mm
- High optical damage threshold

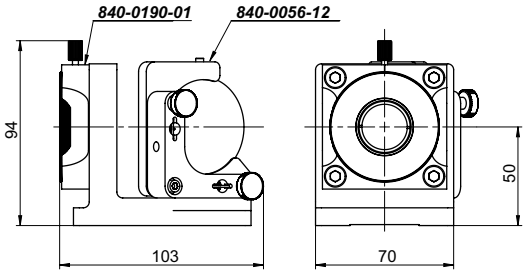
Check ***www.eksmaoptics.com*** for motorized version ***990-0072M***

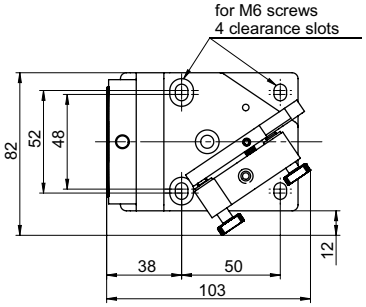
This variable attenuator/beamsplitter consists of Polarizer Holder 840-0190-01 and Kinematic Mirror/Beamsplitter Mount 840-0056-12. UVFS Thin Film Brewster type polarizer diameter 50.8 mm, which reflect s-polarized light while transmitting p-polarized light, is housed into Beamsplitter Mount 840-0056-12. A quartz Zero Order (optically contacted) Half Waveplate Ø25.4 mm (for femtosecond applications), quartz Zero Order Air-Spaced Half Waveplate (for high power femtosecond applications) or quartz Multi Order Half Waveplate Ø25.4 mm (for Nd:YAG laser applications) is housed in rotating polarizer holder 840-0180-A1 and placed in the incident linearly polarized laser beam.

The intensity ratio of those two separated and different polarized beams may be continuously varied without alteration of other beam parameters by rotating the waveplate. The intensity of either exit beam, or their intensity ratio, can be controlled over a wide dynamic range. P-polarization could be selected for maximum transmission, or high-purity s-polarization could be reflected when maximum attenuation of the transmitted beam takes place.

The holder 840-0056-12 allows to adjust Angle Of Incidence of the Thin Film Brewster type polarizers by ±4.5° and to get the maximum extinction contrast. The mounts are on rods, rod holders and Movable Base 820-0090. The optical axis height from the table top can be adjusted in the range 78-88 mm. Other height can be offered as custom changing the standard rods and rod holders into higher.




## For Nd:YAG Laser Applications

| | |
|---|---|
| Clear Aperture diameter | 22 mm |
| Damage threshold | >5 J/cm², 10 ns pulse, 10 Hz at 1064 nm, typical |
| Polarization Contrast | >1:200 |
| Transmitted beam shift | ~ 1 mm |
| Weight | 0.45 kg |

A quartz Multi Order Half Waveplate Ø25.4 mm is housed in rotating holder 840-0180-A1.

### For Nd:YAG Laser Applications

| Wavelength, nm | Catalogue number | Price, EUR |
|---|---|---|
| 266 | 990-0072-266H * | 1115 |
| 355 | 990-0072-355 | 795 |
| 532 | 990-0072-532 | 765 |
| 1064 | 990-0072-1064 | 785 |

* A quartz Zero Order Air-Spaced Half Waveplate clear aperture Ø22 mm is housed in rotating holder 840-0190-01.

## For Femtosecond Applications

| | |
|---|---|
| Clear Aperture diameter | 22 mm |
| Damage threshold | >10 mJ/cm², 50 fs pulse at 800 nm, typical |
| for high power applications | >100 mJ/cm², 50 fs pulse at 800 nm, typical |
| Polarization Contrast | >1:200 |
| Transmitted beam shift | ~ 1 mm |
| Weight | 0.45 kg |

A quartz Zero Order (optically contacted) Half Waveplate (for femtosecond applications) or Zero Order Air-Spaced Half Waveplate (for high power applications) Ø25.4 mm are housed in rotating holder 840-0190-01.

### For Femtosecond Applications

| Wavelength, nm | Catalogue number | Price, EUR |
|---|---|---|
| 266 | 990-0072-266 | 980 |
| 343 | 990-0072-343 | 925 |
| 400 | 990-0072-400 | 895 |
| 515 | 990-0072-515 | 895 |
| 800 | 990-0072-800 | 910 |
| 780 – 820 | 990-0072-800B | 1010 |
| 1030 | 990-0072-1030 | 920 |
| 1010 – 1050 | 990-0072-1030B | 1010 |

### For High Power Femtosecond Laser Applications

| Wavelength, nm | Catalogue number | Price, EUR |
|---|---|---|
| 266 | 990-0072-266H | 1115 |
| 343 | 990-0072-343H | 1060 |
| 400 | 990-0072-400H | 1030 |
| 515 | 990-0072-515H | 1030 |
| 800 | 990-0072-800H | 1045 |
| 780 – 820 | 990-0072-800HB | 1145 |
| 1030 | 990-0072-1030H | 1055 |
| 1010 – 1050 | 990-0072-1030HB | 1145 |

# VARIABLE ATTENUATOR FOR FEMTOSECOND AND Nd:YAG LASER PULSES – 990-0073

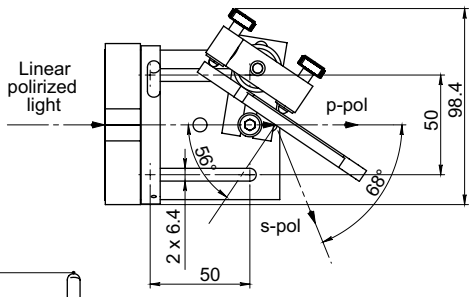
## Features

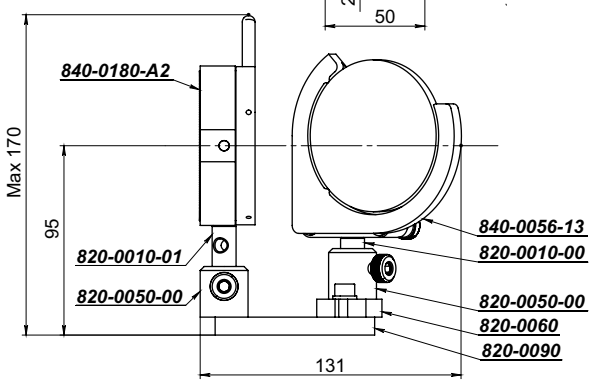
- Divides laser beam into two beams of manually adjustable intensity ratio separated by 68° angle
- Large dynamic range
- Trasmitted beam shift ~1.4 mm
- High optical damage threshold
- Motorized version available on request

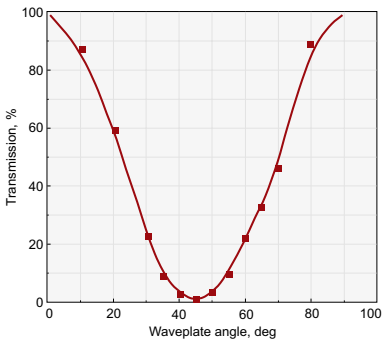
This variable attenuator/beamsplitter consists of Polarizer Holder 840-0180-A2 and Kinematic Mirror/Beamsplitter Mount 840-0056-13. UVFS Thin Film Brewster type polarizer Ø76.2 mm, which reflect s-polarized light while transmitting p-polarized light, is housed into Beamsplitter Mount 840-0056-13. A quartz Zero Order (optically contacted) Half Waveplate Ø40 mm (for femtosecond applications), Zero Order Air-Spaced Half Waveplate (for high power femtosecond applications) or quartz Multi Order Half Waveplate Ø40 mm (for Nd:YAG laser applications) is housed in rotating polarizer holder 840-0180-A2 and placed in the incident linearly polarized laser beam.

The intensity ratio of those two separated and different polarized beams may be continuously varied without alteration of other beam parameters by rotating the waveplate. The intensity of either exit beam, or their intensity ratio, can be controlled over a wide dynamic range. P-polarization could be selected for maximum transmission, or high-purity s-polarization could be reflected when maximum attenuation of the transmitted beam takes place.

The holder 840-0056-13 allows to adjust Angle Of Incidence of the Thin Film Brewster type polarizers by ±4.5° and to get the maximum extinction contrast. The mounts are on rods, rod holders and Movable Base 820-0090. The optical axis height from the table top can be adjusted in the range 92-98 mm. Other height can be offered as custom changing the standard rods and rod holders into higher.




## For Nd:YAG Laser Applications

| | |
|---|---|
| Clear Aperture diameter | 36 mm |
| Damage threshold | >5 J/cm², 10 ns pulse, 10 Hz at 1064 nm, typical |
| Polarization Contrast | >1:200 |
| Transmitted beam shift | ~ 1.4 mm |
| Weight | 0.6 kg |

Quartz Multi Order Half Waveplate Ø40 mm is housed in rotating polarizer holder 840-0180-A2.

### For Nd:YAG Laser Applications

| Wavelength, nm | Catalogue number | Price, EUR |
|---|---|---|
| 266 | 990-0073-266H * | 1820 |
| 355 | 990-0073-355 | 1490 |
| 532 | 990-0073-532 | 1470 |
| 1064 | 990-0073-1064 | 1545 |

* Zero Order Air-Spaced half waveplate is housed in rotating holder.

## For Femtosecond Applications

| | |
|---|---|
| Clear Aperture diameter | 36 mm |
| Damage threshold | >10 mJ/cm², 50 fs pulse at 800 nm, typical |
| for high power applications | >100 mJ/cm², 50 fs pulse at 800 nm, typical |
| Polarization Contrast | >1:200 |
| Transmitted beam shift | ~ 1.4 mm |
| Weight | 0.6 kg |

A quartz Zero Order (optically contacted) Half Waveplate Ø40 mm (for femtosecond applications) or Zero Order Air-Spaced Half Waveplate (for high power applications) is housed in rotating polarizer holder 840-0180-A2.

### For Femtosecond Applications

| Wavelength, nm | Catalogue number | Price, EUR |
|---|---|---|
| 266 | 990-0073-266 | 1720 |
| 343 | 990-0073-343 | 1590 |
| 400 | 990-0073-400 | 1570 |
| 515 | 990-0073-515 | 1570 |
| 800 | 990-0073-800 | 1590 |
| 780 – 820 | 990-0073-800B | 1820 |
| 1030 | 990-0073-1030 | 1645 |
| 1010 – 1050 | 990-0073-1030B | 1880 |

### For High Power Femtosecond Laser Applications

| Wavelength, nm | Catalogue number | Price, EUR |
|---|---|---|
| 266 | 990-0073-266H | 1820 |
| 343 | 990-0073-343H | 1690 |
| 400 | 990-0073-400H | 1670 |
| 515 | 990-0073-515H | 1670 |
| 800 | 990-0073-800H | 1690 |
| 780 – 820 | 990-0073-800HB | 1920 |
| 1030 | 990-0073-1030H | 1745 |
| 1010 – 1050 | 990-0073-1030HB | 1980 |

# COMPACT MOTORIZED LASER POWER ATTENUATOR – 990-0075

## Features

- Compact design
- High optical damage threshold
- Full solution - includes controller, software, power supply and USB cable
- Standard models for the most popular laser wavelengths are offered ex-stock

990-0075 series laser power attenuator is a compact motorized device for laser power control of linearly polarized beam. Its operation principle consists of changing laser beam polarization by rotation of zero-order half-waveplate and then passing the beam through a fixed Brewster type thin film polarizer which transmits p-polarized and reflects s-polarized laser beam. The intensity ratio of s- and p- polarized beams can be continuously varied without alteration of other beam parameters by motorized rotation of the waveplate. The attenuation level is controlled by the software in 0.1 – 97% range.

The device combines unique mechanical design which ensures repeatability and high stability of performance. All optical components of the attenuator have high LIDT coatings and provide stable and reliable performance even using device with high power lasers in industrial applications.

A secondary laser beam with s-polarization can be rejected from the laser power attenuator unit to an external beam dump or utilized for the particular application. A standard compact external beam dump is optionally offered with this attenuator and is suitable for lasers with average power up to 6 W. This beam dump stops secondary s-polarized beam in the attenuator and allows to avoid any thermal effects or stress in the housing of the device.

### Standard Kit includes:

- Motorized laser power attenuator
- Controller
- Software
- Power suppy (DC 12 V)
- USB cable (1.5 m)

## Optical Specifications

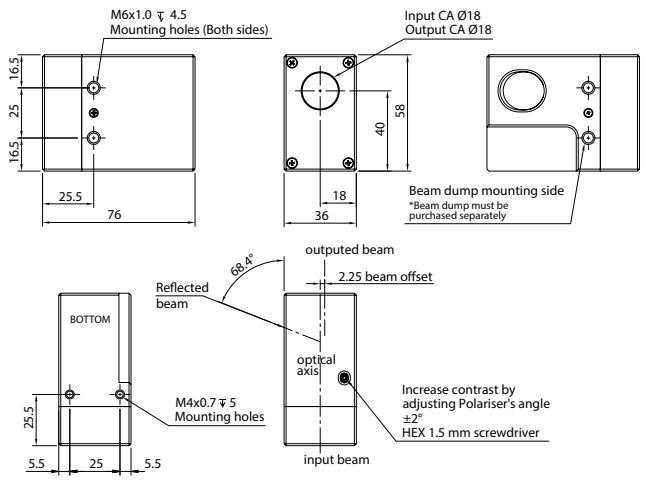
| | |
|---|---|
| Clear input aperture | Ø18 mm |
| Clear output aperture | Ø18 mm |
| Power attenuation range | <0.1 % to >98 % |
| LIDT coating | >10 J/cm², 10 ns @ 1064 nm |
| Close to open time | < 0.2 sec |
| Resolution | 175,542 µsteps in full rotation (0.002 deg, 7.2 arcsec, 0.035 mrad) |
| Accuracy (repeatability after 10,000 positions without homing) | ±10 µsteps (±0.02 deg, less than ±0.035 %) |
| Motor | 2 phase stepper motor, 200 steps with 256 µstepping |

## Mechanical Specifications

| | Length | Width | Height |
|---|---|---|---|
| Attenuator | 76 mm | 36 mm | 58 mm |
| Attenuator with beam dump | 76 mm | 52 mm | 58 mm |
| Controller | 125 mm | 53 mm | 31 mm |

## Operating Conditions

| | |
|---|---|
| Operating temperature | 10 to 40 °C |
| Storage temperature | -15 to 50 °C |




### Laser Power Attenuators

| Wavelength, nm | LIDT | Catalogue number | Price, EUR |
|---|---|---|---|
| 343 | 3 J/cm², 10 ns, 50 Hz @ 343 nm | 990-0075-343M | 1420 |
| 355 | 3 J/cm², 10 ns, 50 Hz @ 355 nm | 990-0075-355M | 1420 |
| 390 – 410 | 3 J/cm², 10 ns, 50 Hz @ 400 nm | 990-0075-400M | 1420 |
| 510 – 520 | 5 J/cm², 10 ns, 50 Hz @ 515 nm | 990-0075-515M | 1310 |
| 532 | 5 J/cm², 10 ns, 50 Hz @ 532 nm | 990-0075-532M | 1310 |
| 780 – 820 | 8 J/cm², 10 ns, 50 Hz @ 800 nm | 990-0075-800M | 1310 |
| 1020 – 1040 | 10 J/cm², 10 ns, 50 Hz @ 1030 nm | 990-0075-1030M | 1310 |
| 1064 | 10 J/cm², 10 ns, 50 Hz @ 1064 nm | 990-0075-1064M | 1310 |

### Additional Accessories

| Catalogue number | Description | Price, EUR |
|---|---|---|
| 990-0075ABD | Attachable Beam Dump <6W with coated protective window | 165 |
| 990-0075SBD | Separated Beam Dump < 30 W | 175 |
| 990-0075C1 | RS232 Cable, 1.8 m | 15 |
| 990-0075C5 | RS232 Cable, 5 m | 20 |
| 990-0075C10 | RS232 Cable, 10 m | 30 |
| 990-0075C15 | RS232 Cable, 15 m | 35 |
| 990-0075RA | DIN35 Rail Adapter | 15 |

# COMPACT VARIABLE LASER POWER ATTENUATOR – 990-0076

## Features

- Attenuation range for reflected beam: 2% – 99.9%
- Attenuation range for transmitted beam: 0.1% – 98%
- Convenient 90° angle between reflected and transmitted beams
- No beam shift at exit

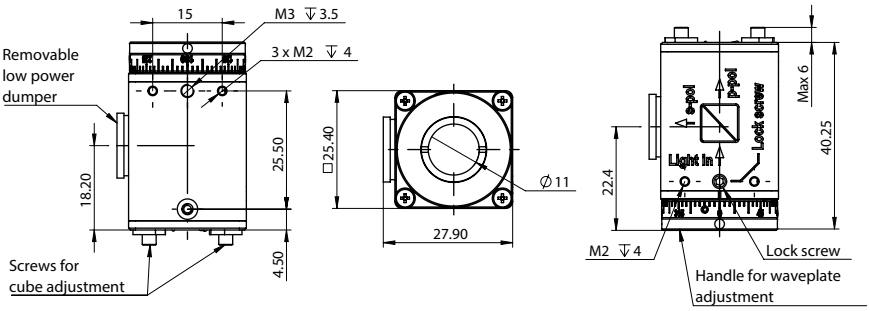

990-0076 Variable Attenuator incorporates a high-performance polarizing cube beamsplitter which reflects s-polarized light at 90° while transmitting p-polarized light. A rotatable λ/2 waveplate is placed in the incident polarized laser beam.

The intensity ratio of the two outgoing beams may be continuously varied without alteration of other beam parameters by rotating the half waveplate. The intensity of either exit beam, or their intensity ratio, can be controlled over a wide dynamic range. Pure p-polarization could be selected for maximum transmission, or pure s-polarization for maximum reflection.

## Specifications

| | |
|---|---|
| Clear aperture diameter | 10 mm |
| Polarization contrast | >1:1000 |
| Weight | 0.1 kg |

| Wavelength, nm | LIDT | Catalogue number | Price, EUR |
|---|---|---|---|
| 343 | 3 J/cm² @ 355 nm, 10 Hz, 10 ns | 990-0076-343 | 825 |
| 355 | 3 J/cm² @ 355 nm, 10 Hz, 10 ns | 990-0076-355 | 825 |
| 515 | 6 J/cm² @ 532 nm, 10 Hz, 10 ns | 990-0076-515 | 800 |
| 532 | 6 J/cm² @ 532 nm, 10 Hz, 10 ns | 990-0076-532 | 800 |
| 1030 | 15 J/cm² @ 1030 nm, 10 Hz, 10 ns | 990-0076-1030 | 800 |
| 1064 | 15 J/cm² @ 1064 nm, 10 Hz, 10 ns | 990-0076-1064 | 800 |



# FILTERS HOLDER WITH 90° FLIP – 990-0400

## Features

- Allows stacking of 5 filters of Ø25.4 mm (1"), or 3 filters of Ø50.8 (2")
- Fast flipping in and out of beam path
- Available to be used in 90° position
- Has one M4, two M6 and two holes Ø6.4mm for mounting on posts or table bases
- Large aperture allows to attenuate large diameter laser beam
- Black Anodized Aluminium and Brass screws

The holder of 1 inch filters 990-0415 allows the fixation of up to 5 filters into 1 inch optics ring holders. The thickness of optical filters (or any other optical elements) to be held is from 0.5 mm to 8.0 mm. Filters can be easily replaced in ring holders. This filter holder allows fast filter removal from beam path flipping it at 90° position. Any position of filters can be fixed with fixing screw. The firm 0° position can be fixed with the second brass screw (included).

The holder of 2 inch filters 990-0423 allows the fixation of up to 3 filters into 2 inch optics ring holders. The thickness of optical filters (or any other optical elements) to be held is from 0.5 mm to 14.0 mm.

The holder 990-0415ND is the same holder 990-0415 but with Neutral Density filters that operates as step energy attenuator and allows adjusting transmission from 100% (all 5 filters are at 90° position) till 0.015% (all 5 filters are at 0° position) at visible region. If you need other adjustment you can choose any other Neutral Density filter Ø25.4 mm.

Using the holder 990-0415 with various color glass or dielectric filters various transmitted band pass regions can be achieved. The Filters Holder with 90° Flip is made of black anodized aluminium and brass screws.

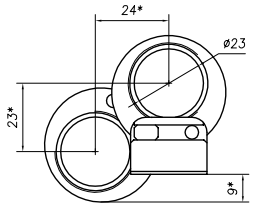
| Acceptable filters number | Suitable filters diameter, mm | Clear aperture diameter, mm | Weight, kg | Catalogue number | Price, EUR |
|---|---|---|---|---|---|
| 5 | 25.4 | 23 | 0.16 | **990-0415** | 170 |
| 5 | 25.4 | 23 | 0.19 | **990-0415ND** | 265 |
| 3 | 50.8 | 48 | 0.22 | **990-0423** | 160 |

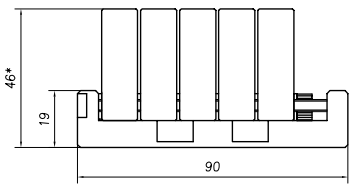
***990-0415***

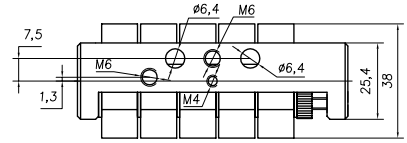
***990-0423***

***990-0415*** at 0° position
(Note: Solid base height extender 820-0210 should be ordered seperately)

***990-0423*** at 0° position
(Note: Solid base height extender should be ordered seperately)





***990-0415*** at 0° or 90° position
(Note: Solid base height extender 820-0210 should be ordered seperately)

## Related Products

Neutral Density Filters Ø25.4 mm

See page 1.14

## AIR-COOLED BEAM DUMP – 990-0800

*990-0800*

Beam Dump 990-0800 is designed to block CW or pulsed laser beams. It can be used on beams of up to 50 W in the wavelength range from 0.1 to 30 µm.

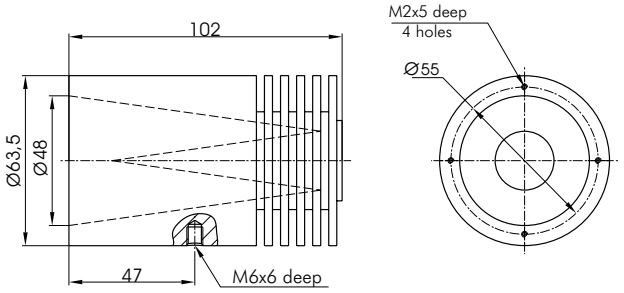
Due to the design of the beam dump, even if the non-reflective coating is damaged by high intensity pulses, there is no backward reflection.

990-0801 is a smaller beam dump designed to block a CW or a pulsed laser beam. It can be used on beams of up to 5 Watts in the wavelength range from 0.1 to 30 µm.

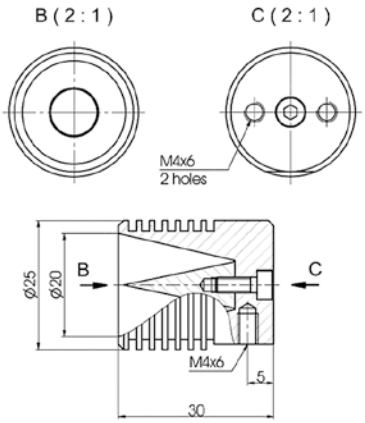
### Specifications

| | |
|---|---|
| Wavelength range | 0.1 – 30 µm |
| Laser type | pulsed, CW |

| Aperture | Description | Catalogue number | Price, EUR |
|---|---|---|---|
| 48 mm | for beams up to 50 W | 990-0800 | 169 |
| 20 mm | for beams up to 5 W | 990-0801 | 119 |




Drawing of ***990-0800***




Drawing of ***990-0801***

## WATER-COOLED BEAM DUMP – 990-0820

*990-0820*

Beam Dump 990-0820 is designed to block CW or pulsed laser beams. It is mainly intended for beams 2 inch wide.

The dump is best suited for beams of up to 1 kW from 0.1 – 30 µm wavelength range.

Even if the non-reflective coating is damaged by high intensity pulses, the beam is not reflected back into your optical scheme.

The dump mounts on M6 hole on its back.

### Specifications

| | |
|---|---|
| Wavelength range | 0.1 – 30 µm |
| Max. handling power | 1 kW |
| Max. energy | 50 J (20 Hz) |
| Acceptance aperture | 48 mm (1.89") |
| Laser type | pulsed, CW |
| Weight | 1.2 kg |

| Catalogue number | Price, EUR |
|---|---|
| 990-0820 | 289 |