Motorized Attenuators – Solution for Industrial Applications

Description

Altechna offers four types of laser beam intensity attenuators for high energy applications:

- CA 8 mm – Compact version
- CA 18 mm – Maxi Reflection/Transmission version
- CA 18 mm – Maxi Transmission Collinear version
- CA 18 mm – Maxi Cube version

PowerXP attenuators are the evolution of well known time-tested and industry-adopted Altechna Watt Pilot attenuators. New generation PXP units have upgraded belt-driven rotator mechanism for quick and precise laser beam intensity control and also brand new electronics and control driver for more connectivity options and reliable long-distance communication.

PowerXP motorized attenuators are a reliable solution for industrial applications. Each attenuator includes motorized rotating quartz λ/2 phase waveplate, optically aligned to a single/dual thin film polarizers or polarizing beamsplitting cube which separates the input beam into individual s-polarized and p-polarized parallel or perpendicular output beams.

Special PowerXP Transmission Collinear version includes an additional uncoated UVFS window positioned at Brewster angle after the polarizer to compensate the lateral beam shift caused by polarizing plate and guarantees less than 100 µm radial beam displacement between input and output laser beam for ultra-precise applications.

The intensity ratio of separated beams is continuously tuned by rotating the waveplate. S-polarized beam output can be used for high purity s-polarized beam requiring applications and p-polarized beam output for power control and attenuation applications.

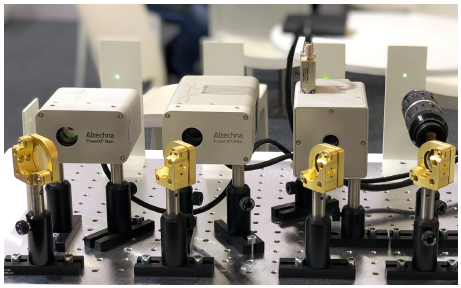
High energy applications compatible optics, fast rotation speed of PowerXP Maxi version, compensated beam displacement output of Maxi Collinear version, convenient polarization separation angle of Maxi Cube version and small footprint of Compact version makes PowerXP motorized attenuators a go-to solution for power control, attenuation, and beam-splitting in demanding laser processing applications.

Features

- User-friendly software interface, USB, RS232, Ethernet connection
- Divides laser beam into two - s-pol and p-pol beams of the adjustable intensity ratio
- Low dispersion optics for ultrashort and high energy laser pulses
- Ideal for integration into other systems
- Time between min and max attenuation less than 0.2 sec

Optional model without attenuating optics set

- A PowerXP Attenuator can also be ordered as a separate motorized waveplate rotator based on the PowerXP Maxi model without attenuating optics set and a polarizer holder
- A motorized waveplate rotator without attenuating optics set is also available on request



Model comparison

	COMPACT	MAXI TRANSMISSION	MAXI COLLINEAR	MAXI REFLECTION	MAXI CUBE
Optimization type	Transmission	Transmission (T model)	Transmission (CL model)	Reflection (R model)	Transmission and Reflection
Clear aperture, mm	Ø8	Ø18	Ø18	Ø18	Ø18
Recommended maximum input beam diameter at $1/e^2$, mm	Ø5	Ø12	Ø12	Ø12	Ø12
Damage threshold @ 1064 nm, 10 ns, 10 Hz	Up to 20 J/cm^2	Up to 10 J/cm^2	Up to 10 J/cm^2	Up to 10 J/cm^2	Up to 10 J/cm^2
Dimensions H x L x W, mm	35 x 55 x 60	56 x 99 x 90	56 x 144 x 90	56 x 99 x 90	56 x 82 x 90
Time between min and max attenuation	<0.2 sec	<0.2 sec	<0.2 sec	<0.2 sec	<0.2 sec
Steps between min and max attenuation	14400	24000	24000	24000	24000
Resolution	<11.25 arcsec/step	<7 arcsec/step	<7 arcsec/step	<7 arcsec/step	<7 arcsec/step
Maximum power transmission	T_{max} >99% at p-pol output	T_{max} >95% at p-pol output	T_{max} >95% at p-pol output	T_{max} >99% at s-pol output	T_{max} >97% at p-pol output T_{max} >99% at s-pol output
Maximum power blocking	T_{min} <0.1% at p-pol output	T_{min} <0.5% at p-pol output	T_{min} <0.5% at p-pol output	T_{min} <0.3% at s-pol output	T_{min} <0.3% at p-pol output T_{min} <3% at s-pol output
***Optional attenuation range**	T_{max} >99.7%, T_{min} <4% at s-pol beam dump output	T_{max} >99.5%, T_{min} <5% at s-pol beam dump output	T_{max} >99.5%, T_{min} <5% at s-pol beam dump output	T_{max} >95%, T_{min} <0.5% at p-pol output	

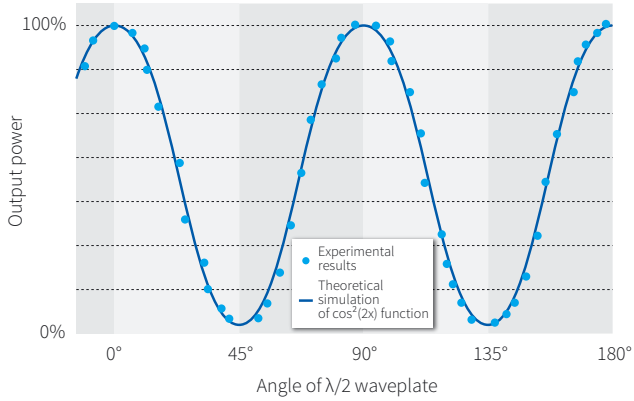


Figure 1. Typical attenuator output power control using rotating waveplate and fixed position polarizer.

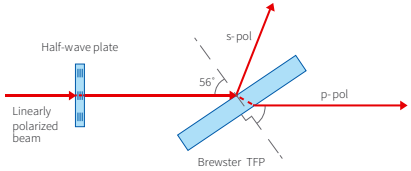
Stage	Average power difference, %	Max power difference @ 250 mW*, %
20%	0.05	0.40
50%	0.1	0.5
80%	0.05	0.40

*Using 250 mW average power output fs pulsed laser.

Figure 2. Measured attenuator power control repeatability values.

NOTE: Each value was calculated from average of 3000 cycles of measured data. At given transmission level, only that particular level data was taken into average value. For example, 20% transmission level data was gathered from power meter when the attenuator was in 20% power level position, during the 0% > 100% and 100% > 0% power level cycles (0% > **20%** > 100% > **20%** > 0% and then repeat for 3000 cycles).

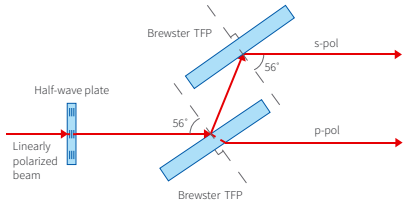
Compact version



Typical items

Wavelength, nm	Configuration	Optimization	Attenuation range at p-pol output (T_{min}-T_{max}) @ CWL	Product ID
343	λ/2 Optically bonded waveplate + High Contrast TFP	Transmission	0.5-96%	PXP-08-0343
355	λ/2 Optically bonded waveplate + High Contrast TFP	Transmission	0.5-96%	PXP-08-0355
515	λ/2 Optically bonded waveplate + High Contrast TFP	Transmission	0.2-99%	PXP-08-0515
532	λ/2 Optically bonded waveplate + High Contrast TFP	Transmission	0.2-99%	PXP-08-0532
1030	λ/2 Optically bonded waveplate + High Contrast TFP	Transmission	0.2-99%	PXP-08-1030
1064	λ/2 Optically bonded waveplate + High Contrast TFP	Transmission	0.2-99%	PXP-08-1064

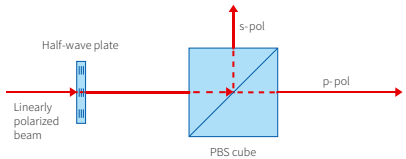
Maxi Reflection version



Typical items

Wavelength, nm	Configuration	Optimization	Attenuation range at s-pol output (T_{min}-T_{max}) @ CWL	Product ID
266	λ/2 Optically bonded waveplate + 2x TFP	Reflection	0.3-99%	PXP-18-R-0266
343	λ/2 Optically bonded waveplate + 2x TFP	Reflection	0.3-99%	PXP-18-R-0343
355	λ/2 Optically bonded waveplate + 2x TFP	Reflection	0.3-99%	PXP-18-R-0355
515	λ/2 Air-spaced waveplate + 2x TFP	Reflection	0.3-99%	PXP-18-R-0515
532	λ/2 Air-spaced waveplate + 2x TFP	Reflection	0.3-99%	PXP-18-R-0532
1030	λ/2 Air-spaced waveplate + 2x TFP	Broadband reflection	0.3-99%	PXP-18-R-1030
1064	λ/2 Air-spaced waveplate + 2x TFP	Reflection	0.3-99%	PXP-18-R-1064

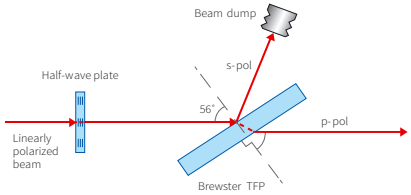
Maxi Cube version



Typical items

Wavelength, nm	Configuration	Attenuation range at p-pol output (T_{min}-T_{max}) @ CWL	Attenuation range at s-pol output (T_{min}-T_{max}) @ CWL	Product ID
355	λ/2 Optically bonded waveplate + Optically bonded PBS cube	1-95%	4-98%	PXP-18-C-0355
515	λ/2 Air-spaced waveplate + Optically bonded PBS cube	1-96%	3-98%	PXP-18-C-0515
532	λ/2 Air-spaced waveplate + Optically bonded PBS cube	1-96%	3-98%	PXP-18-C-0532
1030	λ/2 Air-spaced waveplate + Optically bonded PBS cube	1-96%	3-98%	PXP-18-C-1030
1064	λ/2 Air-spaced waveplate + Optically bonded PBS cube	1-96%	3-98%	PXP-18-C-1064

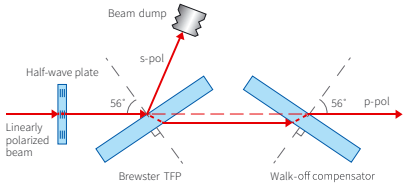
Maxi Transmission version



Typical items

Wavelength, nm	Configuration	Optimization	Attenuation range at p-pol output (T_{min}-T_{max}) @ CWL	Product ID
266	λ/2 Optically bonded waveplate + TFP	Transmission	0.5-95%	PXP-18-T-0266
343	λ/2 Optically bonded waveplate + TFP	Transmission	0.5-95%	PXP-18-T-0343
355	λ/2 Optically bonded waveplate + TFP	Transmission	0.5-95%	PXP-18-T-0355
515	λ/2 Air-spaced waveplate + TFP	Transmission	0.5-95%	PXP-18-T-0515
532	λ/2 Air-spaced waveplate + TFP	Transmission	0.5-95%	PXP-18-T-0532
1030	λ/2 Air-spaced waveplate + TFP	Broadband transmission	0.5-95%	PXP-18-T-1030
1064	λ/2 Air-spaced waveplate + TFP	Transmission	0.5-95%	PXP-18-T-1064

Maxi Collinear version



Typical items

Wavelength, nm	Configuration	Optimization	Attenuation range at p-pol output (T_{min}-T_{max}) @ CWL	Product ID
266	λ/2 Optically bonded waveplate + TFP + compensating window	Transmission	0.5-95%	PXP-18-CL-0266
343	λ/2 Optically bonded waveplate + TFP + compensating window	Transmission	0.5-95%	PXP-18-CL-0343
355	λ/2 Optically bonded waveplate + TFP + compensating window	Transmission	0.5-95%	PXP-18-CL-0355
515	λ/2 Air-spaced waveplate + TFP + compensating window	Transmission	0.5-95%	PXP-18-CL-0515
532	λ/2 Air-spaced waveplate + TFP + compensating window	Transmission	0.5-95%	PXP-18-CL-0532
1030	λ/2 Air-spaced waveplate + TFP + compensating window	Broadband transmission	0.5-95%	PXP-18-CL-1030
1064	λ/2 Air-spaced waveplate + TFP + compensating window	Transmission	0.5-95%	PXP-18-CL-1064

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