

4 LASERS

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

Fixed ratio laser beam expanders FEX

Manual laser power attenuators LPA-M

Motorized polarization rotator MRO

High-power motorized beamexpanders MEX-HP

Motorized laser power attenuators LPA

Laser power attenuators LPA-OEM

Manual 4 axis translation stage

Variable laser beam expanders, reducers VEX

Advanced motorized laser power attenuators LPA-A

Flat top converter FTC

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4 LASERS

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.

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

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 @ 265nm) 5 J/cm ² (10 ns @ 532 nm) 10 J/cm ² (10 ns @ 1064 nm)

*Custom design available

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	47 mm - 1x 46 mm - 3x	45 x 45 x 140 mm	343-355 nm	< 0.2 mrad	4857
						343-355 nm	< 0.3 mrad	4858
						515-532 nm	< 0.2 mrad	4859
						515-532 nm	< 0.3 mrad	4853
						1030-1064 nm	< 0.5 mrad	4855
						1030-1064 nm	< 0.7 mrad	4855
						343-355 + 515-532 nm	< 0.2 mrad	4959
						343-355 + 515-532 nm	< 0.3 mrad	4131
						515-532 + 1030-1064 nm	< 0.2 mrad	4957
						515-532 + 1030-1064 nm	< 0.3 mrad	4131
MEX18	1.0x - 8.0x continuous	11.5 mm	38 mm	47 mm - 1x 45 mm - 5x 43 mm - 8x	45 x 45 x 237 mm	343-355 nm	< 0.5 mrad	9251
						515-532 nm	< 0.5 mrad	4862
						1030-1064 nm	< 0.5 mrad	4861
						343-355 + 515-532 nm	< 0.5 mrad	4864
						515-532 + 1030-1064 nm	< 0.5 mrad	4863
						515-532 + 1030-1064 nm	< 0.5 mrad	4863

MOUNTING OPTION	FOR BEAM HEIGHT OF	SKU
Manual 4 axis translation stage M5TAGE	27 mm (±2 mm travel)	12571

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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 ultrashort 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

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/cm ² (10 ns @ 265nm) 5 J/cm ² (10 ns @ 532 nm) 10 J/cm ² (10 ns @ 1064 nm)

*Custom design available

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-HP	1.0x - 3.0x continuous	11.5 mm	28 mm	47 mm - 1x 46 mm - 3x	40 x 40 x 207 mm	343-355 nm	< 0.5 mrad	9262
						343-355 nm	< 0.2 mrad	9263
						515-532 nm	< 0.5 mrad	9265
						515-532 nm	< 0.2 mrad	9261
						1030-1064 nm	< 0.5 mrad	9259
						1030-1064 nm	< 0.2 mrad	9259
						343-355 + 515-532 nm	< 0.5 mrad	9264
						343-355 + 515-532 nm	< 0.2 mrad	9267
						515-532 + 1030-1064 nm	< 0.5 mrad	9266
						515-532 + 1030-1064 nm	< 0.2 mrad	9265
MEX15-HP	1.0x - 5.0x continuous	11.5 mm	24 mm	47 mm - 1x 43.3 mm - 5x	45 x 45 x 292 mm	343-355 nm	< 0.5 mrad	9252
						515-532 nm	< 0.5 mrad	9250
						1030-1064 nm	< 0.5 mrad	9268
						343-355 + 515-532 nm	< 0.5 mrad	9256
						515-532 + 1030-1064 nm	< 0.5 mrad	9254
						515-532 + 1030-1064 nm	< 0.5 mrad	9254

MOUNTING OPTION	FOR BEAM HEIGHT OF	SKU
Manual 4 axis translation stage M5TAGE-HP (Additional adapter included)	27 mm (±2 mm travel)	12571

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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 allowed 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

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)
	8 J/cm ² (10 ns @ 532 nm)
	10 J/cm ² (10 ns @ 1064 nm)

Standard products		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	ø62 x 110 mm	M30x1 external, SM1 internal, ø38.1 mm (1.5"), T-mount (M42x0.75)							343-355 nm	4267		
														515-532 nm	4987		
														1030-1064 nm	4985		
														343-355 + 515-532 nm	4991		
														515-532 + 1030-1064 nm	4990		
VEX18	1.0x - 8.0x continuous	11 mm	40 mm	ø7 mm - 1x ø5.3 mm - 5x ø3.2 mm - 8x	Standard	ø53 x 203 mm	SM2, ø50.8 mm (2")							343-355 nm	4495		
														515-532 nm	4725		
														1030-1064 nm	4992		
														343-355 + 515-532 nm	4456		
														515-532 + 1030-1064 nm	4994		
VEX15-HP	1.0x - 5.0x continuous	11 mm	26 mm	ø7 mm - 1x ø5.3 mm - 5x	High power	ø58 x 255 mm	T-mount, SM2, ø50.8 mm (2")							343-355 + 515-532 nm	9279		
														515-532 + 1030-1064 nm	9278		
														343-355 nm	4997		
														515-532 nm	4995		
														343-355 + 515-532 nm	9280		
VRE13	0.33x - 1.0x continuous	22 mm	11 mm	ø15 mm - 0.33x ø7 mm - 1x	Standard	ø62 x 110 mm	M30x1 external, SM1 internal, ø38.1 mm (1.5"), T-mount (M42x0.75)							343-355 nm	4267		
														515-532 nm	4987		
														1030-1064 nm	4985		
														343-355 + 515-532 nm	4991		
														515-532 + 1030-1064 nm	4990		

Mounting options for variable beam expanders VEX

MOUNTING OPTION		FOR BEAM HEIGHT OF		SKU	
Fixed post mounting set		100-120 mm (4" - 5")		9336	
Fixed post mounting set		76.2 mm (3")		9337	
X-Y adjustable (2 adjusters) kinematic mount with post holder, C10,8mm option		76.2 mm (3")		9346	
X-Y adjustable (2 adjusters) kinematic mount with post holder, SM2 option		76.2 mm (3")		9349	
X-Y adjustable (2 adjusters) kinematic mount with post holder, C10,8mm option		100-120 mm (4" - 5")		9350	
X-Y adjustable (2 adjusters) kinematic mount with post holder, SM2 option		100-120 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

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		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								
FEX-3	3 x	11.5 mm	ø5.3 mm	23 mm	65 mm								
FEX-4	4 x	11.5 mm	ø6 mm	23 mm	90 mm								
FEX-5	5 x	11.5 mm	ø6.2 mm	23 mm	95 mm								
FEX-8	8 x	7 mm	ø7 mm	23 mm	104 mm								

Mounting accessories for fixed ratio beam expanders FEX

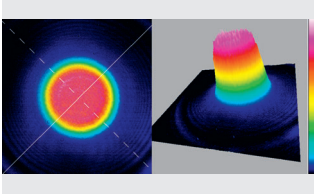
RECOMMENDED ACCESSORY		FOR BEAM HEIGHT OF		SKU	
Adapter SM1 male to M30 X 1 male		-		9339	
Adapter SM1 female to C-mount		-		9340	
X-Y adjustable (2 adjusters) kinematic mount with post holder		50.8 mm (2")		9341	
X-Y adjustable (2 adjusters) kinematic mount with post holder		76.2 - 100 mm (3" - 4")		9342	

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Flat top converter FTC



Flat top converter unit is all in one motorised solution for a Gaussian beam transformation to a Flat-Top (Top Hat) beam. Any focusing element is needed. The beam profile remains Flat-Top shape along optical axis. The device consist of quartz wave-plate, space-variant wave-plate and a high contrast polariser. The FTC is produced in the UV, visible and NIR spectral ranges, from 250 nm to 2000 nm.

All optical components of the FTC are made for high LIDT and provide stable and reliable performance even using them with high power lasers in industrial applications. A secondary laser beam from Flat top converter 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 FTC device.

- Main features**
- Quick change between Gaussian and Flat-top beam
 - The beam profile remains Flat-Top shape along optical axis
 - Integrated controller
 - Designed according your laser specs.
 - Clear aperture up to 15 mm
 - Quick switching time ~ 0.2 sec
 - High damage threshold up to 10J/cm² (10 ns @ 1064 nm)
 - Conversion efficiency up to 70% (while on Flat-Top mode)
- Application examples**
- Precise laser micromachining
 - Life sciences
 - Research

Standard specifications

FLAT TOP CONVERTER FTC SPECIFICATIONS	
Input and output clear aperture	nds on waveplate
Conversion efficiency and transmission	Up to 70% (while on Flat-Top beam mode) No less than 97.5% (Gaussian beam mode)
LIDT coating	>10 J/cm ² (10 ns @ 1064 nm)
Controller	USB and RS232
Control interface	External
Dimensions (H x W x L)	100 x 120 x 42.5 mm FTC 60 x 60 x 40 mm FTC with beam dump (BC-d)

*Custom design available

Standard products

MODEL	APERTURE	WAVELENGTH	ADJUSTMENT	TYPE	CONTROL INTERFACE	TYPICAL APPLICATION	SKU
FTC	ø 6 mm	1030 nm	Motorised	DDE	USB or RS232	Flat top converter	19750
	ø 6 mm	515 nm	Motorised	DDE	USB or RS232	Flat top converter	19751
	ø 3 mm	1030 nm	Motorised	DDE	USB or RS232	Flat top converter	19752
	ø 3 mm	515 nm	Motorised	DDE	USB or RS232	Flat top converter	19753
	ø 6 mm	1064 nm	Motorised	DDE	USB or RS232	Flat top converter	19754
	ø 3 mm	1064 nm	Motorised	DDE	USB or RS232	Flat top converter	19755
	ø 6 mm	532 nm	Motorised	DDE	USB or RS232	Flat top converter	19756
	ø 3 mm	532 nm	Motorised	DDE	USB or RS232	Flat top converter	19757



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Motorized polarization rotator MRO



Rotator [MRO] is a compact motorised device for laser polarisation control. The MRO is produced in the UV, visible and NIR spectral ranges, from 250 nm to 2000 nm. The device has external controller.

All optical components of the MRO are made for high LIDT and provide stable and reliable performance even using them with high power lasers in industrial applications.

- Main features**
- Compact design
 - High resolution - 175543 jsteps in 360 deg rotation
 - High accuracy ~ ±10 jsteps accuracy (± 0.02 deg)
 - Clear aperture ~ 18 mm
 - Fast adjustment - less than 0.2 sec (0 to 45 deg)
- Application examples**
- Flat top or custom laser beam profile shaping
 - Laser micromachining
 - Biophotonics and microscopy

Standard specifications

SPECIFICATIONS	
Travel range	Y axis: 8 mm (ø 4 mm)
	Z axis: 4 mm (ø 2 mm)
Yaw: ±1.5 deg	Pitch: ±2.5 deg
	Resolution
Y axis: 8 mm (ø 4 mm)	Z axis: 0.01 deg/rev
	Yaw: 0.018 deg/rev
Pitch: 0.018 deg/rev	Maximum load
	Mounted horizontally 1.5 kg
Mounted vertically 0.5 kg	Suitable optics
	ø25.4 mm (1.013, 3 x 4 mm thickness)

Standard products

CLEAR APERTURE	CONTROL INTERFACE	WAVEPLATE	RETARDATION	LIDT	SKU
18 mm	USB or RS232	1064 nm	L/2	10 J/cm ² (10 ns @ 1064 nm)	19706
		1030 nm	L/2	10 J/cm ² (10 ns @ 1030 nm)	19712
		507 nm	L/2	5 J/cm ² (10 ns @ 507 nm)	19705
		515 nm	L/2	5 J/cm ² (10 ns @ 515 nm)	19700
		355 nm	L/2	3 J/cm ² (10 ns @ 355 nm)	19702
		343 nm	L/2	3 J/cm ² (10 ns @ 343 nm)	19701
		266 nm	L/2	2 J/cm ² (10 ns @ 266 nm)	19703
		257nm	L/2	2 J/cm ² (10 ns @ 257 nm)	19704
		1064 nm	L/A	10 J/cm ² (10 ns @ 1064 nm)	19708
		1030 nm	L/A	10 J/cm ² (10 ns @ 1030 nm)	19479
		507 nm	L/A	5 J/cm ² (10 ns @ 507 nm)	19709
		515 nm	L/A	5 J/cm ² (10 ns @ 515 nm)	19478
		355 nm	L/A	3 J/cm ² (10 ns @ 355 nm)	19477
		343 nm	L/A	3 J/cm ² (10 ns @ 343 nm)	19477
		266 nm	L/A	2 J/cm ² (10 ns @ 266 nm)	19711
		257nm	L/A	2 J/cm ² (10 ns @ 257 nm)	19710
		without optics	None	None	19707



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