

Precision Spatial Filter

10SF130



10SF130

with Precision Pinholes 10PP and
with Microscope Objectives 10MO

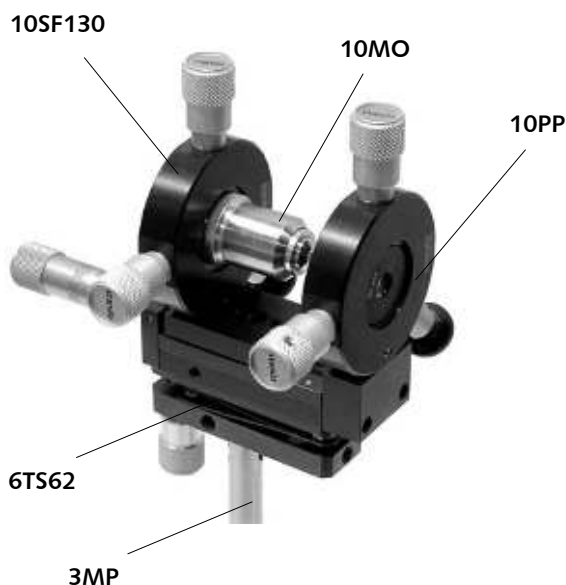
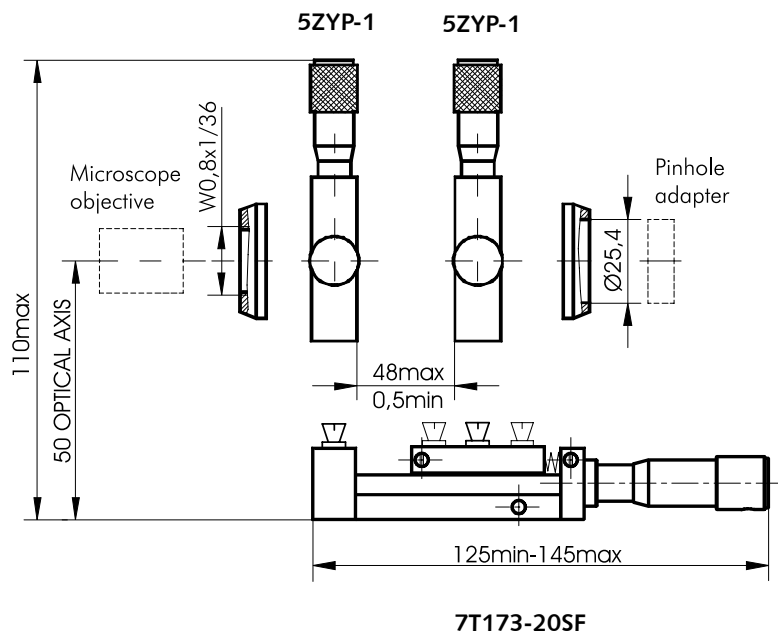
Precision Spatial Filter 10SF130 filters the beam from any low power, visible to near infrared laser. The result – the output beam is delivered with a smooth, near ideal intensity profile. The Spatial Filter consists of two YZ Positioners 5ZYP and Translation Stage 7T173-20SF (modification of 7T173-20). YZ Positioners for Lens, Pinholes and Objectives 5ZYP provides adjustments of the pinhole and objective in two axis. The precision X axis motion is provided by Translation Stage 7T173-20SF.

The pinhole and the objective should be selected and ordered separately. STANDA offers a selection of interchangeable microscope objective lenses and precision pinholes, allowing you to build the best spatial filter for your laser.

Weight **0.87 kg**

- 3-axis adjustment with micrometers
- Accommodates virtually any microscope objective
- Unobscured view of a pinhole facilitates alignment
- Easy pinhole removal and replacement

Microscope objective and Precision Pinholes can be supplied as option.



Single-Axis Tilt Stage 6TS62 greatly facilitates pitch adjustment relative to the optical axis.



See articles:
"Precision Pinholes 10PP" and
"Microscope Objectives 10MO"

e-mail: sales@standa.it

www.standa.it

Phone: +370-5-2651474

Fax: +370-5-2651483

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Precision Pinholes

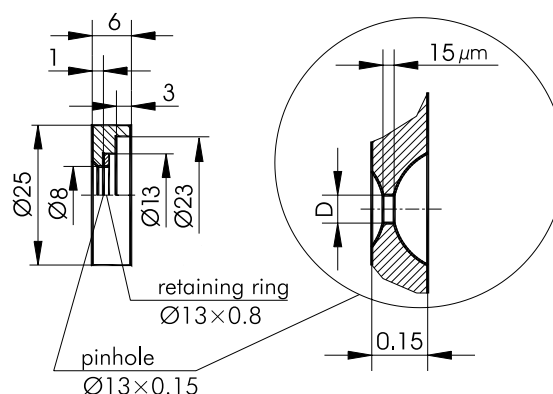
10PP



- For diffraction experiments, alignment purposes, projection applications
- Chemically etched apertures
- Apertures formed in vacuum
- 4 μm thick pinhole in a kovar foil
- Ultra-thin substrate minimizes laser power loss
- Chemically inert

Precision Pinhole 10PP is a round aperture precisely formed and controlled in a kovar foil. To facilitate handling, a pinhole foil is mounted in a $\varnothing 25$ mm black metal donut.

The Precision Pinholes 10PP can be used in our Precision Spatial Filters **10SF130** and YZ Positioner for Lens, Pinholes and Objectives **5ZYP-1**.



Model	D, μm	Model	D, μm
10PP-10	10 $\pm$ 0.5	10PP-50	50 $\pm$ 0.5
10PP-20	20 $\pm$ 0.5	10PP-75	75 $\pm$ 0.5
10PP-30	30 $\pm$ 0.5	10PP-100	100 $\pm$ 0.5
10PP-40	40 $\pm$ 0.5		

We also offer pinholes with diameter D in the range of 45-100 μm every 5 μm .

Pinholes of custom diameters up-to 200 μm are available on request.

Microscope Objectives

10MO



Objective Mount 5OBM119 has W0.8-36 aperture and is used for precise adjustments of standard microscope objective lenses and allows low-cost positioning of a focus point.

Model	10MO-4	10MO-10	10MO-20	10MO-40	10MO-100
Magnification	4x	10x	20x	40x	100x
Numerical Aperture	0.10	0.25	0.40	0.65	1.25
Focal length, mm	40	16	8	4	1,6
Working distance, mm	23.40	13.13	1.70	0.41	0.10
Design type	Air immersion				Oil immersion
Mechanical Tube length, mm			160		
Optical Scheme	Plan Achromat		Achromat		
Mounting Thread	0.8"-36 RMS				
Wavelength Range	Visible Spectrum				

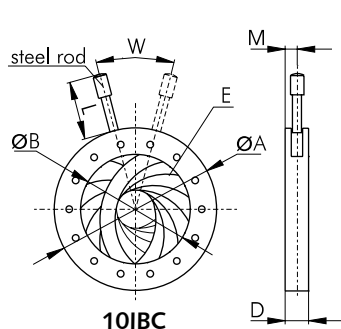
Unmounted Iris Diaphragms

10IBS

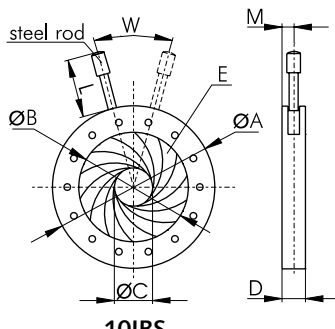
10IBC

10IBV

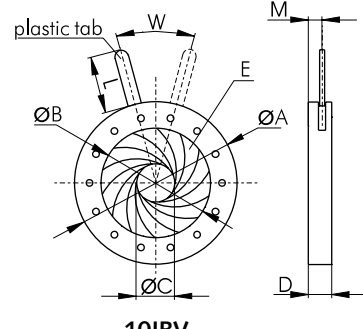
- IBV - Iris diaphragm screwed
- IBS - Iris diaphragm with retainer
- IBC - Zero aperture iris diaphragm



10IBC



10IBS



10IBV

Zero Aperture Iris Diaphragms 10IBC contain two layers of leaves with a gap between them.

Model	A	B	C	D	E	F/R	L	M	W	AR/N/H
10IBS10-5-0.5-AR/N	10	5	0.5	4	8	-	4	2.4	78	AR/N
10IBS12-7-0.5-AR/N	12	7	0.5	4	8	-	6	2.4	88	AR/N
10IBS14-8.2-0.8-N	14	8.2	0.8	4	8	-	6	2.4	80	N
10IBS14.8-8-1-N	14.8	8	1	4.5	9	-	6	2.5	77	N
10IBS19.8-12-1-AR/N/H	19.8	12	1	5	11	-	10	2.7	89	AR/N/H
10IBS22-14-1-AR/N	22	14	1	5	10	-	10	2.7	94	AR/N
10IBS24-15-1-N/H	24	15	1	5	12	-	13	2.7	89	N/H
10IBS28-18-1-AR	28	18	1	5	12	-	13	2.7	90	AR
10IBS30-20-1.2-AR/N/H	30	20	1.2	5.5	12	-	13	2.9	90	AR/N/H
10IBS33-22-1.5-N	33	22	1.5	5.5	14	-	13	2.9	94	N
10IBS37-25-1.5-N	37	25	1.5	5.5	15	-	13	3	94	N
10IBS40-27-1.5-AR/N/H	40	27	1.5	5.5	12	-	13	3	91	AR/N/H
10IBS43-30-1.5-N/H	43	30	1.5	5.5	14	-	13	3	93	N/H
10IBS49-34-2-AR/H	49	34	2	6.5	14	-	13	3.4	93	AR/H
10IBS50-36-2.5-N	50	36	2.5	6	16	-	13	3.2	93	N
10IBS53-37-2.5-N	53	37	2.5	6	16	-	13	3.2	90	N
10IBS58-42-2.5-N	58	42	2.5	6.5	18	-	13	3.3	94	N
10IBS60-40-2.5-N	60	40	2.5	6.5	12	-	13	3.3	88	N
10IBS64-45-2.5-N/H	64	45	2.5	7	14	-	13	3.9	93	N/H
10IBS70-50-2.5-N	70	50	2.5	7	18	-	15	3.8	93	N
10IBS82-60-4-N/H	82	60	4	8	17	-	13	4.5	92	N/H
10IBS100-75-4-N/H	100	75	4	9	20	-	15	4.5	94	N/H
10IBS110-81-3-AR	110	81	3	10	16	-	15	5	95	AR
10IBS120-90-3.5-AR	120	90	3.5	12	20	-	15	6.5	97	AR
10IBS130-98-4-N/H	130	98	4	12	20	-	20	6.5	97	N/H
10IBS150-113-6-N/H	150	113	6	13	20	-	20	7.3	95	N/H
10IBS165-120-6-N/H	165	120	6	15	18	-	20	7.9	95	N/H
10IBV15-8-1-N	15	8	1	5.3	9	-	5	2.3	75	N
10IBV15-8-1-N-1	15	8	1	5.3	9	1.5	5	2.3	76	N
10IBV15.5-8.5-1-N	15.5	8.5	1	5.3	9	-	8	2.3	85	N
10IBV22-14-1-N	22	14	1	6	10	-	12	2.8	91	N
10IBV22-14-1-N-1	22	14	1	6	10	3	15	2.8	91	N
10IBV31-18-1.5-N	31	18	1.5	6.5	11	-	10	3.4	85	N
10IBV31-18-1.5-N-1	31	18	1.5	6.5	11	3	14	3.4	85	N
10IBV40-27-1.5-N	40	27	1.5	6.2	12	-	11	3.4	89	N
10IBV40-27-1.5-N-1	40	27	1.5	6.2	12	3	14	3.4	89	N
10IBV48.5-30-1.2-N	48.5	30	1.2	7	10	-	10	3.7	87	N
10IBV48.5-30-1.2-N-1	48.5	30	1.2	7	10	3	12	3.7	87	N
10IBV60-40-2.5-N	60	40	2.5	7.8	12	-	13	4.5	88	N
10IBV60-40-2.5-N-1	60	40	2.5	7.8	12	3	14	4.5	88	N
10IBV70-50-2.5-N	70	50	2.5	7	18	-	13	3.9	93	N
10IBV82-60-4-N	82	60	4	10	17	-	11	5.4	92	N
10IBV82-60-4-N-1	82	60	4	10	17	3	14	5.4	92	N

e-mail: sales@standa.it

www.standa.it

Phone: +370-5-2651474

Fax: +370-5-2651483

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10IBS



10IBC



10IBV

Model	A	B	C	D	E	F/R	L	M	W	AR/N/H
10IBC25-12-N	25	12	-	5	12	R	12	2.5	96	N
10IBC25-12-H	25	12	-	5	12	R	12	2.5	96	H
10IBC29-15-N	29	15	-	5	12	R	12	2.5	97	N
10IBC29-15-H	29	15	-	5	12	R	12	2.5	97	H
10IBC39-22-N	39	22	-	5	14	R	11	2.5	99	N
10IBC39-22-H	39	22	-	5	14	R	11	2.5	99	H
10IBC48-30-N	48	30	-	5	14	F	11	2.5	100	N
10IBC48-30-H	48	30	-	5	14	F	11	2.5	100	H
10IBC48-30-HT	48	30	-	5	14	F	11	2.5	100	HT
10IBC69-40-N	69	40	-	6.5	14	F	16	3.3	96	N
10IBC69-40-H	69	40	-	6.5	14	F	16	3.3	96	H
10IBC69-40-HT	69	40	-	6.5	14	F	16	3.3	96	HT
10IBC94-60-N	94	60	-	9	16	F	25	4.5	98	N
10IBC94-60-H	94	60	-	9	16	F	25	4.5	98	H
10IBC94-60-HT	94	60	-	9	16	F	25	4.5	98	HT
10IBC117-75-N	117	75	-	9.5	18	F	53	4.8	97	N
10IBC117-75-H	117	75	-	9.5	18	F	53	4.8	97	H
10IBC117-75-HT	117	75	-	9.5	18	F	53	4.8	97	HT
10IBC125-85-N	125	85	-	9.5	18	F	50	4.8	98	N
10IBC125-85-H	125	85	-	9.5	18	F	50	4.8	98	H
10IBC125-85-HT	125	85	-	9.5	18	F	50	4.8	98	HT
10IBC135-98-N	135	98	-	8.5	20	F	50	4.3	102	N
10IBC135-98-H	135	98	-	8.5	20	F	50	4.3	102	H
10IBC135-98-HT	135	98	-	8.5	20	F	50	4.3	102	HT
10IBC160-113-N	160	113	-	13	20	R	18	6.5	101	N
10IBC160-113-H	160	113	-	13	20	R	18	6.5	101	H
10IBC160-113-HT	160	113	-	13	20	R	18	6.5	101	HT

All dimensions in mm

Iris diaphragm provides a continuously variable field stop for controlling the focal length of an optical system or for adjusting the diameter of a beam. All **iris diaphragms** offer exceptionally smooth operation over the lever travel, from maximum to minimum aperture. Zero Aperture iris diaphragms provide total light extinction.

- E** – Number of leaves
- F** – Tab
- R** – Pin
- AR** – Leaves with AR coating, for temperatures up to **180 °C**
- N** – Springsteel, black finished, for temperatures up to **250 °C**
- H** – Stainless steel, for temperatures up to **400 °C**
- HT** – High temperature alloy for up to **1000 °C**
- 1** – 10IBC, 10IBS steel rod

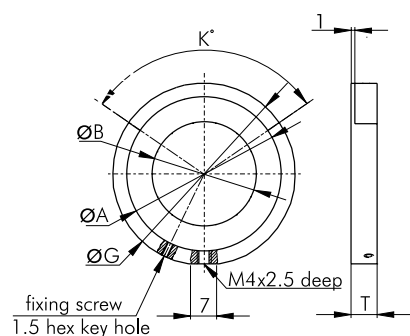


10IBS



Iris Diaphragms Mounts

10IB



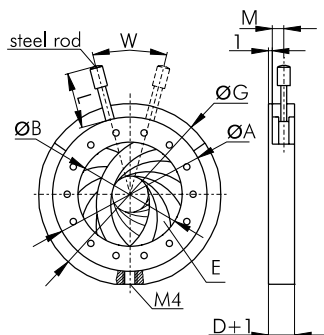
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10IB-14	22	14	10	6	140
10IB-14.8	23	14.8	10	6	130
10IB-15	23	15	10	6.3	123
10IB-15.5	23	15.5	10.5	6.3	125
10IB-22	29.5	22	16	7	130
10IB-24	31	24	17	6	123
10IB-25	32.5	25	14	6	127
10IB-29	36.5	29	17	6	125
10IB-31	38	31	20	7.5	110
10IB-37	44	37	27	6.5	116
10IB-39	46	39	24	6	120
10IB-48.5	55.5	48.5	32	8	104
10IB-49	56	49	36	7.5	110
10IB-50	57	50	38	7	110

Mounted Iris Diaphragms

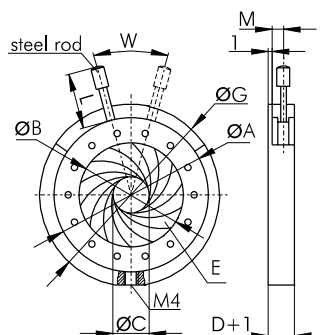
10IB-M



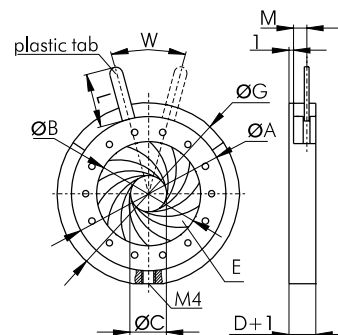
10IBC-M-15



10IBC-M



10IBS-M



10IBV-M

Mounted Diaphragms	Diaphragms	G	A	B	C	D	E	F/R	L	M	W	AR/N/H
10IBC-M-12-N	10IBC25-12-N	32.5	25	12	-	5	12	R	12	2.5	96	N
10IBC-M-12-H	10IBC25-12-H	32.5	25	12	-	5	12	R	12	2.5	96	H
10IBC-M-15-N	10IBC29-15-N	36.5	29	15	-	5	12	R	12	2.5	97	N
10IBC-M-15-H	10IBC29-15-H	36.5	29	15	-	5	12	R	12	2.5	97	H
10IBC-M-22-N	10IBC39-22-N	46	39	22	-	5	14	R	11	2.5	99	N
10IBC-M-22-H	10IBC39-22-H	46	39	22	-	5	14	R	11	2.5	99	H
10IBS-M-8.2-N	10IBS14-8.2-0.8-N	22	14	8.2	0.8	4	8	-	6	2.4	80	N
10IBS-M-8-N	10IBS14.8-8-1-N	23	14.8	8	1	4.5	9	-	6	2.5	77	N
10IBS-M-14-AR	10IBS22-14-1-AR	29.5	22	14	1	5	10	-	10	2.7	94	AR
10IBS-M-14-N	10IBS22-14-1-N	29.5	22	14	1	5	10	-	10	2.7	94	N
10IBS-M-15-N	10IBS24-15-1-N	31	24	15	1	5	12	-	13	2.7	89	N
10IBS-M-15-H	10IBS24-15-1-H	31	24	15	1	5	12	-	13	2.7	89	H
10IBS-M-25-N	10IBS37-25-1.5-N	44	37	25	1.5	5.5	15	-	13	3	94	N
10IBS-M-34-AR	10IBS49-34-2-AR	56	49	34	2	6.5	14	-	13	3.4	93	AR
10IBS-M-34-H	10IBS49-34-2-H	56	49	34	2	6.5	14	-	13	3.4	93	H
10IBS-M-36-N	10IBS50-36-2.5-N	57	50	36	2.5	6	16	-	13	3.2	93	N
10IBS-M-50-N	10IBS70-50-2.5-N	77	70	50	2.5	7	18	-	15	3.8	93	N
10IBV-M-8-N	10IBV15-8-1-N	23	15	8	1	5.3	9	-	5	2.3	75	N
10IBV-M-8-N-1	10IBV15-8-1-N-1	23	15	8	1	5.3	9	1.5	5	2.3	76	N
10IBV-M-8.5-N	10IBV15.5-8.5-1-N	23	15.5	8.5	1	5.3	9	-	8	2.3	85	N
10IBV-M-14-N	10IBV22-14-1-N	29.5	22	14	1	6	10	-	12	2.8	91	N
10IBV-M-14-N-1	10IBV22-14-1-N-1	29.5	22	14	1	6	10	3	15	2.8	91	N
10IBV-M-18-N	10IBV31-18-1.5-N	38	31	18	1.5	6.5	11	-	10	3.4	85	N
10IBV-M-18-N-1	10IBV31-18-1.5-N-1	38	31	18	1.5	6.5	11	3	14	3.4	85	N
10IBV-M-30-N	10IBV48.5-30-1.2-N	55.5	48.5	30	1.2	7	10	-	10	3.7	87	N
10IBV-M-30-N-1	10IBV48.5-30-1.2-N-1	55.5	48.5	30	1.2	7	10	3	12	3.7	87	N
10IBV-M-50-N	10IBV70-50-2.5-N	77	70	50	2.5	7	18	-	13	3.9	93	N

All dimensions in mm

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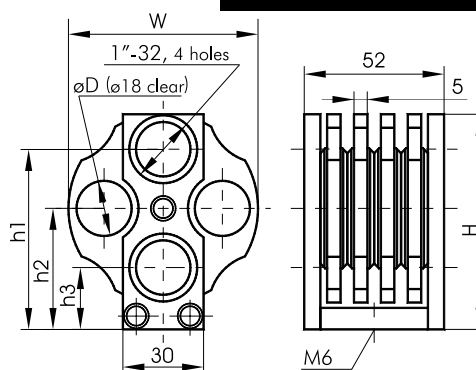
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Variable Wheel Attenuators

10WA168


- 4 wheels
- 3 filter per wheel (12 filters in total)
- Filter diameter - $\varnothing 20/\varnothing 25.4$ mm
- Maximum deviation 0.09 mm
- Clear aperture $\varnothing 18/\varnothing 20$ mm
- C-mount threads on both ends
- Connecting adapters available

10WA168-20


Variable Wheel Attenuator 10WA168-20 is basic model with 4 filter-set wheels. Each wheel contains 4 filter slots each for $\varnothing 20$ mm with clear aperture of $\varnothing 18$ mm. Each filter slot is inclined by 4° to avoid retroreflections.

Each wheel has 4 fixed positions. You can use any of these 4 filter positions as an optical axis. The **back** and **front** panels do not obscure.

Both panels have 1"-32 threaded holes (C-Mounts).

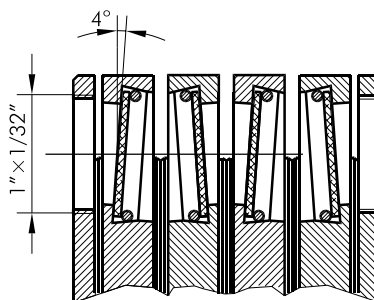
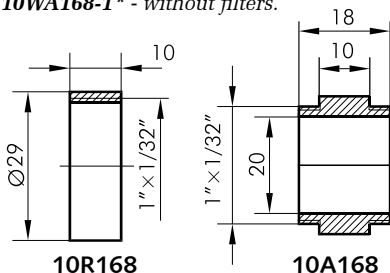
Additionally you may order standard connecting adapters **10AR168**, **10A168** and **10R168**. Custom adapters are available on request.

Mounting M6 hole is provided in the bottom plate.

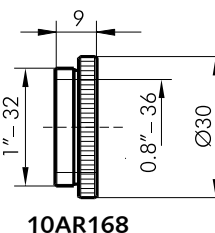
10WA168-1 model is designed to accept 1" (25,4mm) filters with maximum thickness of 4mm. This model comes WITHOUT filters.

Model	H, mm	W, mm	h ₁ , mm	h ₂ , mm	h ₃ , mm	D, mm	Weight, kg
10WA168-20	84	70	67	45	23	$\varnothing 20$	0.35
10WA168-1*	95	80	75	50	25	$\varnothing 25.4$	0.40

10WA168-1* - without filters.



Adapters for Variable Wheel Attenuators:



Closed Variable Wheel Attenuator

10CWA168

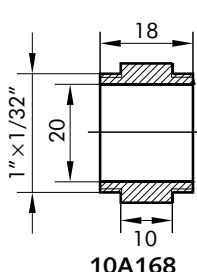
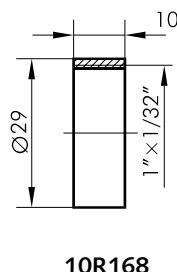
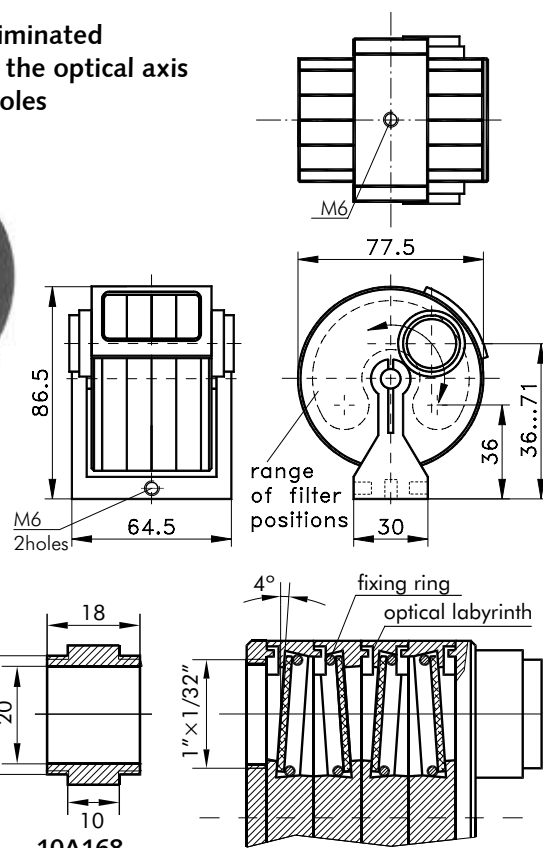

- Stray light fully eliminated
- Variable height of the optical axis
- Three mounting holes
- C-mount threads

Close Variable Wheel Attenuator 10CWA168 is used when it is necessary to fully eliminate the side background lighting when using photodetectors with high sensitivity (e.g. CCD, photomultiplier, etc.). You may order standard connecting adapters **10A168** and **10R168** separately. Custom adapters are available too.

Loosen the central axis and rotate the whole body of the filter to set the desired position of an **optical axis** at a height between **36-71** mm.

The base of the attenuator has **M6** holes on **3 sides** for mounting versatility. See photo below.

Weight: **0.55 kg**



Some applications of optical filters

- In systems for laser beam diagnostics with CCD-cameras
- Measurement of laser power, pulse energy and pulse duration
- Spectroscopy
- We can offer a set of bandpass filters for mercury lamp, laser lines, and for other your needs

A choice of filters is available for our standard 4-wheel attenuators, allowing 256 relative positions of wheels, rendering 99 different transmission values, of which you can find a very close match to the desired value. Discrete filters permit to establish accurate optical density.

Also we can offer designs with 1, 2, 3 and more wheels.

Variable wheel attenuators come with a **standard**, most popular, **set of filters** listed in **table 1**. The standard filters are made of neutral grey glass with spectral characteristics according to **figure 3**.

Alternatively, attenuators (wheels and optics) could be manufactured to individual orders. Or we could supply variable wheel attenuators without filters, which you can fit by yourself.

Transmission		Filter #1	Filter #2	Filter #3	Filter #4
Wheel #1	T	1.00	0.90	0.80	0.50
	dB	0.00	0.46	0.97	3.00
Wheel #2	T	1.00	0.30	0.10	0.03
	dB	0.00	5.20	10.00	15.20
Wheel #3	T	1.00	0.01	0.003	0.001
	dB	0.00	20.00	25.00	30.00
Wheel #4	T	1.00	0.0003	0.0001	0.00003
	dB	0.00	35.00	40.00	45.00

Table 1. List of a standard filter-set

Please use the following equation for easy **T(%) to OD** conversion
 $OD = \log^{10} T$

Charts for the standard filter-set: possible filter positions versus resulting transmission/density.

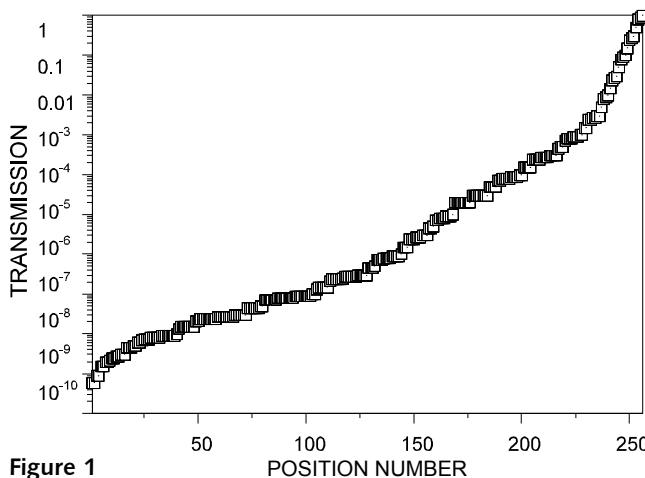


Figure 1

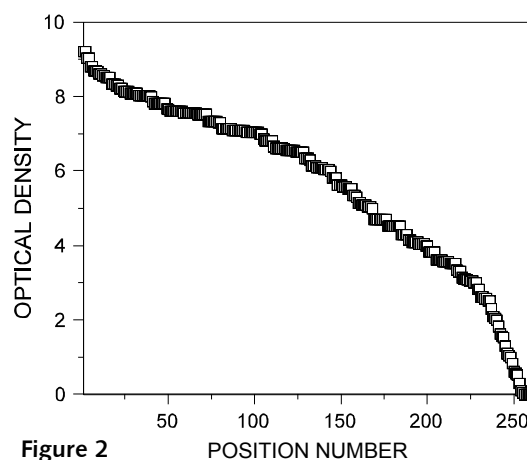


Figure 2

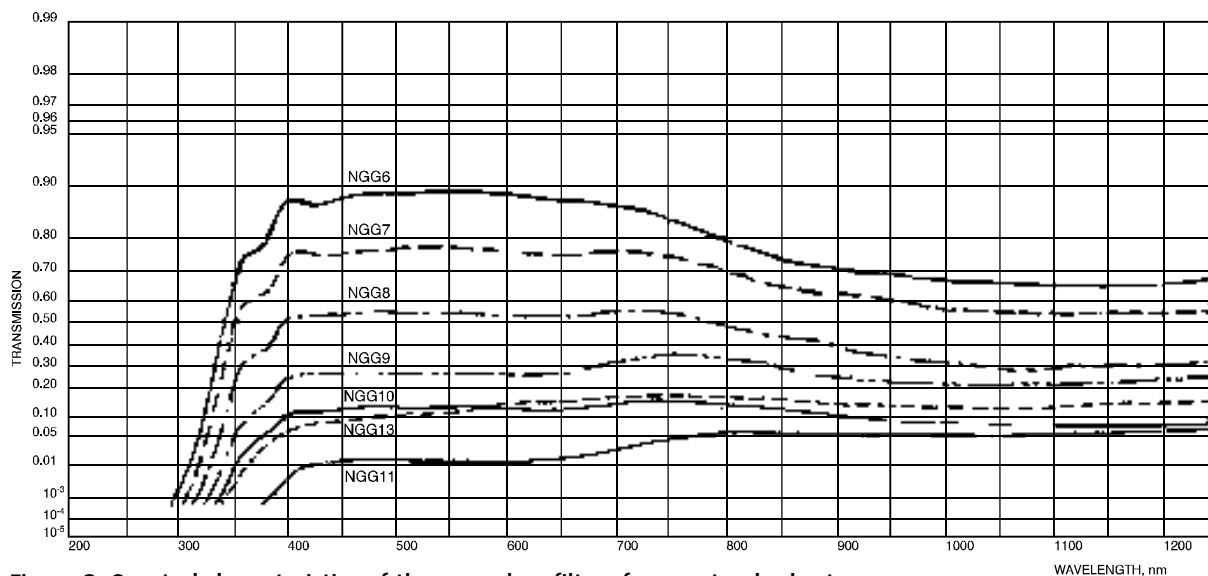


Figure 3. Spectral characteristics of the grey glass filters from a standard set

In most cases the detectors (CCDs, photodiodes, photomultipliers, etc.), which are used for diagnostics of laser radiations, are too delicate for the direct measurement of high powers, such as from ion lasers or pulsed solid-state lasers. An attenuator may be required to reduce laser power density at the surface of detector. Optical attenuators must be used when the laser output-power or power density exceeds the working (linear) range or the damage threshold of the detector. (Draft International Standard ISO/TC172/SC 9/WG1)

For example, the damage threshold for a typical commercially available CCD is about 100 mW/cm², for the ultra high speed photodetectors series AR-S (Antel Optronic Inc.) it is about 200 mW/cm². On the other hand, laser power must be adjusted to the optimum point, which is typically just below the saturation level of the detector. For example, a typical commercially available CCD saturates at

only 0.05 mW/cm² at 632.8 nm and at 5.5mW/cm² at 1.06 mm (see R. Rypma "Dimming the Light ...", in Photonics Spectra N.10, 1995, p.145).

For preliminary attenuation of very high power lasers the simplest approach is to use just the first surface reflection of an uncoated laser-grade substrate.

It is useful to have an intensity adjustment range of at least 1000:1 or more in this final stage. Even when working with a single-wavelength laser, operated at one power level, this range may be encountered when making measurements at different points in the optical train.

After major reduction in intensity by reflection off an uncoated substrate is achieved, some of the low-power neutral density filters of the high optical quality can bring the beam power to the exact level necessary for optimum measurement by detection system.

Set of wheel edge filters for 10WA168EF

Set of wheel edge filters is used when it is necessary to reject the shorter or the longer wavelengths.

Also, a combination of short and long wavelength filters allows to construct band pass filters with variable bandwidth (for fluorescence analysis, etc.)

As standard 10WA168EF of 4 wheels comes with 6 long-wave pass filters and 6 short-wave pass filters. One hole in each wheel is left open.

Long-wave pass filters are made of absorbing color glass.

Shortwave pass filters are interference filters.

Wheel number	Type of edge filters	Filter number	Cut-on/off wavelength, nm
1	Short wave pass	1	550
		2	650
		3	750
2	Short wave pass	1	500
		2	600
		3	700
3	Long wave pass	1	450
		2	550
		3	650
4	Long wave pass	1	500
		2	600
		3	700

Table 2



10WA168-20-2

According to your request we may design an attenuator with any number of wheels.

Two Wheels



10CWA168 with a CCD camera

Close Variable Wheel Attenuator **10CWA168** is ideally suited for use with CCD cameras. Adapters **10R168** and **10A168** are used for connection.

Examples of codes for ordering of **10WA168** series **with any number of wheels**:

10WA168-20-2 – 2 wheels for Ø20 mm filters. This model comes with 3 filters per wheel (6 filters in total).

10WA168-1-2 – 2 wheels for Ø1" filters with maximum thickness of 4mm. This model comes WITHOUT filters.

Beam Splitter Cube

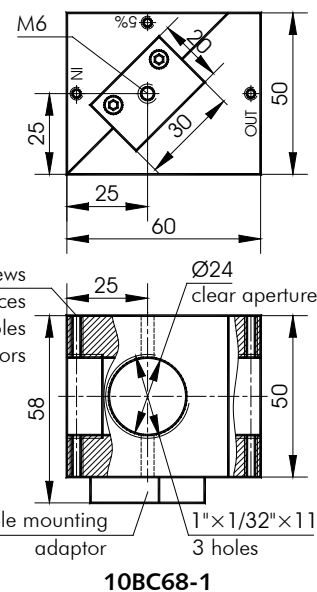
10BC68-1

- Free of multiple interference fringes
- Virtually undistorted attenuation
- No back reflection
- Couples directly to Variable Attenuators

Beam Splitter Cube 10BC68-1 provides fixed attenuation and beam sampling for performing diagnostics on high power laser sources. **10BC68-1-UV** is available for high power UV laser sources.

Beam splitter uses the front surface of an uncoated BK7 glass (or UVFS glass in case of **10BC68-1-UV**) plate installed at 45 degree to achieve a reflection of small portion of the main laser beam for further analysis. It is approximately 5% reflection of non polarized beam or **0.6% to 10.7%** reflection depending on polarization state (and wavelength) of the polarized beam.

The surface is polished to **10-5 scratch-dig** and **1/10 wave finish**, wedged at **30 arcmin** to avoid interference fringes, and can take power densities higher than **2-5 GW/cm²**



(for 10 ns pulsed laser). Similar to **10CWA168** attenuator, it has **C-Mount** ports and can be connected to **10CWA168** and to your camera through a **10AT168** adapter (connecting tube). Beam splitter cube has an M6 mounting hole to mount it on posts.

SPECIFICATIONS

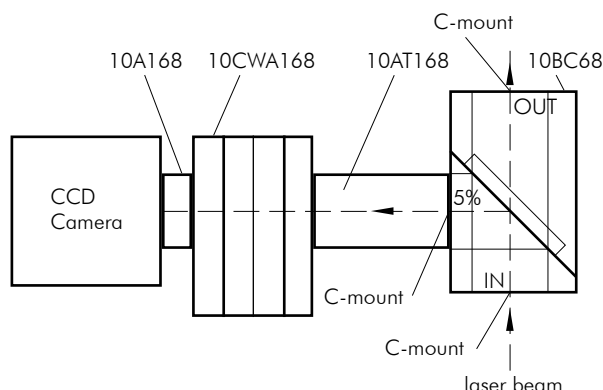
Attenuation (reflection)	0,6% to 10,7% (polarization and wavelength dependent)
Spectral range	
10BC68-1	350-2200 nm
10BC68-1-UV	190-2200 nm
Clear Aperture	19 mm
Damage Threshold	50 J/cm ² (for 10 ns pulses)



10AT168 10A168 10RE168
Connecting adapters available separately



10BC68-1 mounted with adapters 10AT168 and 10RE168



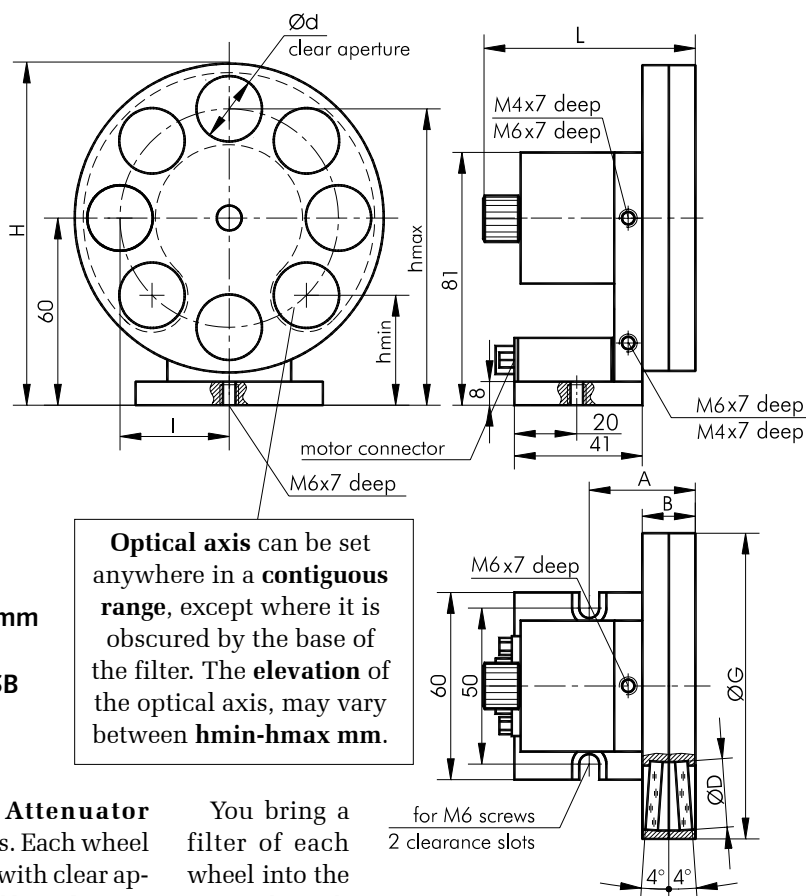
10BC68-1 mounted to 10CWA168 through an adapter tube 10AT168

Motorized Variable Two Wheels Attenuators

10MWA168



10MWA168-20



- Filter diameter – Ø20/Ø25.4 mm
- Clear aperture Ø18/Ø23 mm
- Non parallel filters (inclined by 4°)
- Maximum thickness of filters – 4 mm
- Custom design available
- Control program using 8SMC4-USB controller Xilab interface

Motorized Variable Two Wheel Attenuator 10MWA168 consists of two filter wheels. Each wheel contains eight filter mounts of ØD mm with clear aperture of Ød mm. Each mount is inclined by 4 degrees to prevent mutual reflections between filters.

We supply the attenuator **10MWA168-20** with a standard, most popular, set of filters. See the table below. Alternatively, optics could be manufactured to individual orders. Or we could supply the attenuator without filters, which you can fit by yourself.

10MWA168-1 model comes WITHOUT filters.

You bring a filter of each wheel into the optical path easily by hand or using automation. The two wheels are driven by a single step motor. A computer can operate it via a controller and **Computer Software** come separately.

For fastening, the attenuator has clearance slots for **M6** and **M4** screws. There are also two **M6** holes, and one **M4** hole (opposite to one of the **M6** holes).

Material: black anodized aluminium.

Model	D, mm	d, mm	H, mm	G, mm	A, mm	B, mm	L, mm	hmin, mm	hmax, mm	l, mm
10MWA168-20	Ø20	Ø18	110	Ø100	35	16.5	73.5	34	97	37
10MWA168-1*	Ø25.4	Ø23	115	Ø110	39	20.5	78	32	99.5	39.5

10MWA168-1* - without filters.

Transmittance of filters from a standard set:

WHEEL N1	WHEEL N2
1	1
0	0
0.9	0.8
0.5	0.3
0.1	0.03
0.01	0.003
0.001	0.0003
0.0001	0.00003

The attenuator stepping motor:

SPECIFICATIONS

Rated Current	0.4 A
Resistance	33 Ω
Inductance	52 mH
Holding torque	0.12 N·m
Step angle	1.8 $^{\circ}$
Step angle accuracy	5 minutes
Required electrical power	5.6 W
Weight	
10MWA168-20	0.61 kg
10MWA168-1	0.65 kg

Motors of other types are available.

Software for control Motorized Attenuators
Page 10-12.

Motorized Closed Variable Two Wheels Attenuators

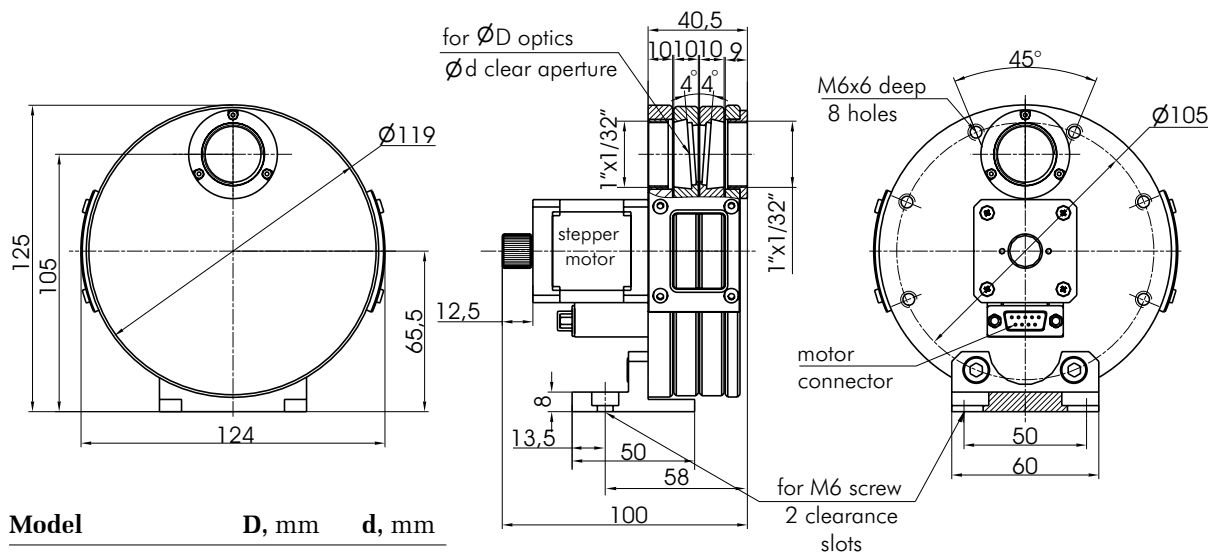
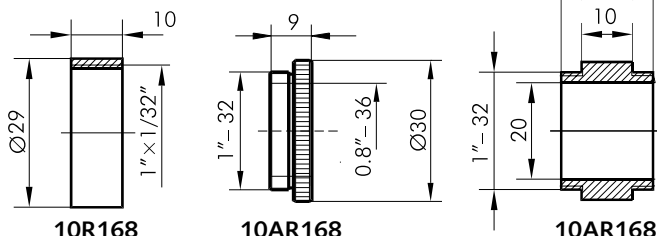
10MCWA168



10MCWA168-1

- Filter diameter - Ø20/Ø25.4 mm
- Clear aperture Ø18/Ø23 mm
- Non parallel filters (inclined by 4°)
- Maximum thickness of filters – 4 mm
- C-mount threads on both ends
- Control program using 8SMC4-USB controller Xilab interface

Adapters for Attenuators



Model	D, mm	d, mm
10MCWA168-20	Ø20	Ø18
10MCWA168-1*	Ø25.4	Ø23

10MCWA168-1* - without filters.

Motorized Closed Variable Two Wheel Attenuator 10MCWA168 consists of two filter wheels. Each wheel contains eight filter mounts of ØD mm with clear aperture of Ød mm. Each mount is inclined by 4 degrees to prevent mutual reflections between filters.

We supply the attenuator **10MCWA168-20** with a standard, most popular, set of filters. See the table below. Alternatively, optics could be manufactured to individual orders. Or we could supply the attenuator without filters, which you can fit by yourself.

10MCWA168-1 model comes WITHOUT filters.

You bring a filter of each wheel into the optical path easily by hand or using automation. The two wheels are driven by a single step motor. A computer can operate it via a controller and **Computer Software** come separately.

For fastening, the attenuator has clearance slots for **M6** and **M4** screws. There are also two **M6** holes, and one **M4** hole (opposite to one of the **M6** holes).

Material: black anodized aluminium.

The attenuator stepping motor:

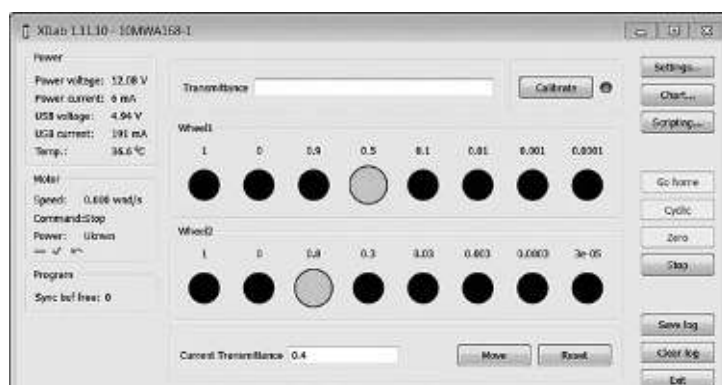
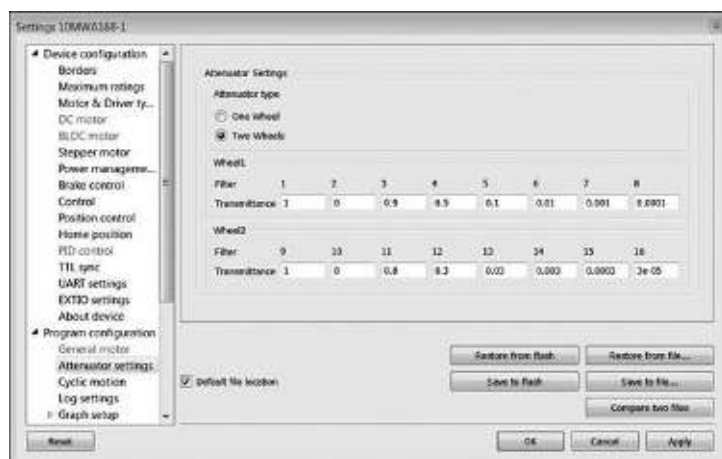
SPECIFICATIONS

Rated Current	0.4 A
Resistance	33 Ω
Inductance	52 mH
Holding torque	0.12 N·m
Step angle	1.8 °
Step angle accuracy	5 minutes
Required electrical power	5.6 W
Weight	
10MCWA168-20	0.7 kg
10MCWA168-1	0.75 kg

Transmittance of filters from a standard set:

WHEEL N1	WHEEL N2
1	1
0	0
0.9	0.8
0.5	0.3
0.1	0.03
0.01	0.003
0.001	0.0003
0.0001	0.00003

Computer Software



- Control of single stepper motor with two wheels and up to 8 filters in every wheel
- Operation in transmittance mode
- Program chooses the best combination of filters for required transmittance
- Transmittance values of each filter can be entered manually

Software Xilab Software XiLab used with controller 8SMC4-USB has integrated filter wheel control functionality designed to control STANDA motorized filter attenuators. Motorized filter attenuators can be used in all kinds of optical circuitry where variable transmittance has to be achieved. Program allows you to easily change transmittance in attenuators 10MWA168, 10MCWA168 and 8MRU-1-WA. Just enter transmittance value, and the program will select the most suitable filters. Or you can select the filters directly. The simple interface allows you to use the program right away. All of our software works only with our controllers. Controller software can be downloaded for the majority of operating systems, e.g., Windows, Mac OS X, Linux etc.

REQUIREMENTS

Display

STANDA's Stepper Motor Controllers
24 V / 36 V power supply



Free software downloads available on www.standa.LT

Stepper motor controllers for

Motorized Variable Two Wheels Attenuators



Motorized Closed One Wheel Attenuator for Microscope



10MWA18-1

- 8 filters
- Filter diameter 1" (Ø25.4 mm)
- Clear aperture Ø23 mm
- Connecting adapters available

SPECIFICATIONS

Rated current	0.67 A
Resistance	5.6 Om
Inductance	4 mH
Step angle	1.8°
Step angle accuracy	5'

More info on www.STANDA.LT

Universal Motorized Rotation Stages



8MRU-1WA

8MRU-1WA - a filter wheel version of universal rotation stage **8MRU**. Accepts up to **eight 1" filters**.

SPECIFICATIONS

Rotation range	360°
Resolution in full step	0.6°
in 1/8 step	4.5 arcmin
Max. rotation speed*	3 ÷ 5 rps
Wobble	2 arcmin
Reduction gear	3:1
Limit switches	mechanical
Drive mechanism	belt
Load capacity	
Horizontal	5 kg
Radial	1.5 kg
Torque	4.5x10 ⁻³ Nm
Cable	integrated, 1.6 m length
Motor connector	HDB15(M)
Stepper motor	28S

*Test condition:

- STANDA controllers;
- Power supply – 36V.

See catalogue page 8-43



8MRU-1TP

8MRU-1TP - a version of **8MRU** with a universal mounting platform with a **pattern** of **M6** and **M4** tapped holes.

Variable Attenuator/Beamsplitter

10APF3



10APF3-1

SPECIFICATIONS

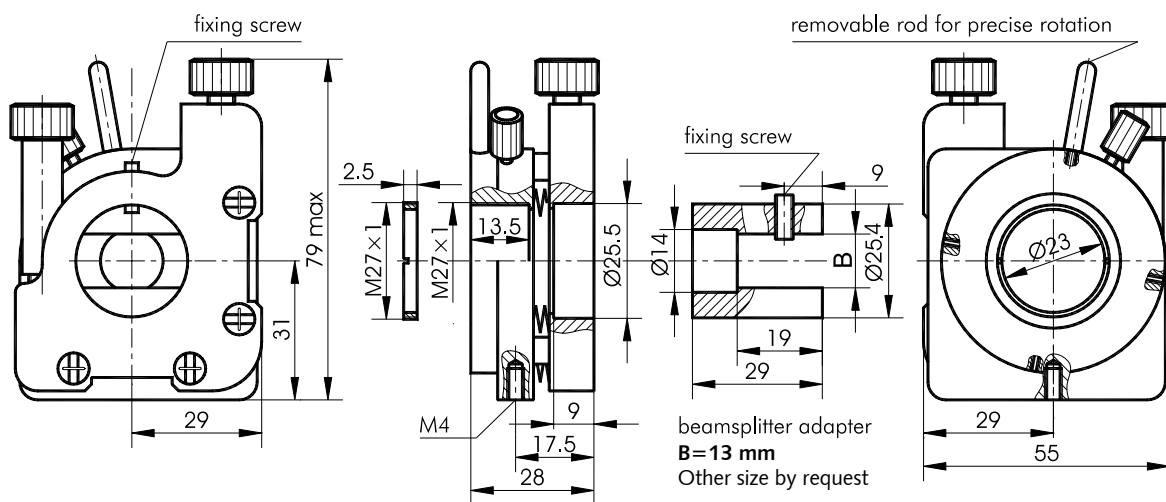
Half waveplate	
rotation range	360°
Scale gradation	2°
Beamsplitter cube	
Pivot	±2.5°
Sensitivity	3 arcsec
Rotation	360°

- Combine Half Waveplate with a Polarizing Beamsplitter
- Both optics are adjustable
- Optics should be ordered separately

10APF units allow to mount a **half waveplate** and a **polarizing beamsplitter**. The result is a combined **Variable Attenuator/Beamsplitter**.

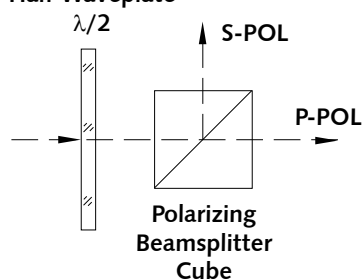
To attenuate the beam, you can rotate the **waveplate** the whole **360°**.

10APF3 is a modified **5APH79T** mount. When mounted on the **M4** hole in the platform, **pivot** is applied to the **base** instead of the **platform**. A beamsplitter is mounted via an adapter to the **base**. Hence the beamsplitter can be **pivoted** within **±2.5°** in one **coordinate**. You can freely **rotate** the **adapter** in the base and clutch it with a **fixing screw**.



10APF3-1

Half Waveplate



see catalogue section 14

ORDERING INFORMATION

10APF3-1	Variable Attenuator/Beamsplitter without optics
10APF3-1CVAB	Variable Attenuator/Beamsplitter with optics (see next page)
WPZO.2-1	Half Waveplate
PBC-10	Polarizing Beamsplitter Cube



10APF3-1CVAF

Variable Attenuator for Femtosecond laser pulses (look next catalogue page)

Continuously Variable Attenuator/Beamsplitter

10APF3-1CVAB



Continuously Variable Attenuator / Beam-splitter for down to **100 fs laser pulses**. This Variable Attenuator / Beamsplitter consists of 2 high-performance polarizing optics components placed in precision opto-mechanical Holder **5APH79T-1**. 10APF3 incorporates a high-performance Polarizing Cube Beam-splitter which reflects s-polarized light 90 while transmitting p-polarized light.

A rotating quartz Phase $\lambda/2$ 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 wave-plate. 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.

- Divides laser beam into two beams of manually adjustable intensity ratio
- Convenient 90 deg angle between reflected and transmitted beams
- Negligible beam deviation
- Large dynamic range

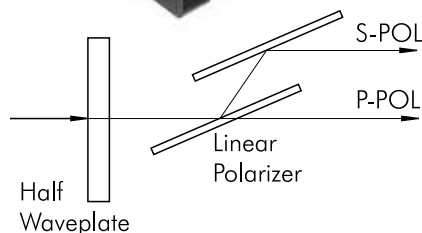
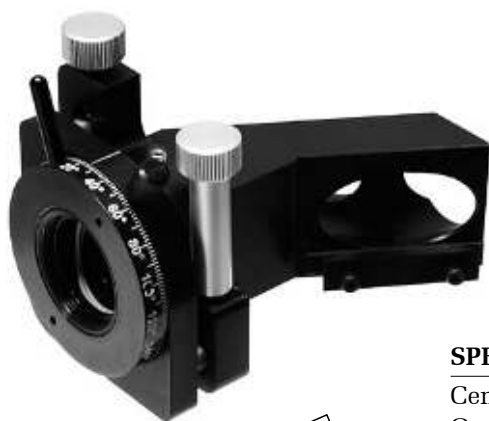
SPECIFICATIONS

Beam deviation	40×10^{-6} rad, average over range
Damage threshold	200 mJ/cm ² pulsed at 1064 nm, typical
Antireflection coating	R < 0.25% all entrance and exit surfaces
Time dispersion	t > 100 fs for laser pulses
Extinction ratio	$T_s/T_p < 1:1000$

Standard Models	Central wavelength, nm	Clear aperture, mm
10APF3-1CVAB-1064-10	1064	10
10APF3-1CVAB-1064-15	1064	15
10APF3-1CVAB-1064-20	1064	20
10APF3-1CVAB-780-10	780	10
10APF3-1CVAB-780-15	780	15
10APF3-1CVAB-780-20	780	20
10APF3-1CVAB-800-10	800	10
10APF3-1CVAB-800-15	800	15
10APF3-1CVAB-800-20	800	20

Variable Attenuator for Femtosecond laser pulses

10APF3-1CVAF



- Divides laser beam into two parallel beams of manually adjustable intensity ratio
- Large dynamic range
- Negligible beam deviation
- High Optical damage threshold

SPECIFICATIONS

Central wavelengths	266, 355, 532, 780, 800, 1064 nm or other
Operational wavelength range	+/- 10 nm
Beam deviation	40×10^{-6} rad, average over range
Aperture diameter	15 mm
Damage threshold	5 J/cm ² pulsed at 1064 nm, typical
Antireflection Coating	R < 0.25% all entrance and exit surfaces
Time dispersion	t < 4fs for Ti:Sapphire laser pulses
Polarization Contrast	> 500:1

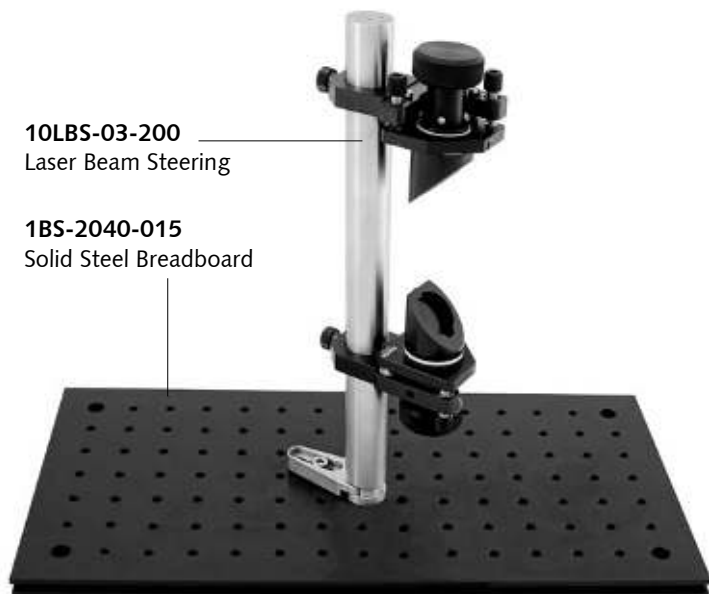
Standard Models	Central wavelength, nm	Standard Models	Central wavelength, nm
10APF3-1CVAF-266	266	10APF3-1CVAF-780	780
10APF3-1CVAF-355	355	10APF3-1CVAF-800	800
10APF3-1CVAF-532	532	10APF3-1CVAF-1064	1064

Laser Beam Steering

10LBS

10LBS-03-200
Laser Beam Steering

1BS-2040-015
Solid Steel Breadboard

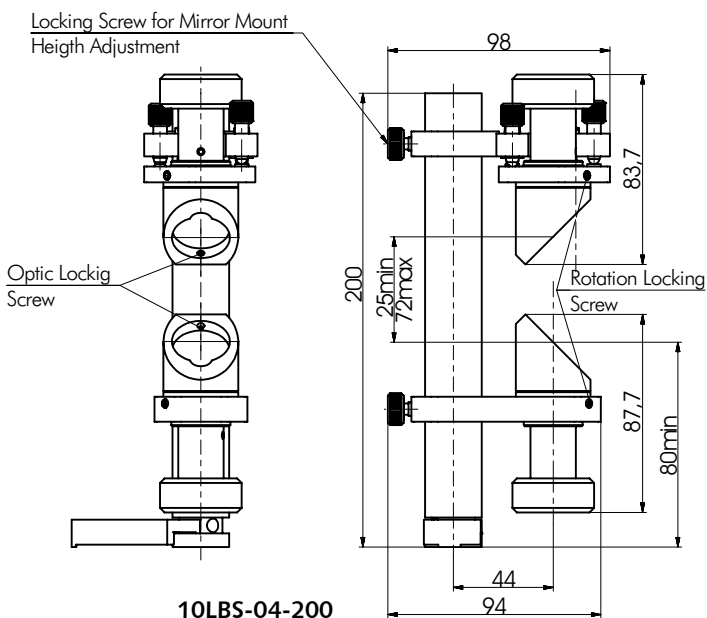
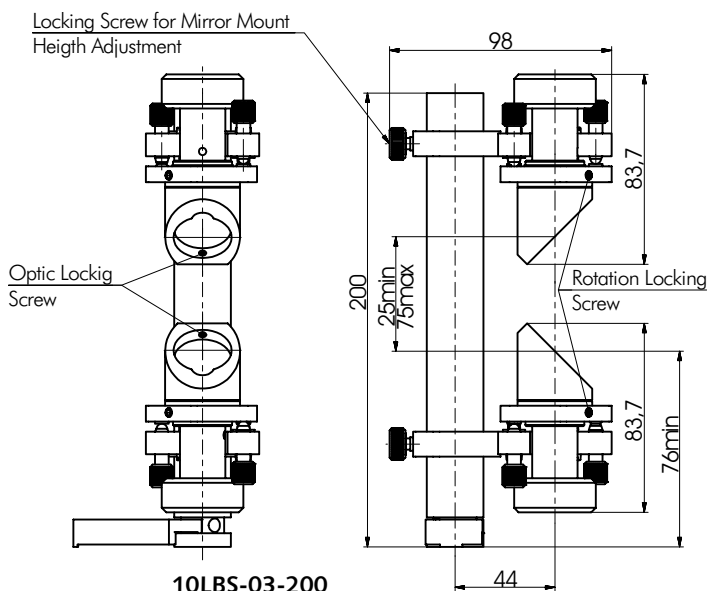


- Precise azimuth control
- Precise angles control
- 1" optics mounts
- Stable and adjustable

SPECIFICATIONS

Optics diameter	Ø1"
	(Ø25.4 mm)
Minimum Optic Thickness	4.5 mm
Angular Adjustment Range	±4.5 °
Rotation	360 °
Height adjustment	

These research and industrial grade periscope assemblies are useful tools for changing beam path direction and elevation. **Laser Beam Steering** uses the **kinematic mount 5BM131E-1-2** to create the most stable and flexible system available. While **10LBS-03-200** allows same functionality on top and bottom optics holders, the **10LBS-04-200** 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**.



Model	Height, mm
10LBS-03-200	200
10LBS-04-300	400

Steel Optical Rail System

10ORS6



2OR6

- Standard and high precision models
- Low profile optical bench
- Translate rod or base mounted components along a bench or rail
- Rails may be mounted anywhere on optical benches/tables



2RC6-50
2RC6-50H



2RC6-25



2SRC6-50



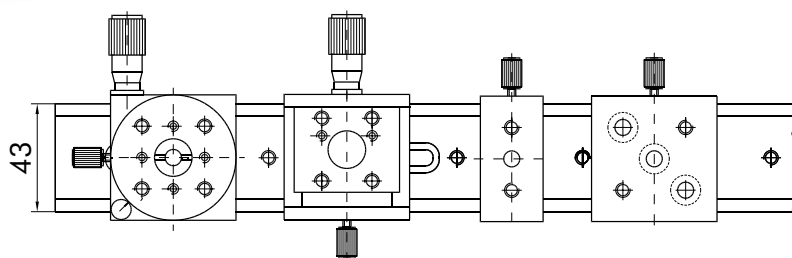
7T8-01



7T8-02



7R7



A Steel Optical Rail System 10ORS6 consists of inter-compatible mechanical elements. The optical rail is the main consolidating element. All elements have adapters, corresponding to rails for mounting between each other. All connections are very simple, quick and reliable. This also provides coarse positioning possibility. The system consists of these elements:

- different lengths black finished steel Optical Rails 2OR6;
- two different widths black finished steel Rail Carriers 2RC6;
- black finished steel Sliding Rail Carrier 2SRC6-50;
- black finished steel Mini Rail System Ball Slide Positioners 7T8-01 and 7T8-02
- black anodized aluminium Mini Rotation Stage 7R7.

It is possible to combine various numbers of elements. All elements are inter-compatible and can be used separately with any STANDA mechanical elements, because they are provided with M6 tapped holes pattern.

Optical Rails can be mounted onto STANDA optical tables either directly, or using any other base elements.

STANDA's Rail System's flexibility is shown in the photos below. Besides the accurate 5mm motion regulation, knots have the possibility of rough positioning by ± 15 mm.

7T8XYZ
3 Axis Translation System

7R7
Mini Rotation Stage

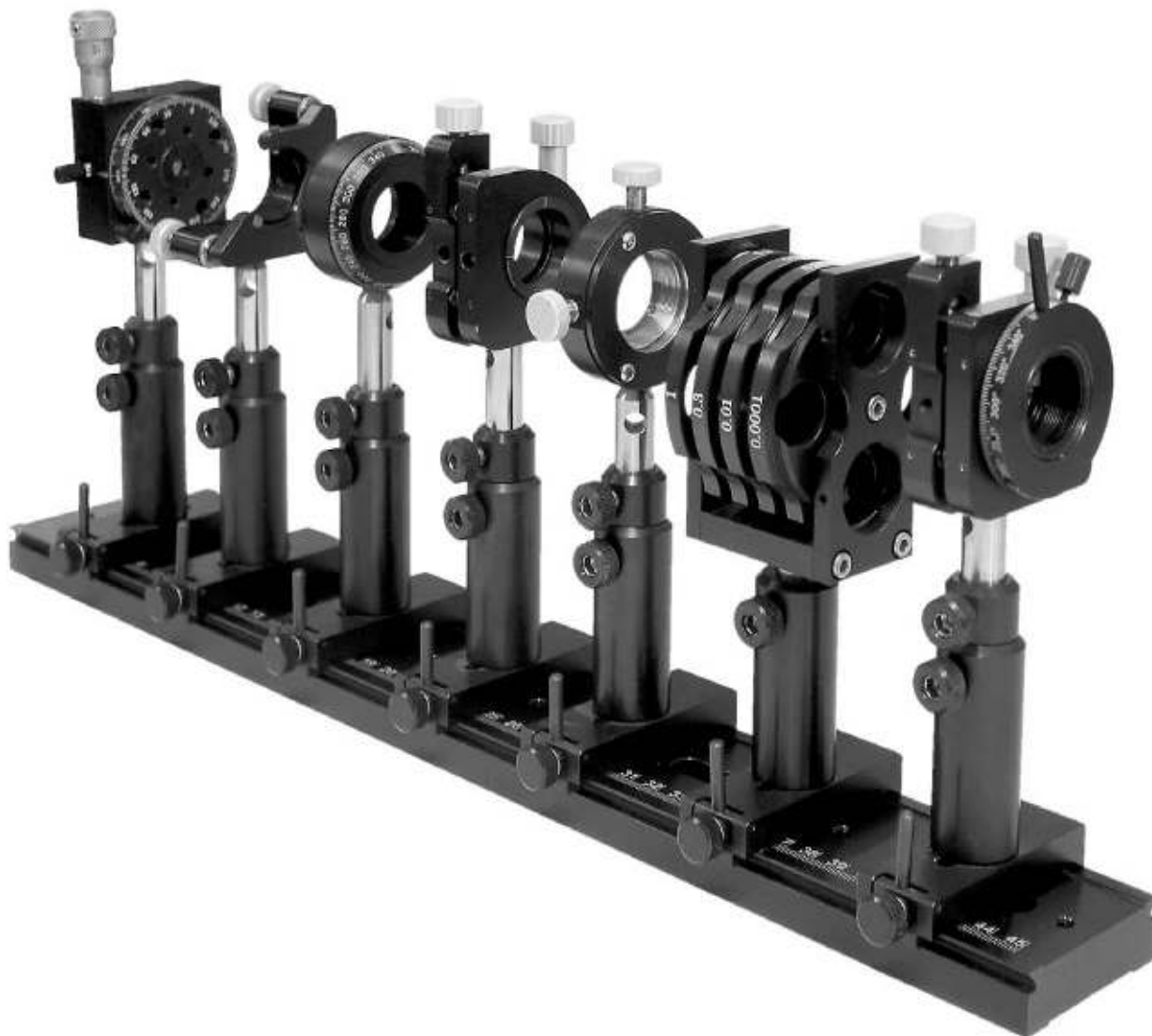
7R7
Mini Rotation Stage

2RC6-25
Steel Rail Carrier

2OR6-270
Steel Optical Rail

2RC6-50
Steel Rail Carrier

Optical Rail System 20R02



*Optical Rail System 20R02
adaptable for any component*

- Stable
- Scale engraved
- Gentle clutching
- Easy lifting

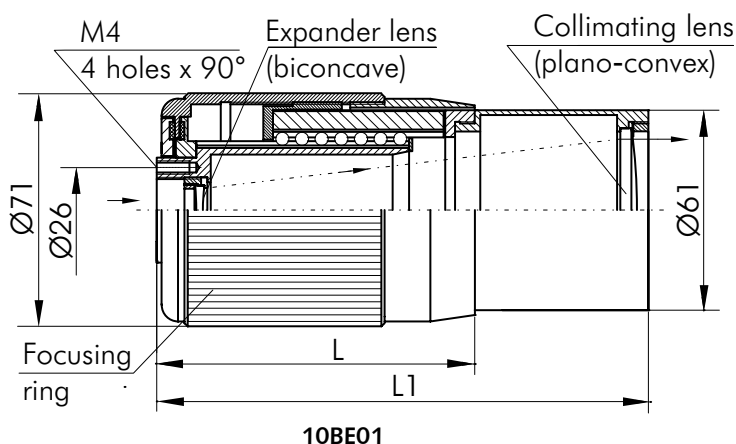
Beam Expanders/Collimators

10BE01



10BE01-5X

- High energy laser beam expansion
- Wave length 532 nm
- Input aperture > 12 mm
- Exit aperture > 45 mm
- Expansion ratio 2.5 X or 5 X
- Focusing range: 2 m to infinity
- Lenses antireflection coated
- Housing Material: Black anodized aluminium
- XY-positioning ± 5 mm
- Tilt angular range: ± 4.5 degrees



10BE01

Our beam expanders have two lenses and are focusable to minimal distance 2 m. In such type expander aberrations can be totally compensated only in one point. Depending on customer needs and application we can customize expander lenses to compensate aberrations in region of 2 m focus point or for infinity. Our beam expanders could be customized for any wavelength from the range of 450-2000 nm. Please give us details of your application and ask for price!

Model	L, mm	L1, mm
10BE01-2.5X	97	150...170
10BE01-5X	97	187.5...207.5

Custom assembly produced on customer's request, where you have possibility of ZY translation and two-axis tilt consisting of:

10BE01-5X(ZYΘ):

10BE01-5X – beam expander,

2AB7T173-10-7T173-10 – angle bracket,

2CP10BE01-2.5X-5OM61-2 – adapter plate,

2CP7T173-10-5OM61-2 – adapter plate,

3BP4-02 – base plate,

3PH-50 – post holder,

3MP-50 – mounting post,

5OM61-2 – optics mount,

two **7T173-10** - translation stages.



10BE01-5X(ZYΘ)

Beam Expanders

10BE02



- Convenient to use and robust design
- Computer optimized single wavelength design
- Anti-reflection coated Fused Silica optics
- Magnification from 2x up to 17x
- Low wave-front distortion (diffraction limited design)

Standa Galilean type fixed magnification **Beam Expanders** are ideal solution to expand or reduce your laser beam diameter. Our beam expanders are a good choice for both scientific and industrial applications. Simple non-adjustable beam expanders containing two or three lenses are often used because of their low cost, simplicity and small size

Our **beam expanders** are compatible with STANDA standard mounts like **5TLM-1TH**, **5TOM**, **5KOM** or **5(M)BM** series. Please see www.standa.it for more details.

Typical applications include:

- Micro drilling
- LIDAR systems
- Beam condensing
- Collimation of laser harmonics
- Cutting of solar cells
- Laser structuring of foils
- Interferometers
- Collimation of high power laser beams

SPECIFICATIONS	10BE02-A series	10BE02-LA-5 series	10BE02-B series	10BE02-D series
Expansion ratio	3x; 5x; 12x	5x	2x-16x	2x-17x
Optics Material	BK7, UVFS, CaF2 (optional), ZnSe (optional)			
Wavelength, nm	355, 515, 532, 780, 800, 1030, 1064			
Input CA, mm	4-12	12	4-10	5-12
Output CA, mm	34-40	60	15-18	25
Housing Diameter, mm	48-52	76	25.4	32
Housing Length, mm	100-120	200	60-100	75-86
Wavefront Disortion	$\lambda/4$ p-v at 633nm over Clear Aperture			
Damage Threshold	$>8 \text{ J/cm}^2$ for 10 ns pulses @ 1064 nm			
Transmission, %	97			
Input mounting Thread	M27x1	additional 4A-1-M27 adapter with M27x1 thread available	M27x1	M27x1
Housing Material	Black Anodized Aluminium	Aluminium	Aluminium	Aluminium

Model	Expansion
10BE02-A-3	3x
10BE02-A-5	5x
10BE02-LA-5	5x
10BE02-A-12	12x
10BE02-B-2	2x
10BE02-B-3	3x
10BE02-B-4	4x
10BE02-B-5	5x
10BE02-B-6	6x
10BE02-B-7	7x
10BE02-B-8	8x
10BE02-B-10	10x
10BE02-B-12	12x

Model	Expansion
10BE02-B-14	14x
10BE02-B-16	16x
10BE02-D-2	2x
10BE02-D-3	3x
10BE02-D-4	4x
10BE02-D-5	5x
10BE02-D-6	6x
10BE02-D-8	8x
10BE02-D-10	10x
10BE02-D-12	12x
10BE02-D-14	14x
10BE02-D-15	15x
10BE02-D-17	17x

Beam Expanders

10BE03



- Continuously Variable Zoom and Focus
- AR Coated Fused Silica Optics
- Diffraction Limited Design
- Applicability to High-Power Optical Systems (no internal focus)
- Robust and Reliable Design. Ready for Industrial Applications

Standa diffraction limited Galilean type **Beam Expanders** offer variable magnification of 2x-12x (other ranges available, see table below) with adjustable focus to correct laser beam divergence. All adjustments can be made quickly and easily by hand using our unique zoom and focus scale engraved directly onto the beam expander. No special tables or fine adjustment curves are required. Frequent set-up changes without compromising optical and mechanical performance are common to **10BE03** series.

Who doesn't need frequent set-up changes we may offer a **simplified version** of **10BE03**. Optical performance is the same as for **10BE03**, but zoom and focusing mechanisms are designed for using with beams with nearly constant parameters (beam diameter and far-field divergence).

Mounting our beam expanders has become easier than ever. You can choose a variety of mounts from our **5TLM-1TH**, **5TOM**, **5KOM** or **5(M)BM** series.

Please see www.standa.it for more details.

Our **beam expanders** are widely used acrossed the world in many different industrial and research applications to name few:

- Micro drilling
- LIDAR systems
- Beam condensing
- Colimation of laser harmonics
- Cutting of solar cells
- Laser structuring of foils
- Interferometers
- Colimation of high power laser beams

Our currently settled "customer-inspired" modifications include:

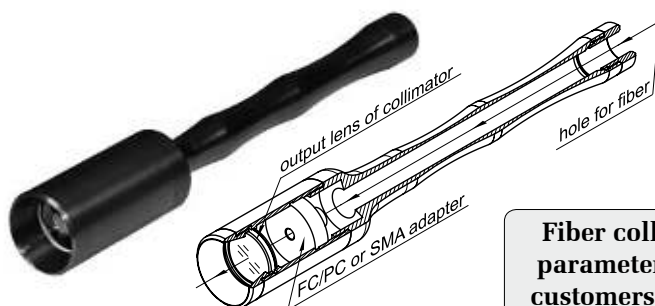
- Dual wavelength Beam expanders:
1064 nm/532 nm
1030 nm/515 nm
800 nm/400 nm
other wavelengths available as well.
- Input side with Fiber Connector installed (FC/PC or SMA905)
- Reflective type Beam Expanders.
- Output apertures up to 6".
- Beam expanders with 1x-8x-expansion ratio

SPECIFICATIONS	10BE03-1-8	10BE03-1.5-4	10BE03-1.5-5 10BE03-2-12	10BE03-2-8	10BE03S-2-8	10BE03-5-8
Expansion ratio (variable)	1-8x	1.5-4x	1.5-5x	2-8x 2-12x	2-8x	5-8x
Optics Material	BK7, UVFS, CaF ₂ (optional), ZnSe (optional)					
Wavelength, nm	355, 515, 532, 780, 800, 1030, 1064					
Input CA, mm	8		7	11	5	12
Output CA, mm	40		30	36	25	16
Housing Diameter, mm	60	28	45	50	45	28
Housing Length, mm	150	110-120	130	130-150	110	110-120
Wavefront Distortion	$\lambda/4$ p-v at 633nm over Clear Aperture					
Damage Threshold	>8 J/cm ² for 10 ns pulses @ 1064 nm					
Transmission, %	97					
Input mounting Thread	M27x1					
Housing Material	Black Anodized Aluminium					

* Expansion ratio range could differ for some wavelengths.

Custom Fiber Collimators

12HP02



Fiber collimator parameters upon customers request

- Compact Design
- Excellent beam quality
- Low wavefront distortion
- FC/PC or SMA connection

APPLICATIONS

Medical, industrial and research
Integrated devices
OEM equipment