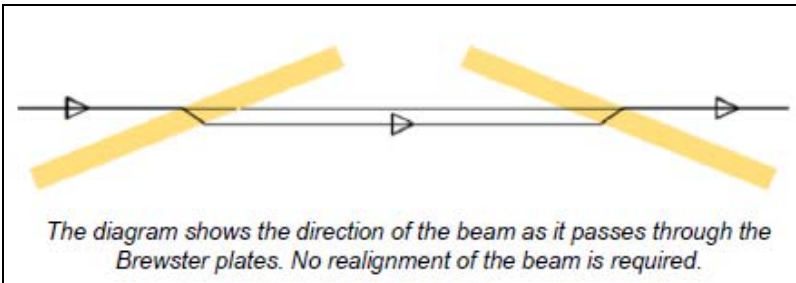


Compact Series Manual CO2 Laser Beam Attenuator

Our manual attenuator allows the user to externally vary the power delivered from the laser. Many lasers only vary their output by pulsing full power on and off, and this does not always provide fine levels of control needed in some materials. This device will give infinitely variable control of the transmitted beam from approximately 6% to 100%. An optional manual attenuator with 'enhanced' coated Brewster plates provides a transmittance to as low as 0.04% up to 98%. Both types of manual attenuator can come as a water-cooled version.

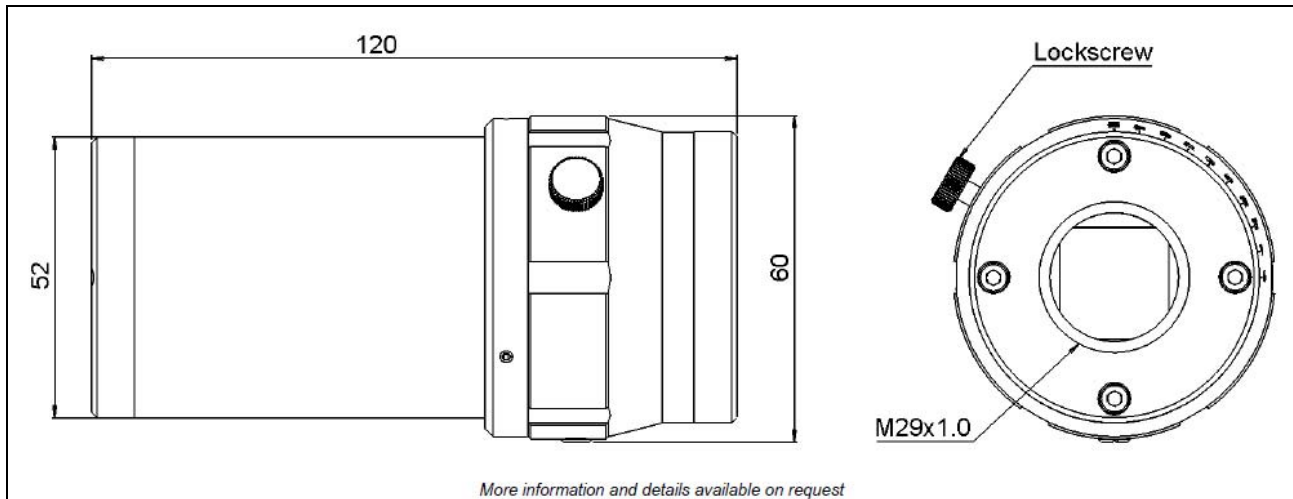
Technical Specifications

Aperture: 19mm
 Power rating: $\leq 500W$
 Cooling: Air & Water-cooled, 6/4 Connector
 Mechanics: Aluminium Alloy, Black Anodised.
 Fitting: M29x1.0, female, both ends
 Transmission: 6% - 100%, 0.04% - 98%
 Optics: Laser grade ZnSe Brewster plates
 Coating: AR/AR 10.6 μm & 9.3/9.6 μm



Manual Attenuator Options

Part No.	Transmittance	Cooling Type
STU-C-MA	6%-100%	Air-cooled
STU-C-MA-WJ	6%-100%	Water-cooled
STU-C-MA-E	0.04%-98%	Air-cooled
STU-C-MA-E-WJ	0.04%-98%	Water-cooled



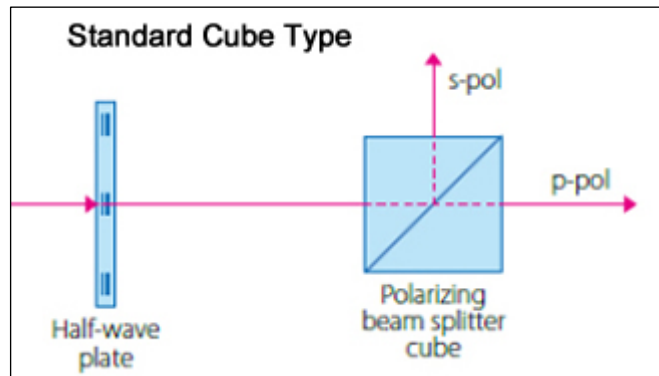
Watt Pilot Motorized Attenuators



Watt Pilot is a laser beam intensity attenuator. Enhanced version contains a rotating quartz $\lambda/2$ phase waveplate and one or two thin film plate polarizers for parallel s-polarized and p-polarizer beam separation, meanwhile Standard version attenuator contains a single polarizing cube beam splitter for orthogonal s-polarized and p-polarized beams separation. The intensity ratio of two separated beams is continuously tuned by rotating the waveplate. Despite the stand-alone look, Watt Pilot motorized attenuator is a compact, rigid and precise device and it can be easily integrated into custom optical systems.

Features

- User-friendly software interface, RS232 connection
- Divides laser beam into two s-pol and p-pol beams of adjustable intensity ratio
- Low dispersion for ultrashort and high energy laser pulses
- Clear aperture: >15 mm



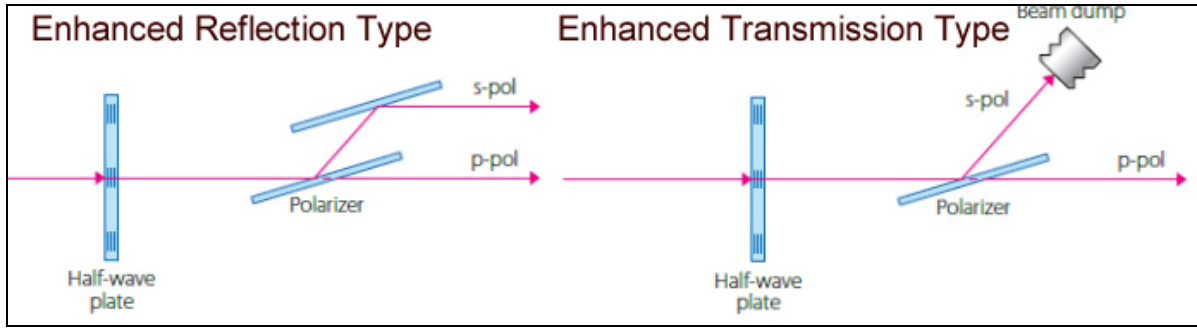
1. Standard Version

Clear aperture	10 mm
Bandwidth	Up to ± 10 nm
Configuration	$\lambda/2$ ZO Waveplate + High Energy Polarizing Cube
Attenuation range (Tmin-Tmax) @ CWL	Up to 0.5-95%
Typical applications	Medium and high power CW and pulsed lasers, LDs
Damage threshold	>20 J/cm ² @ 1064 nm, 10 ns, 10 Hz
Dimensions (H x L x W)	63 x 78 x 91 mm
Time between min and max attenuation	<3 sec
Steps between min and max attenuation	3900

Typical items

Product ID	Wave-length, nm	Bandwidth, nm	Configuration	Optimization	Attenuation range (Tmin-Tmax) @ CWL
STA-SWP-HP-0355	355	± 10	$\lambda/2$ ZO waveplate + High Energy PBS cube	Transmission/Reflection	0.5-95%
STA-SWP-HP-0532	532	± 10	$\lambda/2$ ZO waveplate + High Energy PBS cube	Transmission/Reflection	0.5-95%
STA-SWP-HP-1064	1064	± 10	$\lambda/2$ ZO waveplate + High Energy PBS cube	Transmission/Reflection	0.5-95%

2. Enhanced version

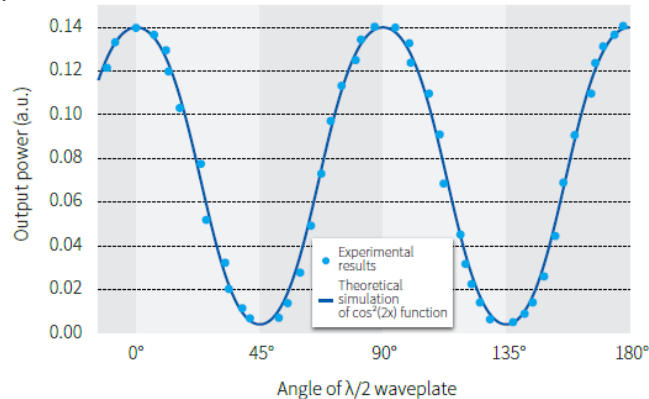


Clear aperture	15mm
Bandwidth	Up to $\pm 10\text{nm}$ ($20 > 10$)
Optimization	Reflection or transmission type
Configuration	$\lambda/2$ ZO Waveplate + 1x or 2x Thin Film Polarizers
Attenuation range (Tmin-Tmax) @ CWL	Up to 0.3-99%*
Typical applications	High power CW and pulsed lasers, LDs
Damage threshold	$>5 \text{ J/cm}^2$ @ 1064 nm, 10 ns, 10 Hz
Dimensions (H x L x W)	63 x 108 x 91mm - reflection mode 63 x 106 x 91mm - transmission mode
Time between min and max attenuation	$<3 \text{ sec}$
Steps between min and max attenuation	3900
*Attenuation range for transmission type	Tmax (when open): $>95\%$; Tmin (when closed): $<0.5\%$ (P-pol output)
*Attenuation range for reflection type	Tmax (when open): $>95\%$; Tmin (when closed): $<0.5\%$ (P-pol output) Tmax (when open): $>99\%$; Tmin (when closed): $<0.3\%$ (S-pol output)

Typical items

Product ID	Wavelength nm	Bandwidth nm	Configuration	Optimization	Attenuation range* (Tmin-Tmax) @ CWL
STA-EWP-R-0266	266	± 5	$\lambda/2$ ZO waveplate + 2x TFP	Reflection	0.3-99%
STA-EWP-R-0343	343	± 5	$\lambda/2$ ZO waveplate + 2x TFP	Reflection	0.3-99%
STA-EWP-R-0355	355	± 5	$\lambda/2$ ZO waveplate + 2x TFP	Reflection	0.3-99%
STA-EWP-R-0515	515	± 5	$\lambda/2$ ZO waveplate + 2x TFP	Reflection	0.3-99%
STA-EWP-R-0532	532	± 5	$\lambda/2$ ZO waveplate + 2x TFP	Reflection	0.3-99%
STA-EWP-R-1030	1030	± 10	$\lambda/2$ ZO waveplate + 2x Broadband TFP	Broadband Reflection	0.3-99%
STA-EWP-R-1064	1064	± 5	$\lambda/2$ ZO waveplate + 2x TFP	Reflection	0.3-99%
STA-EWP-T-0266	266	± 5	$\lambda/2$ ZO waveplate + TFP	Transmission	0.5-95%
STA-EWP-T-0343	343	± 5	$\lambda/2$ ZO waveplate + TFP	Transmission	0.5-95%
STA-EWP-T-0355	355	± 5	$\lambda/2$ ZO waveplate + TFP	Transmission	0.5-95%
STA-EWP-T-0515	515	± 5	$\lambda/2$ ZO waveplate + TFP	Transmission	0.5-95%
STA-EWP-T-0532	532	± 5	$\lambda/2$ ZO waveplate + TFP	Transmission	0.5-95%
STA-EWP-T-1030	1030	± 10	$\lambda/2$ ZO waveplate + Broadband TFP	Broadband Transmission	0.5-95%
STA-EWP-T-1064	1064	± 5	$\lambda/2$ ZO waveplate + TFP	Transmission	0.5-95%

Example of performance provided by attenuator comprising a waveplate and a polarizer.



PowerXP – Motorized Attenuators



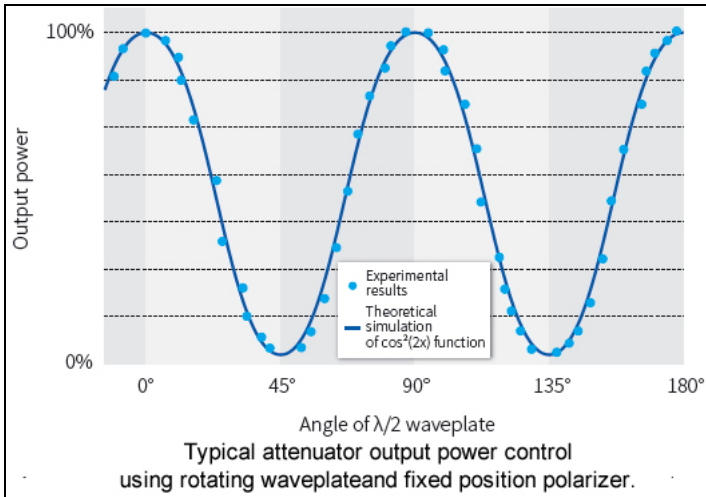
PowerXP motorized attenuators are reliable solution for industrial applications. Each attenuator includes motorized rotating quartz $\lambda/2$ phase waveplate, optically aligned to a single/ dual thin film polarizer or polarizing beamsplitting cube which separates the input beam into individual s-polarized and p-polarized parallel or perpendicular output beams. 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 and Cube versions 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, RS232 connection
- Divides laser beam into two s-pol and p-pol beams of adjustable intensity ratio
- Low dispersion for ultrashort and high energy laser pulses
- Ideal for integration in other systems
- Time between min and max attenuation less than 0.2 sec

Model Comparison

	COMPACT	MAXI TRANSMISSION	MAXI REFLECTION	MAXI CUBE
Optimization type	Transmission	Transmission (T model)	Reflection (R model)	Transmission and Reflection
Clear aperture, mm	Ø8	Ø18	Ø18	Ø18
Recommended maximum input beam diameter at $1/e^2$, mm	Ø5	Ø12	Ø12	Ø12
Damage threshold @ 1064 nm, 10 ns, 10 Hz	>20 J/cm ²	>10 J/cm ²	>10 J/cm ²	>10 J/cm ²
Dimensions H x L x W, mm	32 x 56 x 60	56 x 99 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
Steps between min and max attenuation	14400	24000	24000	24000
Resolution	<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} >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} <0.3% 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} >95%, T _{min} <0.5% at p-pol output	



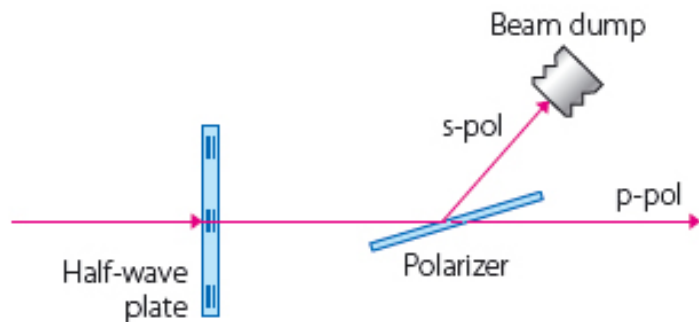
The following table shows measured attenuator power control repeatability values.

Stage	Average power difference, %	Max power difference @ 250mW*, %
20%	0.05	0.30-0.40
50%	0.1	0.5
80%	0.05	0.40

*Using 250 mW average power output fs pulsed laser.

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).

1. Compact Version



Clear aperture	8mm
Bandwidth	Up to ± 5 nm
Optimization	Transmission type
Configuration	$\lambda/2$ High Energy Waveplate + IBS coated High Contrast Thin Film Polarizer
Attenuation range (Tmin-Tmax) @ CWL	Up to 0.1-99%
Typical applications	High power CW and pulsed lasers
Damage threshold	$>10\text{J/cm}^2$ @ 1064nm, 10ns, 10Hz
Dimensions (H x L x W)	74 x 32 x 66 mm
Time between min and max attenuation	$<1\text{sec}$
Steps between min and max attenuation	14400

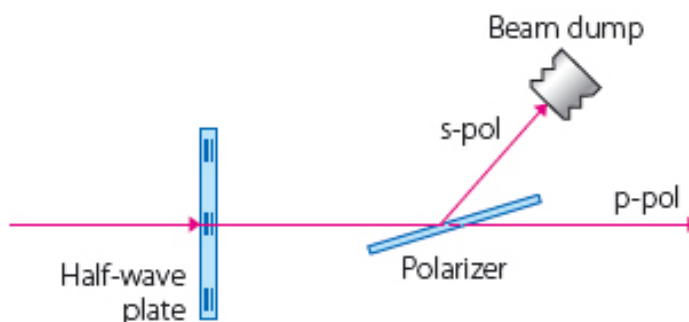
Product Number	Wave-length, nm	Bandwidth, nm	Configuration	Optimization	Attenuation range (Tmin-Tmax) @ CWL
STA-PXP-08-0343	343	± 5	$\lambda/2$ High Energy waveplate + High Contrast TFP	Transmission	0.3-97%
STA-PXP-08-0355	355	± 5	$\lambda/2$ High Energy waveplate + High Contrast TFP	Transmission	0.3-97%

STA-PXP-08-0515	515	±5	λ/2 High Energy waveplate + High Contrast TFP	Transmission	0.1-99%
STA-PXP-08-0532	532	±5	λ/2 High Energy waveplate + High Contrast TFP	Transmission	0.1-99%
STA-PXP-08-1030	1030	±5	λ/2 High Energy waveplate + High Contrast TFP	Transmission	0.2-99%
STA-PXP-08-1064	1064	±5	λ/2 High Energy waveplate + High Contrast TFP	Transmission	0.2-99%

2. Maxi Version

Clear aperture	18mm
Bandwidth	Up to ±10nm
Optimization	Reflection or transmission type
Configuration	λ/2 ZO Waveplate + 1x or 2x Thin Film Polarizers
Attenuation range (Tmin-Tmax) @ CWL	Up to 0.3-99%*
Typical applications	High power CW and pulsed lasers
Damage threshold	>5 J/cm ² @ 1064nm, 10ns, 10Hz
Dimensions (H x L x W)	56 x 99 x 90 mm
Time between min and max attenuation	<0.2sec
Steps between min and max attenuation	24000
*Attenuation range for transmission type	Tmax (when open): >95%; Tmin (when closed): <0.5% (P-pol output)
*Attenuation range for reflection type	Tmax (when open): >95%; Tmin (when closed): <0.5% (P-pol output) Tmax (when open): >99%; Tmin (when closed): <0.3% (S-pol output)

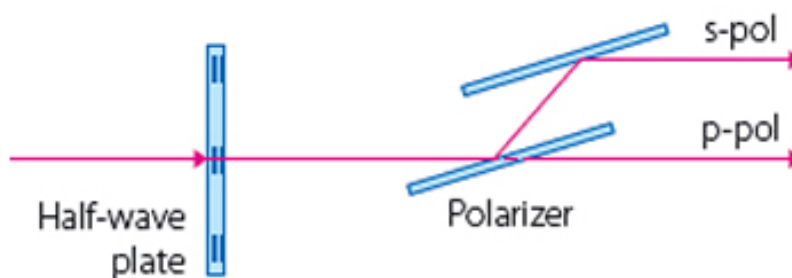
2.1 Maxi Transmission Version



Product Number	Wave-length nm	Bandwidth, nm	Configuration	Optimization	Attenuation range* (Tmin-Tmax) @ CWL
STA-PXP-15-T-0266	266	±5	λ/2 ZO waveplate + TFP	Transmission	0.5-95%
STA-PXP-15-T-0343	343	±5	λ/2 ZO waveplate + TFP	Transmission	0.5-95%
STA-PXP-15-T-0355	355	±5	λ/2 ZO waveplate + TFP	Transmission	0.5-95%
STA-PXP-15-T-0515	515	±5	λ/2 ZO waveplate + TFP	Transmission	0.5-95%
STA-PXP-15-T-0532	532	±5	λ/2 ZO waveplate + TFP	Transmission	0.5-95%
STA-PXP-15-T-1030	1030	±10	λ/2 ZO waveplate + Broadband TFP	Broadband Transmission	0.5-95%
STA-PXP-15-T-1064	1064	±5	λ/2 ZO waveplate + TFP	Transmission	0.5-95%

Their dimensions are same as 56x99x90mm.

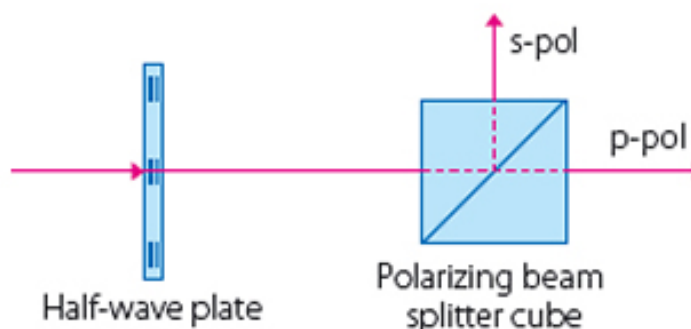
2.2 Maxi Reflection Version



Product Number	Wave-length nm	Bandwidth, nm	Configuration	Optimization	Attenuation range* (Tmin-Tmax) @ CWL
STA-PXP-15-R-0266	266	±5	$\lambda/2$ ZO waveplate + 2x TFP	Reflection	0.3-99%
STA-PXP-15-R-0343	343	±5	$\lambda/2$ ZO waveplate + 2x TFP	Reflection	0.3-99%
STA-PXP-15-R-0355	355	±5	$\lambda/2$ ZO waveplate + 2x TFP	Reflection	0.3-99%
STA-PXP-15-R-0515	515	±5	$\lambda/2$ ZO waveplate + 2x TFP	Reflection	0.3-99%
STA-PXP-15-R-0532	532	±5	$\lambda/2$ ZO waveplate + 2x TFP	Reflection	0.3-99%
STA-PXP-15-R-1030	1030	±10	$\lambda/2$ ZO waveplate + 2x Broadband TFP	Broadband Reflection	0.3-99%
STA-PXP-15-R-1064	1064	±5	$\lambda/2$ ZO waveplate + 2x TFP	Reflection	0.3-99%

Their dimensions are same as 56x99x90mm.

2.3 Max Cube Version



Product Number	Wavelength nm	Bandwidth nm	Configuration	Attenuation range at p-pol output (Tmin-Tmax) @ CWL	Attenuation range at s-pol output (Tmin-Tmax) @ CWL
STA-PXP-18-C-0355	355	±5	$\lambda/2$ Optically bonded waveplate + Optically bonded PBS cube	0.3-96%	4-99%
STA-PXP-18-C-0515	515	±5	$\lambda/2$ Air-spaced waveplate + Optically bonded PBS cube	0.3-97%	3-99%
STA-PXP-18-C-0532	532	±5	$\lambda/2$ Air-spaced waveplate + Optically bonded PBS cube	0.3-97%	3-99%
STA-PXP-18-C-1030	1030	±5	$\lambda/2$ Air-spaced waveplate + Optically bonded PBS cube	0.3-97%	3-99%
STA-PXP-18-C-1064	1064	±5	$\lambda/2$ Air-spaced waveplate + Optically bonded PBS cube	0.3-97%	3-99%

Their dimensions are same as 56x82x90mm.

Manual Attenuators

1. Laser Beam Attenuator, Enhanced Version

The Enhanced version of the attenuator incorporates a rotating quartz $\lambda/2$ phase waveplate and one or two Thin Film Polarizers that separate s-polarized and p-polarized beams in parallel directions. The polarizers are housed in a specially designed opto-mechanical holder mounted together with a precision kinematic adjustable waveplate holder. Pure p-polarization should be selected for maximum transmission and pure s-polarization for maximum attenuation. The intensity ratio of separated beams is continuously tuned by rotating the waveplate in the holder.

Custom wavelengths are available upon request. Contact us and we will find a solution for your beam attenuation, power control and beam splitting needs. We can also recommend compatible optical components for your beam delivery applications.

Features

- Easy operated manual design
- Ideal for femtosecond and high power laser applications
- Two parallel p-pol and s-pol output beams
- Interchangeable optics

*Attenuation range for transmission type

Tmax (when open): >95%; Tmin (when closed): <0.5%

*Attenuation range for reflection type

Tmax (when open): >95%; Tmin (when closed): <0.5% (P-pol output)

Tmax (when open): >99%; Tmin (when closed): <0.3% (S-pol output)



Specifications

- Clear aperture: 15 mm
- Bandwidth: Up to ± 20 nm
- Optimization: Reflection or transmission type
- Configuration: $\lambda/2$ ZO waveplate + 1x or 2x Thin Film polarizers
- Attenuation range (Tmin-Tmax) @ CWL: Up to 0.3-99 %*
- Typical applications: High power CW and pulsed lasers, LDs
- Damage threshold: >5 J/cm² @ 1064 nm, 10 ns, 10 Hz
- Dimensions (L x W x H): 89 x 72 x 78 mm – reflection type, 87 x 68 x 78 mm – transmission type

Product ID	Wavelength nm	Bandwidth nm	Configuration	Optimization	Attenuation range* (Tmin-Tmax) @ CWL
STA-ELA-R-0266	266	± 5	$\lambda/2$ ZO waveplate + 2x TFP	Reflection	0.3-99%
STA-ELA-T-0266			$\lambda/2$ ZO waveplate + TFP	Transmission	0.5-95%
STA-ELA-R-0343	343	± 5	$\lambda/2$ ZO waveplate + 2x TFP	Reflection	0.3-99%
STA-ELA-T-0343			$\lambda/2$ ZO waveplate + TFP	Transmission	0.5-95%
STA-ELA-R-0355	355	± 5	$\lambda/2$ ZO waveplate + 2x TFP	Reflection	0.3-99%
STA-ELA-T-0355			$\lambda/2$ ZO waveplate + TFP	Transmission	0.5-95%
STA-ELA-R-0515	515	± 5	$\lambda/2$ ZO waveplate + 2x TFP	Reflection	0.3-99%
STA-ELA-T-0515			$\lambda/2$ ZO waveplate + TFP	Transmission	0.5-95%
STA-ELA-R-0532	532	± 5	$\lambda/2$ ZO waveplate + 2x TFP	Reflection	0.3-99%
STA-ELA-T-0532			$\lambda/2$ ZO waveplate + TFP	Transmission	0.5-95%
STA-ELA-R-1064	1064	± 5	$\lambda/2$ ZO waveplate + 2x TFP	Reflection	0.3-99%
STA-ELA-T-1064			$\lambda/2$ ZO waveplate + TFP	Transmission	0.5-95%
STA-ELA-R-1030	1030	± 10	$\lambda/2$ ZO waveplate + 2x Broadband	Broadband	0.5-98%

			TFP	reflection	
STA-ELA-T-1030			$\lambda/2$ ZO waveplate + Broadband TFP	Broadband transmission	0.5-95%

2. Laser Beam Attenuator, Ultrafast Version

The Ultrafast version of the attenuator is intended for laser pulses of <100 fs. It incorporates a rotating Achromatic $\lambda/2$ phase waveplate and two high-performance Broadband 72° Thin Film Polarizers that separate s-polarized and p-polarized beams in parallel directions. The polarizers are housed in a specially designed opto-mechanical holder mounted together with a precision kinematic adjustable waveplate holder. The intensity ratio of separated beams is continuously tuned by rotating the waveplate in the holder.

There are 2 standardized types of ultrafast attenuators – one for maximum transmitted energy and one for maximum beam attenuation.

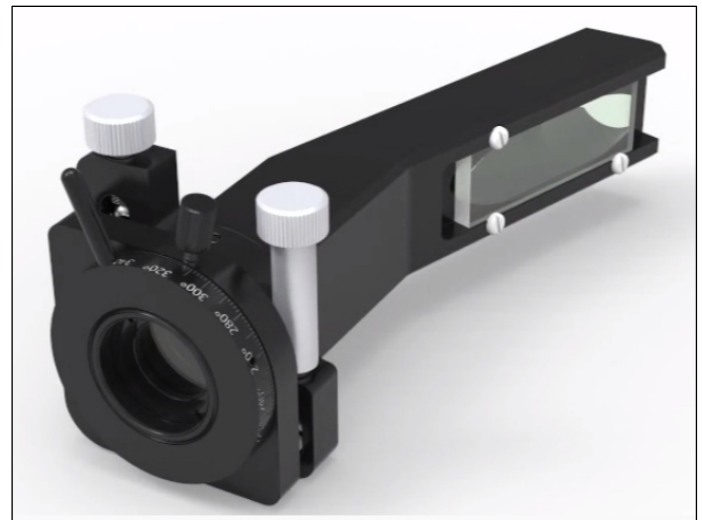
Custom wavelengths are available upon request. Contact us and we will find a solution for your beam attenuation, power control, beam splitting needs. We can also recommend compatible optical components for your beam delivery applications.

Features

- Easy operated manual design
- Low dispersion optical design for ultrashort pulse high power laser applications
- Two parallel p-pol and s-pol output beams
- Interchangeable optics

Specifications

- Clear aperture: 15 mm
- Bandwidth: Up to ± 50 nm
- Configuration: $\lambda/2$ Achromatic waveplate + 2x Broadband (Ultrafast) Thin Film polarizers
- Attenuation range (Tmin-Tmax) @ CWL: 4-96%, 0.1-70%
- Typical applications: Ultrafast broadband laser sources with pulse length <100 fs
- Damage threshold: >100 mJ/cm² @ 800 nm, 100 fs, 1 kHz
- Dimensions (L x W x H): 167 x 72 x 78 mm



Product ID	Wavelength, nm	Bandwidth, nm	Configuration	Optimization	Attenuation range* (Tmin-Tmax) @ CWL
STA-ULA-R1-0800	800	± 50	$\lambda/2$ Achromatic waveplate + Broadband (Ultrafast) TFP	Reflection	4-96%
STA-ULA-R2-0800				Reflection contrast	0.1-70%

3. Large Aperture Attenuator

The main feature of Large Aperture Attenuators is larger than 30 mm diameter clear aperture. These incorporate a rotating $\lambda/2$ phase waveplate and one or two Thin Film Polarizers that separate s-polarized and p-polarized beams in parallel directions. The polarizers are housed in a specially designed opto-mechanical holder which is mounted together with a precision waveplate holder. Pure p-polarization should be selected for maximum transmission and pure s-polarization for maximum attenuation. The intensity ratio of the separated beams is continuously tuned by rotating the waveplate in the holder.

Custom wavelengths are available upon request. Contact us and we will find a solution for your beam attenuation, power control and beamsplitting needs. We can also recommend compatible optical components for your beam delivery applications.

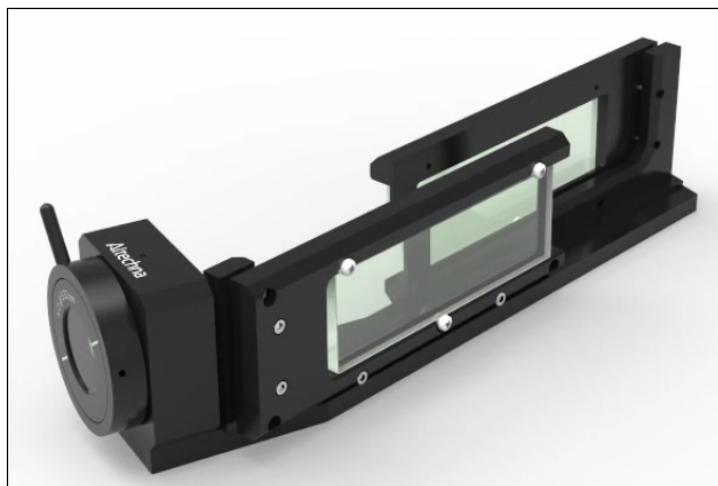
Features

- Large input aperture

- Easy operated manual design
- Ideal for femtosecond and high power laser applications
- Two parallel p-pol and s-pol output beams
- Interchangeable optics

Specifications

- Clear aperture: 30 mm
- Bandwidth: Up to ± 50 nm
- Optimization: Reflection or transmission type
- Attenuation range (Tmin-Tmax) @ CWL: 0.3-99% or 0.1-70% or 4-96%
- Typical applications: High power and ultrafast lasers
- Damage threshold: >5 J/cm² @ 1064 nm, 10 ns, 10 Hz, >100 mJ/cm² @ 800 nm, 100 fs, 1 kHz
- Dimensions (L x W x H): 299 x 135 x 70 mm – ultrafast reflection type, 147 x 136 x 60 mm – transmission type
- Configuration: $\lambda/2$ ZO waveplate + 1x or 2x Thin Film polarizers, $\lambda/2$ Achromatic waveplate + 2x Broadband (Ultrafast) Thin Film polarizers



Product ID	Wavelength, nm	Bandwidth, nm	Configuration	Optimization	Attenuation range* (Tmin-Tmax) @ CWL
STA-LAT-R-0515	515	± 5	$\lambda/2$ ZO waveplate + 2x TFP	Reflection	0.3-99%
STA-LAT-T-0515			$\lambda/2$ ZO waveplate + TFP	Transmission	0.5-95%
STA-LAT-R-0532	532	± 5	$\lambda/2$ ZO waveplate + 2x TFP	Reflection	0.3-99%
STA-LAT-T-0532			$\lambda/2$ ZO waveplate + TFP	Transmission	0.5-95%
STA-LATU-R2-0800	800	± 50	$\lambda/2$ Achromatic waveplate + 2x Broadband (Ultrafast) TFP	Reflection contrast	0.1-70%
STA-LATU-R1-0800			$\lambda/2$ Achromatic waveplate + 2x Broadband (Ultrafast) TFP	Reflection	4-96%
STA-LAT-R-1030	1030	± 10	$\lambda/2$ ZO waveplate + 2x Broadband TFP R	Reflection	0.3-99%
STA-LAT-T-1030			$\lambda/2$ ZO waveplate + Broadband TFP	Transmission	0.5-95%
STA-LAT-R-1064	1064	± 5	$\lambda/2$ ZO waveplate + 2x TFP	Reflection	0.3-99%
STA-LAT-T-1064			$\lambda/2$ ZO waveplate + TFP	Transmission	0.5-95%