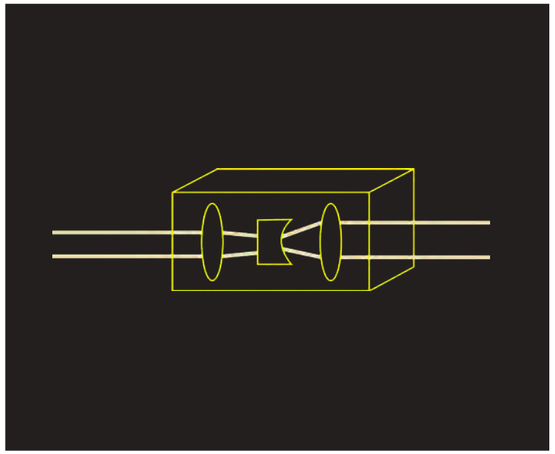
Beam delivery devices

4Lasers designs and manufactures compact laser beam delivery systems, laser beam expanders, reducers, divergence compensators and laser power attenuators, which are used to increase or decrease laser beam diameter, control beam divergence, and adjust laser power.



Compact motorized beam expanders MEX

High-power motorized beam expanders MEX-HP

Variable laser beam expanders and reducers VEX

Fixed ratio laser beam expanders FEX

Motorized laser power attenuators LPA

Advanced motorized laser power attenuators LPA-A

Manual laser power attenuators LPA-M

Manual 4 axis translation stage

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Compact motorized beam expanders MEX

Motorized laser beam expanders MEX series are used to increase the laser beam diameter and adjust divergence. Standard or custom-made beam expanders feature a unique mechanical closed loop sliding-lens design ensuring high pointing stability and minimal dimensions.

These variable magnification (zoom) beam expanders and reducers are designed for required wavelength and each type of our beam expanders have motorized divergence adjustability.

Main features

- Highest beam pointing stability (< 0,1 mrad)
- All-in-one design with integrated controller
- Two lens simultaneous movement assuring no misfocus
- Absolute encoder (both lenses)
- Adjustment time <1s (all magnifications)
- Fused silica optical elements
- No homing after switching on/off
- Diffraction limited performance for all magnifications

Application examples

- Precise laser micromachining
- Life sciences
- Research

Standard specifications

MOTORIZED BEAM EXPANDERS SPECIFICATIONS	
Adjustment	Motorized
Divergence	Adjustable
Clear input aperture	11,5 mm
Lens material	UVFS
Transmission	>97%
Controller	Integrated
Control interface	USB or RS232
Housing material	Black anodized aluminum
LIDT	3 J/cm^2 (10 ns @ 355nm) 5 J/cm^2 (10 ns @ 532 nm) 10 J/cm^2 (10 ns @ 1064 nm)

*Custom design available

Standard products

ITEM MODEL	EXPANSION	CLEAR INPUT APERTURE	CLEAR OUTPUT APERTURE	RECOMMENDED MAX. INPUT BEAM SIZE, 1/E^2	DIMENSIONS (H X W X L)	WAVELENGTH	POINTING STABILITY	SKU
MEX13	1,0x - 3,0x continuous	11,5 mm	23 mm	ø7 mm - 1x ø6 mm - 3x	45 x 45 x 140 mm	343-355 nm	< 0,2 mrad	6857
						343-355 nm	< 0,5 mrad	6838
						515-532 nm	< 0,2 mrad	6856
						515-532 nm	< 0,5 mrad	6833
						1030-1064 nm	< 0,5 mrad	6825
						1030-1064 nm	< 0,2 mrad	6855
						343-355 + 515-532 nm	< 0,2 mrad	6928
						343-355 + 515-532 nm	< 0,5 mrad	6131
						515-532 + 1030-1064 nm	< 0,5 mrad	6836
						515-532 + 1030-1064 nm	< 0,2 mrad	6927
MEX18	1,0x - 8,0x continuous	11,5 mm	38 mm	ø7 mm - 1x ø5 mm - 5x ø3 mm - 8x	45 x 45 x 237 mm	343-355 nm	< 0,5 mrad	6121
						350-800 nm	< 0,5 mrad	9235
						515-532 nm	< 0,5 mrad	6842
						1030-1064 nm	< 0,5 mrad	6841
						343-355 + 515-532 nm	< 0,5 mrad	6844
						515-532 + 1030-1064 nm	< 0,5 mrad	6843

Mounting options for motorized beam expanders MEX

MOUNTING OPTION	FOR BEAM HEIGHT OF	SKU	PRICE
Manual 4 axis translation stage MSTAGE	27 mm (±2 mm travel)	12571	580 €

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High-power motorized beam expanders MEX-HP

High power motorized laser beam expanders MEX series are used to increase the laser beam diameter and adjust divergence. The optical design is dedicated for high power ultrafast femtosecond laser applications. These magnification (zoom) beam expanders are designed for required wavelength and each type of our beam expanders has motorized divergence adjustability. Standard or custom-made beam expanders feature a unique mechanical closed loop sliding-lens design ensuring high pointing stability and minimal dimensions.

Main features

- High power optical design (up to 200 W @ 1030 nm, 500 fs, 1 Mhz)
- No internal reflections on optical elements
- Highest beam pointing stability < 0,2 mrad
- All-in-one design with an integrated controller
- Two lens simultaneous movement assuring no misfocus
- Absolute encoder (both lenses)
- Fused silica optical elements
- Diffraction limited performance for all magnifications

Application examples

- Precise laser micromachining
- High power laser beam management
- Research

Standard specifications

HIGH POWER MOTORIZED LASER BEAM EXPANDERS SPECIFICATIONS	
Adjustment	Motorized
Divergence	Adjustable
Lens material	UVFS
Transmission	>97% (MEX13-HP), >95% (MEX15-HP)
Control interface	USB or RS232
Controller	Integrated
Housing material	Black anodized aluminum
Max. laser power	Up to 200 W @ 1030 nm, 500 fs, 1 MHz
LIDT	3 J/cm² (10 ns @ 355nm) 5 J/cm² (10 ns @ 532 nm) 10 J/cm² (10 ns @ 1064 nm)

*Custom design available

Standard products

ITEM MODEL	EXPANSION	CLEAR INPUT APERTURE	CLEAR OUTPUT APERTURE	RECOMMENDED MAX. INPUT BEAM SIZE, 1/E²	DIMENSIONS (H X W X L)	WAVELENGTH	POINTING STABILITY	SKU
MEX13-HP	1,0x - 3,0x continuous	11,5 mm	28 mm	ø7 mm - 1x ø6 mm - 3x	60 x 60 x 207 mm	343-355 nm	< 0,5 mrad	9242
						343-355 nm	< 0,2 mrad	9243
						515-532 nm	< 0,5 mrad	9240
						515-532 nm	< 0,2 mrad	9241
						1030-1064 nm	< 0,5 mrad	9238
						1030-1064 nm	< 0,2 mrad	9239
						343-355 + 515-532 nm	< 0,5 mrad	9246
						343-355 + 515-532 nm	< 0,2 mrad	9247
						515-532 + 1030-1064 nm	< 0,5 mrad	9244
						515-532 + 1030-1064 nm	< 0,2 mrad	9245
MEX15-HP	1,0x - 5,0x continuous	11,5 mm	24 mm	ø7 mm - 1x ø3,3 mm - 5x	65 x 65 x 250 nm	343-355 nm	< 0,5 mrad	9252
						515-532 nm	< 0,5 mrad	9250
						1030-1064 nm	< 0,5 mrad	9248
						343-355 + 515-532 nm	< 0,5 mrad	9256
						515-532 + 1030-1064 nm	< 0,5 mrad	9254

Mounting options for high-power motorized beam expanders MEX-HP

MOUNTING OPTION	FOR BEAM HEIGHT OF	SKU	PRICE
Manual 4 axis translation stage MSTAGE-HP (Additional adapter included)	27 mm (±2 mm travel)	12571	580 €

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Variable beam expanders VEX and reducers VRE

4Lasers introduces variable manual beam expanders VEX series used to increase or decrease the laser beam diameter. Standard or custom-made laser beam expanders for the UV, visible, and NIR spectral ranges feature a unique mechanical sliding-lens design, ensuring a high pointing stability and minimal dimensions. These variable magnification (zoom) beam expanders are designed for the required wavelength and each type of our beam expanders have divergence adjustability.
All optical elements of beam expanders are made of fused silica with high LIDT coatings and provide stable and reliable performance even when using them with high power lasers. Large input and output apertures allow the optical beam expanders to produce diffraction limited expanded (or reduced) beams for a wide range of input beams.

Main features

- Highest beam pointing stability (< 0.5 mrad)
- Fused silica optical elements
- Grease free mechanical design
- Sliding lens design
- Diffraction limited performance for all magnifications

Application examples

- Laser micromachining
- Research

Standard specifications

VARIABLE BEAM EXPANDERS AND REDUCERS SPECIFICATIONS	
Adjustment	Manual
Divergence	Adjustable
Pointing stability	< 0,5 mrad, < 1 mrad (VEX15-HP)
Lens material	UVFS
Transmission	>97%, >95% (VEX15-HP)
LIDT	3 J/cm^2 (10 ns @ 355nm) 5 J/cm^2 (10 ns @ 532 nm) 10 J/cm^2 (10 ns @ 1064 nm)

Standard products

ITEM MODEL	EXPANSION	CLEAR INPUT APERTURE	CLEAR OUTPUT APERTURE	RECOMMENDED MAX. INPUT BEAM SIZE, 1/E^2	DESIGN	DIMENSIONS	MOUNTING OPTIONS	WAVELENGTH	SKU
VEX13	1,0x - 3,0x continuous	11 mm	23,5 mm	ø7 mm - 1x ø5 mm - 3x	Standard	ø42 x 110 mm	M30x1 external, SM1 internal, ø38,1 mm [1,5"], T-mount (M42x0,75)	343-355 nm	4357
								515-532 nm	6987
								1030-1064 nm	6985
								343-355 + 515-532 nm	6991
								515-532 + 1030-1064 nm	6990
VEX18	1,0x - 8,0x continuous	11 mm	40 mm	ø7 mm - 1x ø5,3 mm - 5x ø3,3 mm - 8x	Standard	ø53 x 203 mm	SM2, ø50,8 mm [2']	343-355 nm	6455
								515-532 nm	6725
								1030-1064 nm	6992
								343-355 + 515-532 nm	6456
								515-532 + 1030-1064 nm	6994
VEX15-HP	1,0x - 5,0x continuous	11 mm	24 mm	ø7 mm - 1x ø3,3 mm - 5x	High power	ø58 x 250 mm	T-mount, SM2, ø50,8 mm [2"]	343-355 + 515-532 nm	9279
								515-532 + 1030-1064 nm	9273
VRE13	0,33x - 1,0x continuous	22 mm	11 mm	ø15 mm - 0,33x ø7 mm - 1x	Standard	ø42 x 110 mm	M30x1 external, SM1 internal, ø38,1 mm [1,5"], T-mount (M42x0,75)	343-355 nm	6997
								515-532 nm	6995
								343-355 + 515-532 nm	7000
								515-532 + 1030-1064 nm	6999

Mounting options for variable beam expanders VEX

MOUNTING OPTION	FOR BEAM HEIGHT OF	SKU
Fixed post mounting set	100-125 mm (4" – 5")	9336
Fixed post mounting set	76,2 mm (3")	9337
X-Y adjustable (3 adjusters) kinematic mount with post holder, D50,8mm option	76,2 mm (3")	9348
X-Y adjustable (3 adjusters) kinematic mount with post holder, SM2 option	76,2 mm (3")	9349
X-Y adjustable (3 adjusters) kinematic mount with post holder, D50,8mm option	100-125 mm (4" – 5")	9350
X-Y adjustable (3 adjusters) kinematic mount with post holder, SM2 option	100-125 mm (4" – 5")	9351

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Fixed ratio beam expanders FEX

Fixed ratio beam expanders FEX series are used to increase the laser beam diameter. The FEX model diversity cover the UV, visible and NIR spectral ranges.
These compact beam expanders are designed for required wavelength and have divergence adjustability.

All optical elements of beam expanders are made of fused silica with high LIDT coatings and provide a stable and reliable performance even using them with high power lasers.

Main features

- Divergence adjustment
- Galilean optical design
- UVFS optical elements
- Grease free mechanical design
- Wide wavelength adoption - 200 nm to 2 µm

Application examples

- Laser material processing
- Medical
- Research

Standard specifications

FIXED RATIO BEAM EXPANDER SPECIFICATIONS	
Clear output aperture	23 mm
Divergence	Adjustable
Outer Diameter	30 mm
Mounting options	SM1 (male, female), ø30 mm
Transmission	>98%
LIDT	3 J/cm^2 (10 ns @ 355nm) 5 J/cm^2 (10 ns @ 532 nm) 10 J/cm^2 (10 ns @ 1064 nm)

*Custom design available

Standard products

ITEM MODEL	EXPANSION	CLEAR INPUT APERTURE	RECOMMENDED MAX. INPUT BEAM SIZE, 1/E^2	CLEAR OUTPUT APERTURE	MECHANICAL LENGTH	WAVELENGTH	SKU
FEX-2	2 x	11,5 mm	ø7 mm	23 mm	65 mm	343-355 nm	7723
						515-532 nm	7725
						1030-1064 nm	7727
						1030-1064 + 515-532 nm	11169
FEX-3	3 x	11,5 mm	ø5,3 mm	23 mm	65 mm	343-355 nm	7733
						515-532 nm	7731
						1030-1064 nm	7729
						1030-1064 + 515-532 nm	11170
FEX-4	4 x	11,5 mm	ø4 mm	23 mm	90 mm	343-355 nm	7735
						515-532 nm	7737
						1030-1064 nm	7739
						1030-1064 + 515-532 nm	11171
FEX-5	5 x	11,5 mm	ø3,2 mm	23 mm	95 mm	343-355 nm	7741
						515-532 nm	7743
						1030-1064 nm	7746
						1030-1064 + 515-532 nm	11172
FEX-8	8 x	7 mm	ø2 mm	23 mm	104 mm	343-355 nm	7749
						515-532 nm	7752
						1030-1064 nm	7754
						1030-1064 + 515-532 nm	11173

Mounting accessories for fixed ratio beam expanders FEX

RECOMMENDED ACCESSORY	FOR BEAM HEIGHT OF	SKU
Adapter SM1 male to M30 X 1 male	-	9338
Adapter SM1 female to C-mount	-	9339
Adapter SM1 female to M30 X 1 male	-	9340
X-Y adjustable (3 adjusters) kinematic mount with post holder	50,8 mm (2")	9341
X-Y adjustable (3 adjusters) kinematic mount with post holder	76,2 - 100 mm (3" – 4")	9342

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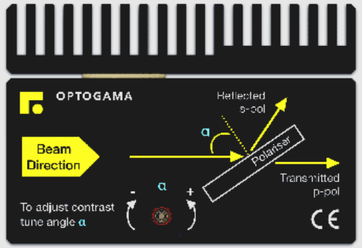
Motorized laser power attenuators LPA



4Lasers designs and manufactures motorized laser power attenuators for laser power control.
LPA could be produced for use in the UV, visible, and NIR spectral ranges from 250 nm to 2000 nm. These devices feature a large clear aperture dedicated for considerable beam application.
All optical elements of these laser power attenuators are made for high LIDT and provide a stable and reliable performance even when using them with high power lasers in industrial applications.
Secondary laser beam from the laser power attenuator unit is rejected out through the output window to an external beam dump (optional) in order to avoid any thermal effects or stress in the housing of the LPA device. Exit laser beam has a 2,25 mm beam offset.

Main features

- Robust design
- Damage threshold up to 10J/cm^2 (10 ns @ 1064 nm)
- Adjustable polarizer angle ±2 deg
- Clear aperture 18 mm
- External controller included
- Intuitive software
- 175,543 steps in full rotation
- ± 0,05 % laser power accuracy
- Adjustment time <0,2 sec (min to max)

Application examples

- Laser machining
- Research
- Laser power control and attenuation

Standard specifications

MOTORIZED LASER POWER ATTENUATOR SPECIFICATIONS	
Input and output clear aperture	18 mm
Dimensions (H x W x L)	58 x 36 x 74,5 mm | 58 x 51,5 x 74,5 mm with beam dump
Control interface	USB and RS232
Controller	External

*Custom design available

Standard products

ATTENUATION RANGE	LIDT	WAVELENGTH	SKU
0,5 - 95 %	2 J/cm^2 (10 ns @ 266 nm)	257 nm	9326
		266 nm	9327
0,2 - 96 %	3 J/cm^2 (10 ns @ 355nm)	343 nm	9264
		355 nm	9263
0,1 - 98 %	5 J/cm^2 (10 ns @ 532 nm)	515 nm	9262
		532 nm	9260
	10 J/cm^2 (10 ns @ 1064 nm)	1030 nm	9259
		1064 nm	9258

Accessories for laser power attenuators LPA

RECOMMENDED ACCESSORY	FOR BEAM HEIGHT OF	SKU
Post mounting set	50 mm or 76 mm (2" or 3")	9343
Post mounting set	73 – 125 mm (2,9" – 5")	9344
Dedicated beam dump with protective window	-	9345

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Advanced motorized laser power attenuators LPA-A

Advanced laser power attenuator LPA-A is a compact motorized device for laser power control with an integrated controller and absolute encoder. The LPA-A is produced in the UV, visible and NIR spectral ranges, from 250 nm to 2000 nm.
This device is combined with the unique mechanical design which ensures repeatability and high stability of performance.

All optical components of the LPA-A are made for high LIDT and provide a stable and reliable performance even when using them with high power lasers in industrial applications.
A secondary laser beam from the laser power attenuator unit can be rejected to an external beam dump. The beam dump is used for avoiding any thermal effects or stress in the housing of the LPA-A device.

Main features

- Integrated controller
- Absolute encoder - no homing required
- High accuracy - ±0,004 deg (less than ± 0,01 % of laser power)
- Resolution - 0,002 deg, 7,4 arcsec, 0,035 mrad
- Fast adjustment - less than 0,2 sec (min to max)
- High damage threshold: up to 10J/cm^2 (10 ns @ 1064 nm)
- Adjustable polarizer angle

Application examples

- Precise laser micromachining
- Laser power stabilization
- Research

Standard specifications

ADVANCED VARIABLE MOTORIZED LASER POWER ATTENUATOR SPECIFICATIONS	
Input and output clear aperture	15 mm
Controller	Integrated
Dimensions (H x W x L)	86 x 47 x 58 mm
Control interface	USB or RS232

Standard products

ATTENUATION RANGE	LIDT	WAVELENGTH	SKU
0,5 - 95 %	2 J/cm^2 (10 ns @ 266 nm)	257 nm	11809
		266 nm	11810
	5 J/cm^2 (10 ns @ 532 nm)	515+1030 nm	14898
0,2 - 96 %	3 J/cm^2 (10 ns @ 355nm)	343 nm	11808
		355 nm	11805
0,1 - 98 %	5 J/cm^2 (10 ns @ 532 nm)	515 nm	11807
		532 nm	11806
	10 J/cm^2 (10 ns @ 1064 nm)	1030 nm	11804
		1064 nm	11708

Accessories for laser power attenuators LPA-A

MOUNTING OPTION	FOR BEAM HEIGHT OF	SKU
Post mounting set	76,2 - 100 mm (3" – 4")	9346
Post mounting set	57 - 65 mm (2,2" – 2,6")	9347
Dedicated beam dump with protective window	-	9345

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Manual laser power attenuators LPA-M

4Lasers designs and manufactures industrial grade manual control laser power attenuators for use in the UV, visible, and NIR spectral ranges, from 240 nm to 2000 nm.

All optical elements of these laser power attenuators are made for high LIDT and provide a stable and reliable performance even when using them with high power lasers in industrial applications.

Main features

- Industrial robust design
- Wide wavelength adoption 240 nm - 2 µm
- Cost effective
- Suitable for high power industrial lasers

Application examples

- Laser micromachining
- Laser power attenuation
- Research

Standard specifications

VARIABLE MANUAL LASER POWER ATTENUATOR SPECIFICATIONS	
Adjustment	Manual
Input and output clear aperture	8 mm
Dimensions (H x W x L)	57 x 72 x 105 mm

*Custom design available

Standard products

ATTENUATION RANGE	LIDT	WAVELENGTH	SKU
0,5-95 %	2 J/cm² (10 ns @ 266 nm)	257 nm	7896
		266 nm	7887
0,2-96 %	3 J/cm² (10 ns @ 355nm)	343 nm	7885
		355 nm	7886
0,1-98 %	5 J/cm² (10 ns @ 532 nm)	515 nm	7673
		532 nm	7672
	10 J/cm² (10 ns @ 1064 nm)	1030 nm	7671
		1064 nm	7670

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Manual 4 axis translation stage

MSTAGE is an industrial mounting solution for MEX compact series beam expanders.
This 4-axis manual translation stage contains a locking mechanism preserving the aligned position. It features sapphire contact pads determining long-lasting and smooth micro screw operation.

There are four M6 x 0,25 micro screws for adjusting platform's pitch, yaw, Y and Z axis.
Two micro screws control platform's pitch and Z axis, while another two-control yaw and Y axis. All of them can be adjusted with 2 mm HEX screwdriver.

Main features

- Sapphire contact pads
- Platform's locking mechanism
- Industrial design
- 4 axis fine adjustment
- Maximum load up to 1,5 kg

Application examples

- Motorized beam expander MEX fine adjustment
- Precise alignment of optical components and other laser accessories

Standard specifications

SPECIFICATIONS	
Travel range	Y axis: 8 mm (±4 mm)
	Z axis: 4 mm (±2 mm)
	Yaw: ±5.5 deg
	Pitch: ±2.5 deg
Resolution	Y axis: 8 mm (±4 mm)
	Z axis: 145 µm/rev
	Yaw: 0.018 deg/rev
	Pitch: 0.010 deg/rev
Maximum load	Mounted horizontally 1.5 kg
	Mounted vertically 0.6 kg

Standard products

MODEL	DIMENSION (W X H X L)	WEIGHT	HEX SCREWDRIVER	SKU
Mstage	75 x 28 x 100 mm	27 mm (±2 mm travel)	3mm, 2mm, 1.5 mm HEX	12571

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